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OWTS 100 Overview and Principles of Wastewater Treatment Systems
Brief Review of All Types of Systems

Outcomes

1. Know the general principles of onsite treatment systems – create an environment and conditions where removal or separation occurs and where biological and chemical treatment can occur.

2. Recognize the two general stages in a system, initial treatment components and final treatment in soil absorption system.

3. Able to describe common systems used, basic drawing of system, terminology.

4. Able to identify basic principles used in the parts/stages/types of systems, aerobic-anaerobic-settling-biological. Describe principles used in various types and parts of systems.

5. Recognize the various liquid measures used in sewage systems design – metric, imperial, U.S.

6. Recognize basic impact caused by climate conditions – the need to protect from freezing and added hydraulic loading on soil. Basic methods of frost protection are covered in modules on design and construction of systems.

7. Basic understanding of the effect of temperature on biological activity, recognize reduced consumption of contaminants.

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OWTS 101 Regulations and the SOWDG

Outcomes

1. Understand existence of the Private Sewage Works Regulation and its relation to the Saskatchewan Onsite Wastewater Disposal Guide (SOWDG).

2. Understand the purpose of the SOWDG is to support minimum standards for design and installation. Identifying design conditions and applying them requires training.

3. Know the performance objectives for systems.

4. Basic knowledge of Regulation requirements– engineering required, certified installers; aware of the regulation and have a copy of it.

5. Understand the layout of the SOWDG, division of sub-sections – design – installation – materials.

6. Be familiar with the layout and general content of the SOWDG.

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OWTS 102 Sewage and Effluent Strength

Outcomes

1. What is in sewage – basic understanding of:
   - BOD
   - TSS
   - Nutrients
   - Pathogens
   - FOG

   What are these components of effluent, where do they come from and how are they measured?

2. What is not sewage; clear water waste, e.g. storm water.

3. Why is it important to treat sewage, impact of contaminants on the environment and water sources?

4. How to recognize indicators or signs that suggest high strength sewage will be generated and what high strength sewage is.

5. Difference between sewage and effluent – measures qualities, recognize reduced contaminant levels in effluent.

6. How does sewage strength affect the system operation – general impact on plugging system and effect on sizing?

7. Why is sewage strength and the effluent quality discharged to system important to customers – explain impact on their system.

8. Identify laboratory testing available to test sewage and recognize there are specific collection procedures for testing samples.

9. Able to recognize contaminants in sewage, common terms applied to the measurement of contaminants, values of measurements applied to residential strength sewage and effluent, and a basic understanding of the impact of contaminants on the environment and water.

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OWTS 103 Movement of Water in Soil – The key to soil treatment dispersal of effluent

Outcomes

1. Where does the water go (vertical movement and horizontal movement) when it meets a restricting layer?

2. How fast does water move in soil (very basic vertical and horizontal movement of groundwater).

3. What affects the movement of water volume and speed?
    - Pore space, void space relative to soil texture, matric potential of soils (suction – capillary action) 20
    - Structure 20
    - Hydraulic head 5
    - Affect of SAR on clays and recognition of expandable clays

4. Desired movement of wastewater (saturated vs. unsaturated) video.

5. Water holding capacity of soil (water holding capacity of various soils).
    - Field capacity, upper and lower water limits
    - Saturation
    - Saturation percentage test

6. Percolation test, general method, limits, locations, depths, outside effects on results, relation to soil texture and structure.

7. Infiltration into soil vs. percolation within the soil and the effect of biomat formation.

8. Recognition of ground water mounding occurring and what it is.

9. Understanding the conditions that affect movement of water in soil and that it will affect the sizing of a soil absorption system.

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OWTS 104 Soil Treatment of Effluent

Outcomes

1. Understand basic treatment mechanisms in soil used to treat sewage.
    - Filtration
    - Adsorption – binding or holding of contaminants to soil
    - Chemical – chemicals in soils changing contaminants to a form that is not harmful or that can be held in soil.
    - Flora, fauna microbial role in treatment

2. Understand the effect of saturated and unsaturated flows on basic treatment processes.

3. Basic knowledge of the biomat – cause for formation, treatment benefits, limitations created, effect on water movement.

4. Basic knowledge of what conditions will enhance soil treatment and what conditions deter treatment.

5. Basic understanding of the fate of nitrogen in soil – conversion of ammonia to nitrate and nitrate being negatively charged is difficult to remove – no adsorption – minimal dentrification.

6. Understand the depth of effective soil needed for treatment.

7. Recognize the different expected treatment efficiencies.

8. Understand the effect of initial treatment levels on soil treatment.

9. Know where the highest population of microbes/flora-fauna/biota live in the soil.

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OWTS 105 Sewage Volumes and Loading Rates

Outcomes

1. Able to identify why it is important to accurately anticipate sewage volumes – main factor in design.

2. Identify factors that impact the source of sewage from facility served.
   - Water use patterns (chart)
   - Number of people or anticipated number of people using facility.
   - Recognition of sewage strength sources.
   - Recognize benefit of water conservation and impact on sewage strength.

3. Ability to apply SOWDG tables:
   - How to use them
   - Understand tables include estimates for average conditions, include a safety factor and have limits in their applications.
   - Understand differences in application of actual measured amount and estimated amounts in tables to design of system.
   - Recognize facility characteristics that affect applying suitable safety factors to using actual flow volumes.

4. Basic understanding of differing flow volume patterns:
   - Day vs. evening and night, and daily changes in flow from facilities such as a church or hall.
   - Basic understanding of how flows volume can affect initial treatment and methods of managing flow volumes.

5. Know basic methods to obtain actual flow measurements and limits on information received – considerations for adjustment – e.g. community hall could not be measured over a month and divided by 30 to get daily flow.

6. Ability to recognize and use characteristics of facility to determine sewage flows used for the design of the system and recognize problem situations.

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OWTS 106 Soil Evaluation

Outcomes

Soil evaluation identifying characteristics that affect sewage systems.

1. Understand the general method of how to evaluate soil characteristics that affect water movement.
    - Excavate soil pit – depth, location (don't ruin site)
    - Available tools – soil auger, probe, permeameter

2. Basic knowledge of how to examine the soil profile and identify
    - Major soil structure features (why it is important is covered in soil/water)
    - Colour – mottles and gleyed soils (washed out gray) identified high water table or saturated soils (reason saturated/unsaturated flow in previous module)
    - Soil texture, make up of sand/silt/clay, don't count gravel component
    - Effect of gravel component
    - Where to take sample
    - Basic hand texturing procedures
    - Trial hand texturing
    - Lab testing availability and basic knowledge of lab testing method
    - Recognize changes in soil horizons and understand effect on sewage system design.

3. Ability to conduct a perc test (method).

4. Understand and apply the soil texture triangle.

5. Able to determine effluent-loading rate for a soil texture set in the SOWDG.

6. Able to determine effluent-loading rate from a perc test set in the SOWDG.

7. Know what restricting/limiting layers are and able to recognize major characteristic.

8. Ability to recognize major soil characteristic and determine soil effluent loading rates or limitations.

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OWTS 107 Site Evaluation – selecting a site for a system

Outcomes

1. Basic awareness of First Call – use and benefits.

2. Understand purpose of defining scope of facility development – size, location, footprint – driveway, utility, right of way, outbuildings, other planned development and landscaping plans.

3. Know basic process for preliminary site inspection/evaluation.
    - Identify characteristics to look for
    - Elevations
    - Vegetation
    - Standing water
    - Soils characteristics anticipated for observation of elevation, vegetation, possible places affected by soil movement over long periods of time

4. Able to select appropriate location for soil tests, location of soil test for detailed design.

5. Ability to read and create a basic site map to:
    - Identify location of system and influencing site characteristics
    - Adequate to confirm plan with customer
    - Provide to customer in manual
    - Provide with permit application

6. Knowledge of clearance requirements required by SOWDG for system components.

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OWTS 108 Initial Treatment Processes

Outcomes

1. Able to describe initial treatment stage (components) and recognize basic and advanced treatment levels (septic tanks or package treatment plants, etc.).

2. Understand the main basic function of a septic tank – settling/floating – clarification of sewage.

3. Ability to distinguish between treatment stage and effluent holding and dosing tanks or compartments.

4. Recognize conditions that affect the effectiveness of clarification.
    - Capacity related to expected volume – effect of accumulated sludge
    - Degreasers
    - Inlet fittings and purpose
    - Filters
    - Garbage grinders
    - Basic hydraulic flow characteristics in a tank – change in volume in to volume out e.g. estimated 10 gallons in at 5 gallons per minute will take 25 minutes to discharge

5. Understand the need for tank water tightness and impact on infiltration volume concern with exfiltration.

6. Know the basic biological and chemical changes to sewage that occur in the septic tank:
    - Breakdown of organic matter into soluble BOD
    - Conversion of nitrogen in tank
    - Gases produced – harmful

7. Understand basic limits on processes – strength of sewage.

8. Apply tank sizing methods and requirements from SOWDG – tables etc.

9. Know certification requirements of tanks.

10. Know location requirements and separation distances required.

11. Basic understanding of additives – starters and treatment enhancements that are not required.

12. Able to describe the purpose of the initial stage of treatment – prepare sewage to a suitable condition or quality for the soil absorption (final treatment component) system selected.

13. Basic understanding of which conditions will enhance initial treatment and which conditions deter initial treatment.

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14. Recognize that temperature will impact biological activity in both septic tank and to a larger degree, the treatment plant.

15. Recognize key difference between septic tanks and treatment plants:

    - To create aerobic conditions to enhance microbial activity as opposed to anaerobic or anoxic conditions in a septic tank.
    - To recognize expected levels of effluent quality from treatment plants and septic tanks.

16. Recognize the limits on treatment plants effectiveness and things they don't do.

17. Know typical household waste problem items that affect system performance – cleaners, medical, hobby, oils and greases.

18. Able to identify common unexpected or undesirable sources of wastewater – water conditioning equipment – leaky faucets and toilets.

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OWTS 109 Effluent Distribution Systems – gravity and pressure

Outcomes

1. Recognize and understand benefits from effective effluent distribution.

2. Basic understanding of Gravity Distribution method and able to design basic system:
    - Know the advantages and disadvantages of gravity distribution/recognize when gravity may be used.
    - Knowledge of gravity distribution piping arrangements – headers, distribution boxes, bi-level cross, serial distribution
    - SOWDG recommendations

3. Basic understanding of Pressure Distribution method and able to design basic system:
    - Recognize difference between pressure distribution only to head of treatment field laterals and of distribution through entire lateral length.
    - Know the advantages and disadvantages of pressure distribution.
    - Understand and able to determine orifice size/spacing from tables.
    - Able to determine desired/required dose volume
    - Understand benefits of timed interval dose volumes over demand dosing
    - Calculate piping friction loss pressure head, total head and apply to piping and pump selection
    - Ability to use related tables in SOWDG
    - Recognize the effect of distribution laterals at difference elevations on effluent volumes delivered
    - Know effluent filtering requirements

4. Know the basic advantages of pressure distribution and able to design basic pressure distribution lateral systems and determine pump performance requirements.

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OWTS 110 Dose Tanks and Chambers – Choosing chamber size and dose volume

Outcomes

1. Ability to identify and apply factors to determine adequate volume including reserve volume where required due to timed dosing or flow equalization.

2. Able to perform tank volume calculations – area to volume/know formula.

3. Ability to identify and apply factors to determine required volumes for dosage.

4. Understand concept of setting pump float switches to deliver desired effluent volume and application in timed dosing.

5. Able to calculate the required vertical distance of pump down in a dosing tank to deliver a desired volume of water.

6. Know requirements in SOWDG for dose tanks in a system.

7. Able to determine desired dose tank size and determine draw down elevation to deliver required dose.

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OWTS 111 Pumps and Controls – Selecting pumps and controls

Outcomes

1. Know common pump types and why they would be selected.
2. Apply pump curves in selection of pump for desired volume and total pressure head.
3. Understand pressure head concepts/dynamic and total.
4. Describe function and purpose of common controls.
5. Understand types of settings commonly required for pumps: timed dosing.
6. Establish pumped volume based on pump performance and duration of timed cycle.
7. Know the purpose of, common types of, and requirements for effluent pump filters in SOWDG.
8. Able to select appropriate pumps, identify basic control/float configurations to deliver demand doses and timed dosing.

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OWTS 112 Drainfield Design and Sizing

Outcomes

1. Able to apply soil characteristics to field design:
    - Soil limits on use; from SOWDG
    - Soil characteristics affecting design; structure and horizons, soil plastics limits and smearing
    - Vertical separation requirements
    - Selecting depth of weeping lateral trench; effective treatment vs. frost protection
    - Determine total field area and length of laterals – aggregate and chamber trenches; apply chart and loading rates for soils
    - Knowledge of allowable reduction for treatment plant effluent and pressure distribution laterals; recognize 50% reduction

2. Knowledge of required design and configuration of weeping lateral trenches:
    - Location – clearances – preferred locations: SOWDG requirements and landscape
    - Maximum and minimum width and depth
    - Requirements for aggregate and chambers; SOWDG and effect of dirty gravel
    - Trench separation; SOWDG requirements and desired/ground water mounding
    - Level trench bottoms: SOWDG requirements and reasoning

3. Recognize alternate and desirable layout configurations on both sloping and level ground (does not have to be rectangular).

4. Understand concept of lined trenches and SOWDG requirements.
    - Pressure distribution preferred distribution method
    - Type of soil for lining

5. Able to use SOWDG requirements and apply utilizing ability to identify limiting soil characteristics to plan treatment fields and be able to size and layout a treatment field.

6. Understand Linear Loading rates, how to utilize them in the design process, and how they impact the treatment system.

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OWTS 113 Mounds – principles, design, sizing and construction

Outcomes

1. Understand basic principals of how mounds work – treatment in sand layer and dispersal horizontally. Apply soil evaluation information. Ground water mounding.

2. Know mound design configurations and materials; sand layer, fill, gravel, chambers.

3. Basic knowledge of utilizing typography of installation site.

4. Know factors in locating the mound – slope vs. level; clearance separations, vertical separations, fill materials for raised bed.

5. Ability to design pressure distribution laterals for mound, orientation of orifices, spacing, preferred vs. cost.

6. Knowledge of and ability to apply concepts of Saskatchewan Onsite Wastewater Disposal Guide:
    - Ability to interpret mound design worksheet
    - Ability to complete mound design worksheet

7. Ability to describe construction practices.

8. Ability to perform clarity test on sand.

9. Identify typical mound failure.

10. Ability to apply soil characteristics at site to mound design, identify key material requirements and calculate mound size.

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OWTS 114 Aerobic Treatment Units – a brief overview of common types

Outcomes

1. Able to recognize basic types – suspended growth and attached growth.
2. Basic understanding of the principles to enhance biological growth – PH and different microorganisms.
3. Recognize NSF certification requirements.
4. Recognize limits on measured performance indicators – no nitrogen phosphorus or pathogen rating.
5. Know expected effluent quality compared to septic tank effluent.
6. Recognize susceptibility to upsets caused by irregular flow.
7. Basic nitrification and denitrification.
8. Accumulation of dead biomass and cleaning and maintenance of aerobic treatment units.

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OWTS 115 Sand Filters – principles of operation and overview

Outcomes

1. Recognize as attached growth treatment.
2. Principles of operation – not a filter.
3. Know treatment expectations.
4. Types, recirculating, intermittent.
5. Understand basic construction and design characteristics.
6. Able to identify sizing requirements.

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OWTS 116 Open Discharge – Brief Overview

Outcomes

1. Know SOWDG requirements.
2. Understand objective and methods of spreading effluent and landscaping the area.
3. Limited volume.
4. Frozen effluent accumulation: freezing does not kill pathogens, example, manage spring runoff.

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OWTS 117 Sewage Lagoons – Brief overview

Outcomes

1. Understand basic sizing concepts.
2. Basic understanding of limiting water movement in soil.
3. Understand purpose of sloped side walls – ice and safety for egress.

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OWTS 118 Design Process – Review and application of learned components

Outcomes

1. Ability to understand and implement components of the design process:
    - Interviewing client for lifestyle and water component choices
    - Site evaluation – identification of topography, plant matter, site characteristics, site layout, relation of buildings/wells/property lines to system site
    - Soil characteristics – identification of soil types, textures, structure, limiting layers etc.
    - Utilizing site and soil evaluation criteria, determine sewage flows – peak and average
    - Utilizing site and soil evaluation, determined sewage flows and homeowner needs, identify correct treatment system
    - Design distribution system – pressure
    - Determine septic tank and dosing tank size
    - Determine dosing frequency and volume
    - Set timed dosing float controls and pump run times
    - Initial treatment component sizing
    - Design of treatment component

2. Interview with customer:
    - Explain system design and uses to customer
    - Identify type of system, volume capabilities
    - Identify dos and don'ts for septic systems
    - Explain maintenance requirements and frequencies