Issue Paper for Technical Subcommittee Meeting		*Number of Members Present: ____*	
Engineering / Design Topics	**Topic Number: 8A**	*50% +1= ____*	*Two Thirds = ____*

Topic Statement	Establish design flow requirements for residential development.
Problem Statement	The daily design flow serves at the starting point for a design. Design flow is a key determinant for sizing both the treatment and the soil dispersal (drainfield) components. It must be sufficiently conservative or have safety factors built in so that it accounts for periodic surges if and when they occur but still reflect the typical maximum expected daily flow. Some term the design flow as being an anticipated average peak flow. It is usually not the anticipated peak-peak daily flow. Safety factors get expensive as they get more conservative. For residential development, design flow is typically calculated using either the number of bedrooms, the size of residential units, or by the average number of residents in each unit.
Background	• Per the definitions from the small OSS rule (see reference section), design flow should incorporate both an operating capacity (an anticipated average daily flow) and a surge capacity (generally short-term surges lasting from a few minutes to a few hours to a day). This means the design flow used for sizing LOSS components should contain a peaking factor. • If a mistake is made calculating design flow problems may occur. If the design flow is lower than the actual flow, the potential for failure significantly increases. For some systems, if the design flow is much higher than the resulting actual flow, some treatment components (especially mechanical aerobic processes) may operate inefficiently. • An individual OSS serving a single-family home must have more surge capacity built into it than a group of residences. The greater the number of residences on a system, the less the surge capacity will be. This may mean that for bigger LOSS, the design flow may approach the operating capacity ***times*** the number of homes. There are families that generate both large and small volumes of wastewater each day. Also, surges during a day in a single family home are balanced out by different work schedules, etc. in other homes. The problem then becomes to determine when the design flow starts approximating operating capacity. • For a residential LOSS, the actual number of bedrooms in all future residential or mobile home units is not known during the design phase (the flows will be known for repairing or expanding an existing LOSS). Assumptions are made about the average number of bedrooms in future residences, apartment/condominium units, or mobile homes will have. • As noted in the reference section, the LOSS foundation document, using data from the small OSS rule, direction from the initial LOSS rule process, and staff discussion suggests 120 gallons per bedroom per day as the starting point. Suggested are 2-bedroom minimums for multi-family housing, such as apartments or condominiums, and 3-bedroom minimums for a single-family housing development or a mobile home park. • Ecology's "Orange Book" (see reference section) suggests using 100 gallons per person per day to determine design flows for residential sewer systems they review and approve. Official planning projections are to be used for determining an average number of persons per residence (frequently 2.3 to 2.5). The average number of persons per residence ***times*** the number of residences results in the daily design flow (plus an added inflow and infiltration factor). For conventional sewers, design flows around 240 gallons per residence are routine, regardless of anticipated residence sizes.

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Reference / Research

LOSS Foundation Document

"Design Flow" means the maximum volume of sewage a residence, structure, or other facility is estimated to generate in a 24-hour period. It incorporates both an operating capacity and a surge capacity for the system during periodic heavy use events. The sizing and design of the onsite sewage system components are based on the design flow. (From WAC 246-272A-0010)

"Operating Capacity" means the average daily volume of sewage an OSS can treat and disperse on a sustained basis. The operating capacity, which is lower than the design flow, is an integral part of the design and is used as an index in OSS monitoring. (From WAC 246-272A-0010)

For residential development, minimum design flow:

- Is 120 gallons/bedroom/day - assumes 90 gallons operating capacity and 30 gallons surge capacity (From WAC 246-272A-0010)
- For multi-family development – minimum of 240 gallons/residence/day
- For single-family development or mobile home park – minimum of 360 gallons per lot or space per day
- If different flows are used, the design flow should incorporate both an operating capacity and a surge capacity.

Ecology's Criteria for Sewage Works Design (Orange Book)

- Sewage treatment plants to serve new sewerage systems should be designed on the basis of 100 gallons/day/person. The numbers of persons per dwelling should be based on planning projections derived from an official source. Any deviations should be based on sound engineering judgment substantiated in the engineering report.

- The hydraulic and biological treatment capacity of the treatment works must be designed for the following flows:
  - Annual Average Design Flow (AADF): The average of the daily flow volumes anticipated to occur over a calendar year.
  - Maximum Month Design Flow (MMDF): The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.
  - Maximum Week Design Flow (MWDF): The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.
  - Maximum Day Design Flow (MDDF): The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.
  - Peak Hour Design Flow (PHDF): The largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.
  - Peak Instantaneous Design Flow (PIDF): The maximum anticipated instantaneous flow.

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Questions

1. Does 120 gallons/bedroom/day, which incorporates both an "operating capacity" and a "surge capacity," provide an acceptable starting point for determining design flow for LOSS?
    a. If **YES**, should the suggested minimums for multi-family development, single-family development, and mobile home parks be as suggested in the LOSS foundation document, at least at the lower end of the LOSS sizes (3,500 gpd)?
        i. If **YES**, go to question #2.
        ii. If **NO**, what should the minimums be? Or should there be no minimum and the design flow be calculated similarly to what is done in Ecology's "Orange Book?" (Go to question #2 if an "Orange Book" process is selected.)
    b. If **NO**, go to question #2.

TRS Recommendation: NO.

- Too high for applications such as mobile home parks, part-time residences.
- Over-design for non-soil-based treatments. Some MBR designs are phased; can use actual flows for later phases.
- Some like the per-bedroom approach for soil-based treatment; 120 too high.

Committee Vote		
GRN	*YEL*	*RED*

2. At some size of residential development (LOSS), should anticipated reductions in surge capacity because of balancing of many residences (number of people, daily/hourly flows, etc.) be incorporated into the determination of design flow?
    a. If **YES**, what is the size of development or LOSS flows when this should occur? Should there be some sort of a sliding scale – as residential LOSS get bigger, should we move toward more averaging?
    b. If **YES**, which of the following methodologies should be used? (Go to question #3 when finished)
        i. The anticipated operating capacity (2 or 3 bedrooms, depending on the type of development noted in the LOSS foundation document ***times*** 90 gallons/bedroom ***times*** the number of residential units)
        ii. An average number of persons/residence from official planning documents as per the "Orange Book."
        iii. Some other methodology – specify what it should be.
    c. If **NO**, go to question #3.

TRS Recommendation: NO. No reduction in surge capacity.

Committee Vote		
GRN	*YEL*	*RED*

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Questions

3. Should some additional peaking or inflow and infiltration factor be added?
    a. If **YES**, what should the factor(s) be?

If **NO**, that's it.

TRS Recommendation: NO. No peaking or I/I factor should be added. Considered to be already incorporated in LOSS design flow.

Committee Vote		
GRN	*YEL*	*RED*

DESIGN FLOW RECOMMENDATIONS:

TRS Recommendation for 3500-14,500 gpd LOSS:

120 gpd per bedroom with a 240 gpd minimum per equivalent residential unit (ERU) AND allow engineering/hydrogeo justification to alter these numbers.

- May account for additional treatment.
- Consider low-use developments.
- May define commercial, residential.
- Account for restricted use and/or size.

Raw surge flow minimum for single family residence: 240 gpd. Raw surge flow minimum for MHP: 360 gpd.

Committee Vote		
GRN	*YEL*	*RED*

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TRS Recommendation for 14,500-100,000 gpd LOSS:

270 gpd minimum per ERU for all types of LOSS treatment AND allow engineering/hydro geo justification to alter this number.

- Considered flow minimums from 240-300 gpd. 270 gpd is consistent with WAC 272A for onsite systems< 3500 gpd. {90 gpd/bedroom; assume 3 bedrooms per ERU.}
- Loading rates may vary depending on treatment.
- Could size drainfield on lower flow; be more conservative on tank sizing.
- Low flow fixtures yield higher organic loading rates, which may require pretreatment. Then the key drainfield sizing issue is hydraulic loading.
- Mechanical treatment systems prefer not to have a septic tank (grinder pumps to MBR).

Committee Vote		
GRN	*YEL*	*RED*

Questions