Approved Capacity Webcast Series

Session 2: Determining Approved Capacity of Water-Supply Sources, Water Treatment Plants and Source/WTP Systems

March 10, 2011

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Ohio EPA Division of Drinking and Ground Waters

Ohio Environmental Protection Agency

Webcast Audio

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Approved Capacity of a Water Supply Source

Developed by the Ohio EPA/AWWA Technology Committee

Presented by Jeff Davidson

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Presentation Content

- Approved Capacity of a Water-Supply Source
- Components of a Surface/Ground Water Source
- Determining the Approved Capacity of a Surface Water Source
- Determining the Approved Capacity of a Ground Water Source
- Discussion of the Stable Yield of an Aquifer

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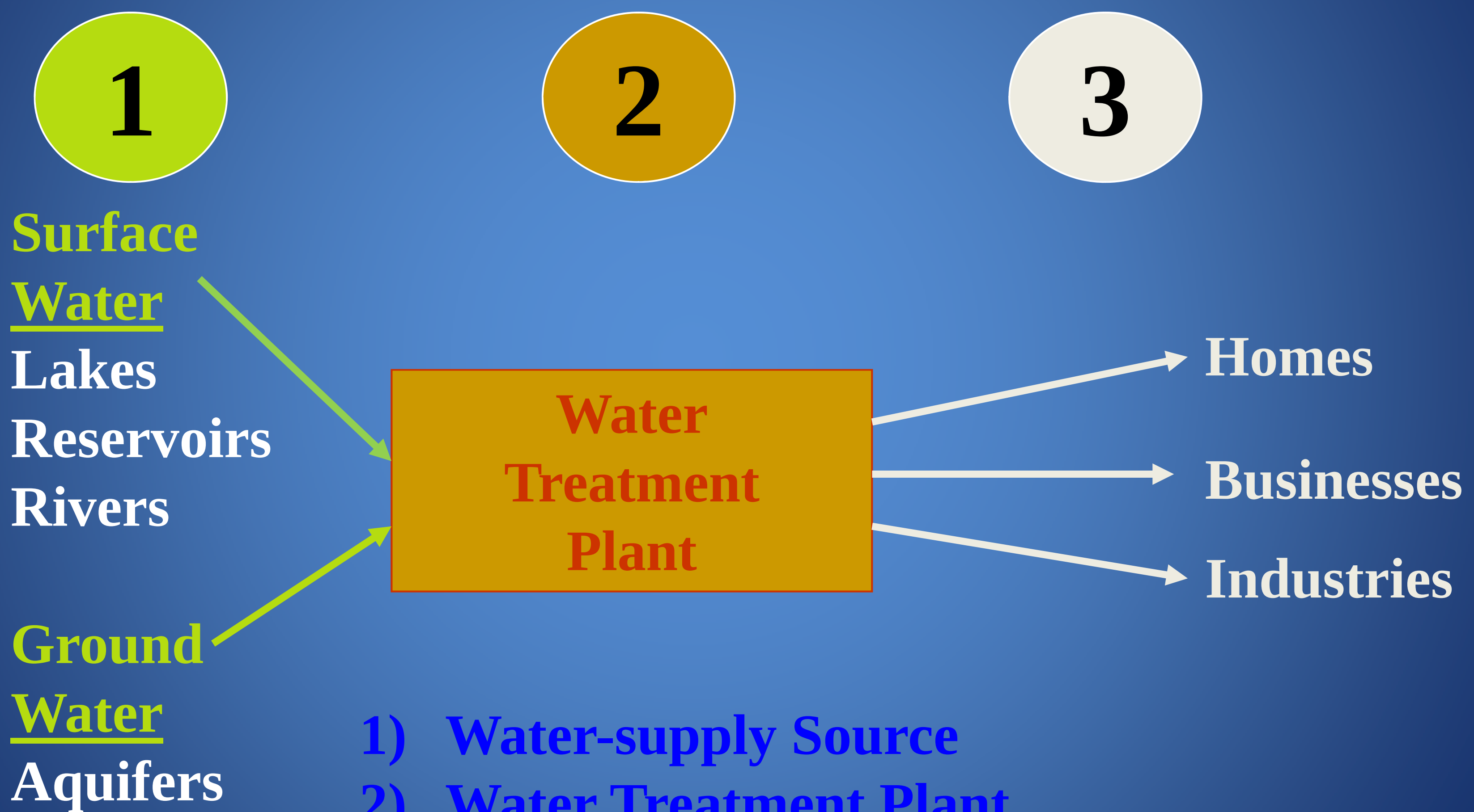
"Major Parts" of a Water System



1) Water-supply Source
2) Water Treatment Plant
3) Distribution System

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The Approved Cap. of a "Water-supply Source" . . .

. . . Must be large enough that source water can be delivered to the WTP:

1. continuously, at a flow rate equivalent to the Design-year, Avg.-day water production,

   and

2. on at least a one-day basis, at a flow rate equivalent to the Design-year, Max.-day water production.

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"Components" of Surface, Water-supply Sources

- River or Stream,
- Natural lake,
- On-line storage,
- Off-line storage,
- Intake,
- Source-water pumping (e.g., pumping upstream of off-line storage, pumping directly to the WTP, etc.),
- Combinations of the above.

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“Components” of Groundwater, Water-supply Sources

- Aquifer,
- Well pumping (e.g., for vertical wells, for horizontal collector wells, etc.)
- Off-line storage,
- Source-water pumping (e.g., pumping upstream of off-line storage, pumping directly to the WTP, etc.),
- Combinations of the above.

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The Basis-of-Design Table for Water-supply Source Components for a Surface Water Source

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Determining Approved Capacity of a Water System (cont)

This PWS wants to expand its 7.5-MGD water system to an approved capacity of 10.0 MGD (i.e., to be able to meet the projected, Max.-day finished-water production in the design year)

The ratio of Projected, Pk.-hour : Max.-day production is:

$$\frac{15.0 \text{ MGD}}{10.0 \text{ MGD}} = 1.50$$

The ratio of Projected, Pk.-hour treatment : Max.-day production is:

$$\frac{13.5 \text{ MGD}}{10.0 \text{ MGD}} = 1.35$$

The ratio of Projected, Max.-day : Avg.-day production is:

$$\frac{10.0 \text{ MGD}}{7.5 \text{ MGD}} = 1.33$$

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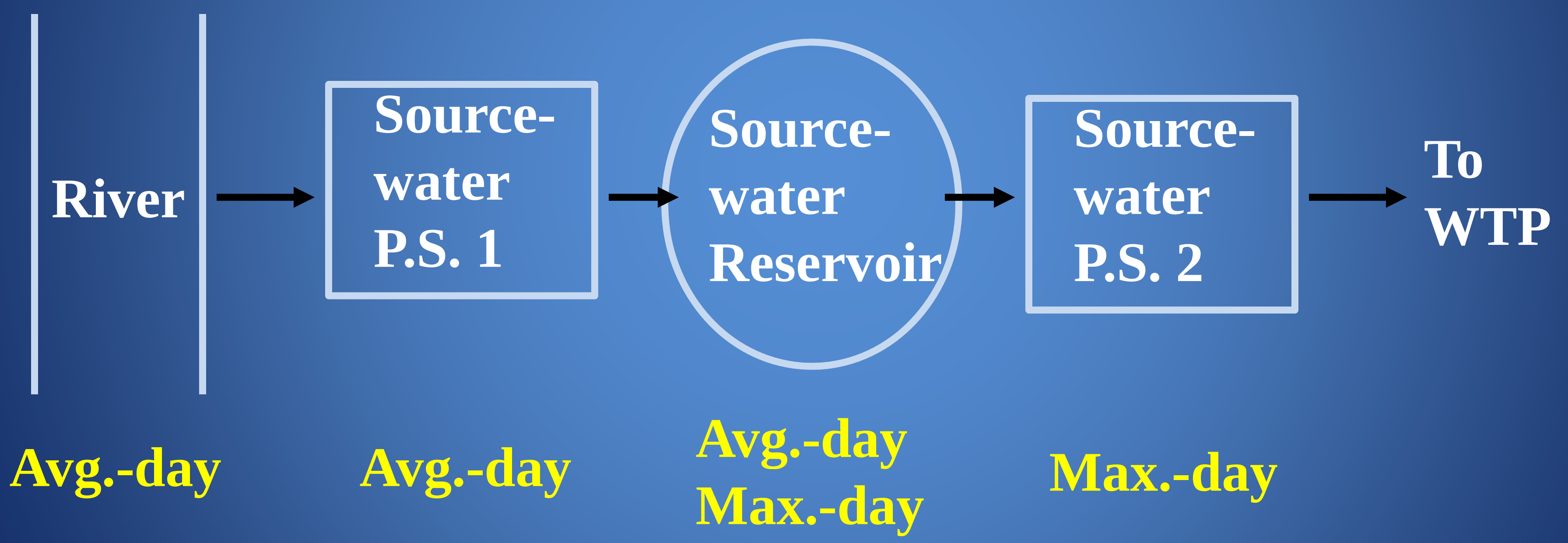
Determining Approved Capacity of a Surface Water Source

Water-supply Source



Flow-rate Basis for Component Design Criteria

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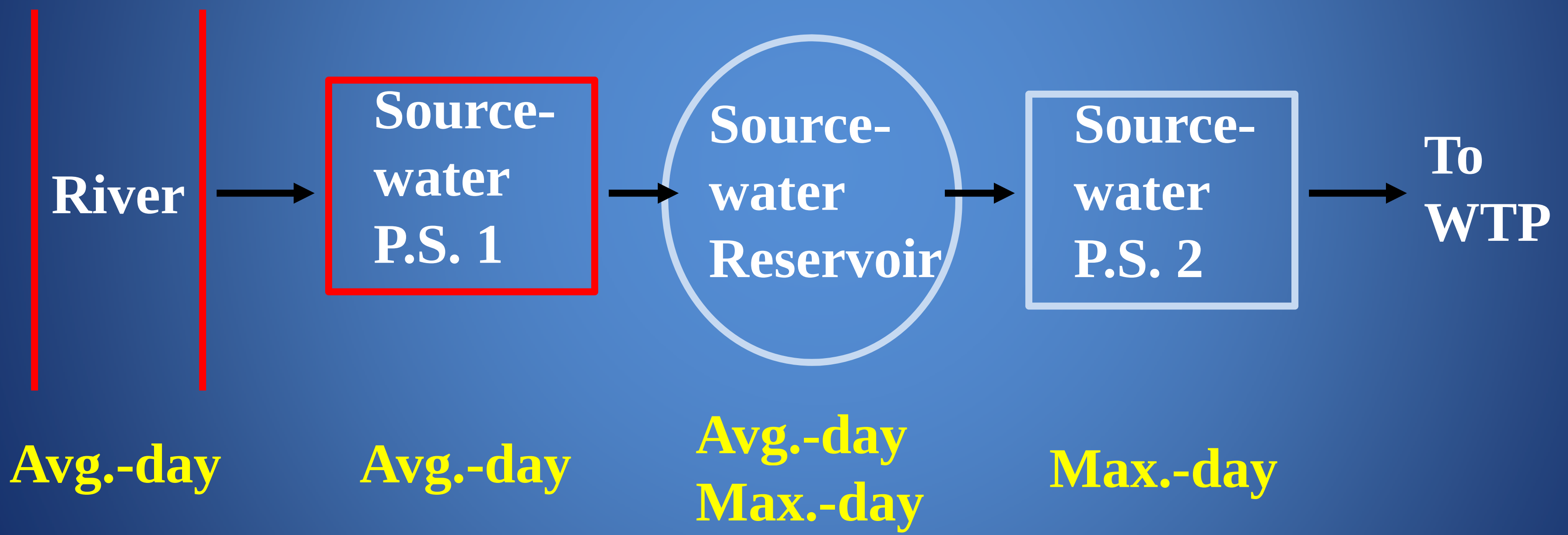
1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
River	One		Stable Yield based on an Engrg. Submission (1)	Req'd	7.5 MGD	Avg. day 1.33	10.0 MGD
Source-water P.S. 1	Four Pumps		Avg. day w/o largest	Req'd	9.0 MGD	Avg. day 1.33	12.0 MGD
		Max. day w/ all in-service		Rec	12.5 MGD	Max. day 1.0	(2)

(1) Engineering submission based on "USGS, Water-Resources Investigations Report 01-4256"

(2) No Equiv. Max-day Capacity based on Design standards or Recommended Design criteria. Only Required Design criteria determines approved capacity.

Determining Approved Capacity of a Surface Water Source

Water-supply Source



Flow-rate Basis for Component Design Criteria

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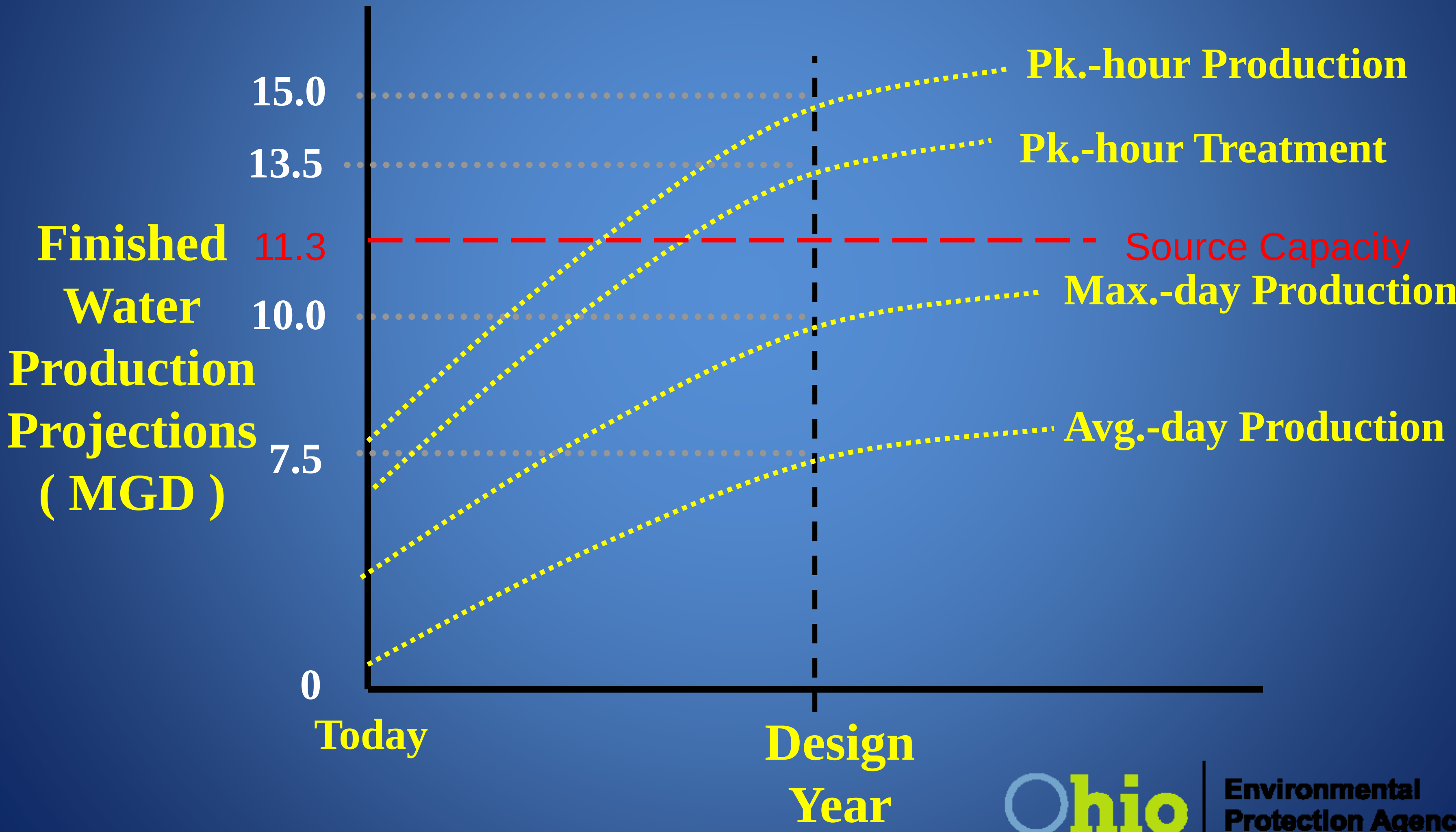
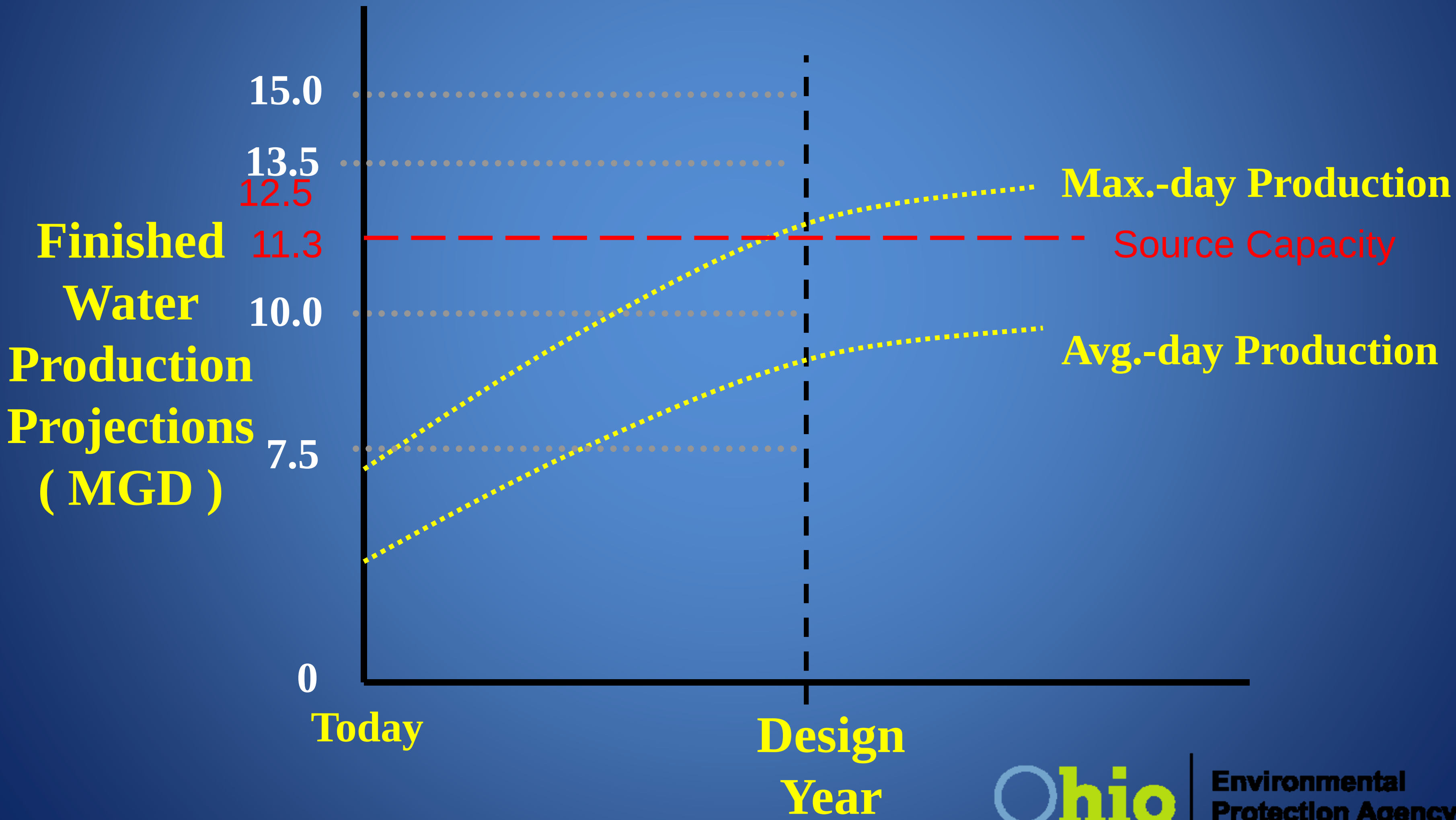
1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Comp. Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Source-water Res.	One		Based on an Engrg. Submission (3)	Req'd	8.5 MGD	Avg. day 1.33	11.3 MGD
		Storage to Assist w/ Max. day		Rec	12.0 MGD	Max. day 1.0	
Source-water P.S. 2	Five Pumps		Max. day w/o largest	Req'd	12.5 MGD	Max. day 1.0	12.5 MGD
		Pk. hour Trtmnt w/ all in-service		Rec	16.5 MGD	Pk. hour Trtmnt 1.35	

(3) An Engineering submission must justify the River, Source-water P.S. 1 & Source-water Reservoir working closely together as a Single Component.

This Figure shows the Finished-water production Projections for a Water System



This Figure shows the Finished-water Production Projections for a Water System



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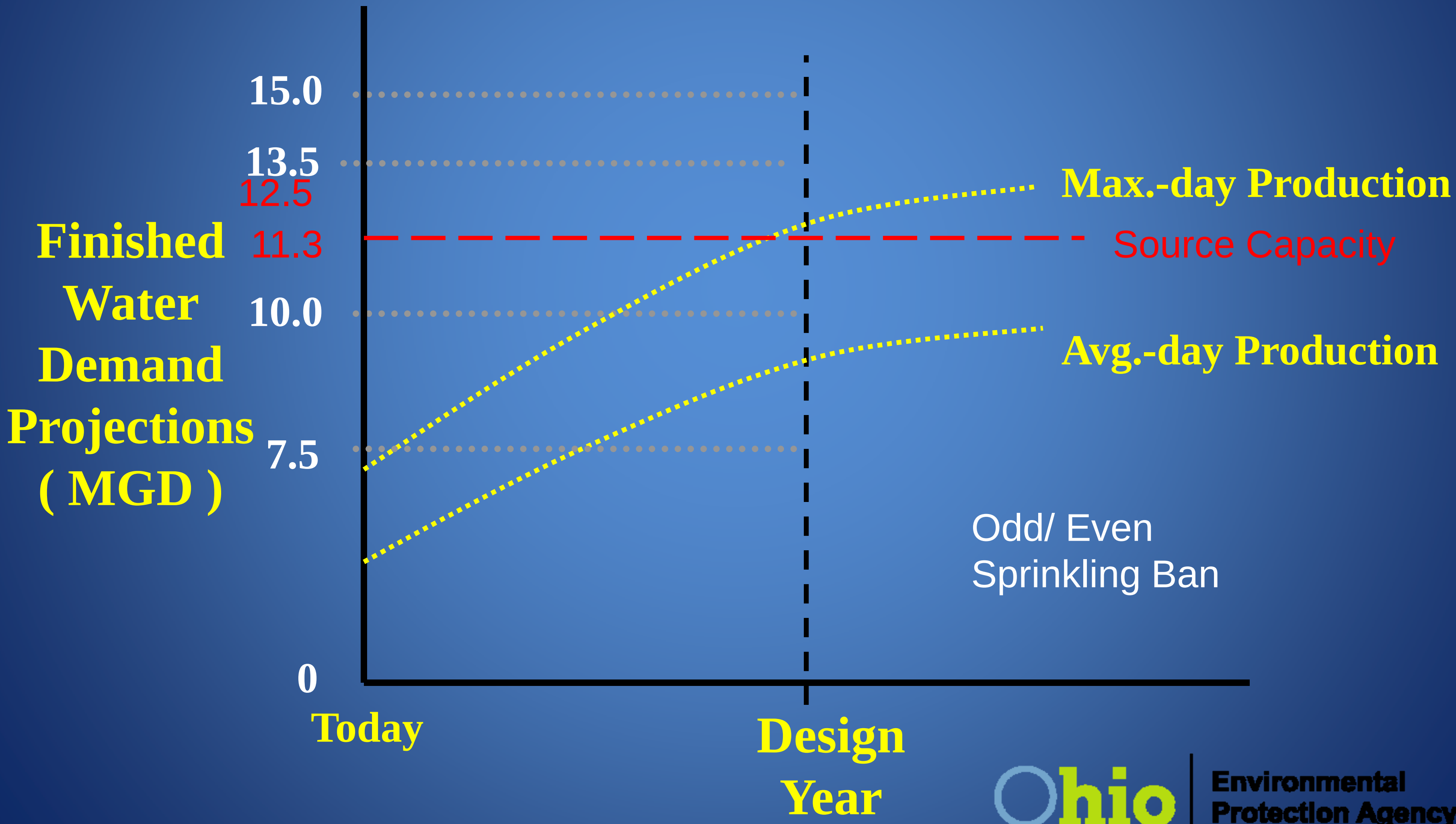
This Figure shows the Finished-water Production Projections for a Water System



Key Conclusions from the B-o-D Table for the Water-supply Source

1. The Approved capacity of the Water-supply source is 11.3 MGD (i.e., the 8.5 MGD Avg.-day Combined Component capacity for the River, Pump Sta. and Reservoir makes this combination the Limiting component of the Water-supply Source)

2. The water system will have to draw from a new River or construct an additional off-line storage reservoir(s) if another expansion is ever needed to meet an Avg.-day water production > 8.5 MGD

3. Source-water P.S. 1, by itself, must deliver only Avg.-day water production since it pumps into the Source-water Reservoir (for which the reservoir storage provides a buffering capacity)

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Key Conclusions from the B-o-D Table for the Water-supply Source

4. An Engineering Submission must justify the combined capacity of the River, P.S. 1 & the Reservoir if these components are to be combined as a single component

5. Source-water P.S. 2 must deliver Max.-day water production since it pumps directly to the WTP

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The Basis-of-Design Table for Water-supply Source Components for a Groundwater Source

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Determining Approved Capacity of a Water System (cont)

This PWS wants to expand its 2.0-MGD water system to an approved capacity of 3.3 MGD (i.e., to be able to meet the projected, Max.-day finished-water production in the design year)

The ratio of Projected, Pk.-hour : Max.-day production is:

$$\frac{5.0\ \text{MGD}}{2.5\ \text{MGD}} = 1.50$$

The ratio of Projected, Pk.-hour treatment : Max.-day production is:

$$\frac{4.5\ \text{MGD}}{3.3\ \text{MGD}} = 1.36$$

The ratio of Projected, Max.-day : Avg.-day production is:

$$\frac{3.3\ \text{MGD}}{2.5\ \text{MGD}} = 1.32$$

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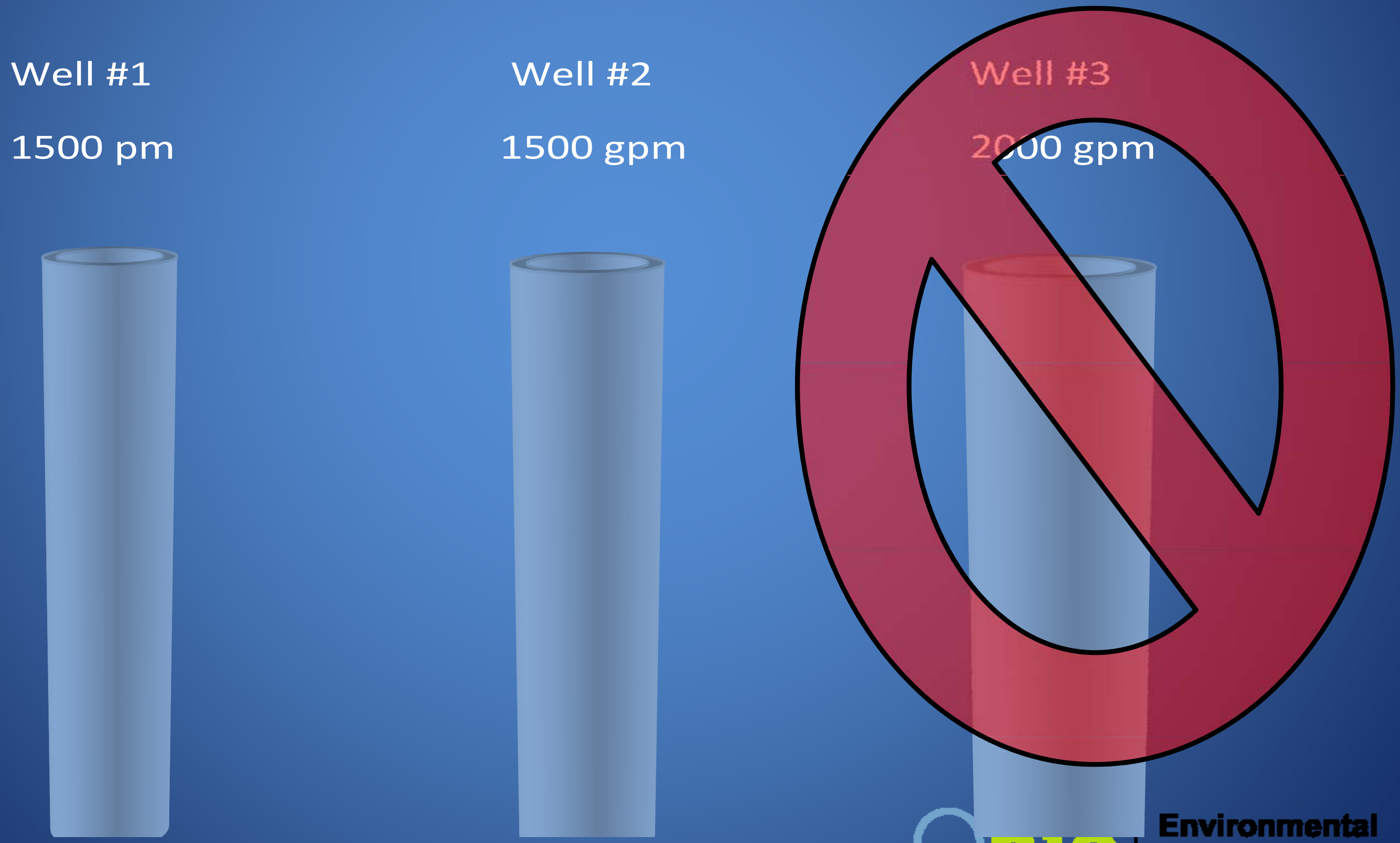
Determining Approved Capacity of a Ground Water Source



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Determining Approved Capacity of a Ground Water Source

1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Aquifer	1	?	?	?	?	?	?
Wells	3		Max. day w/o largest	Req'd	4.32 MGD	Max. Day 1.0	4.32 MGD

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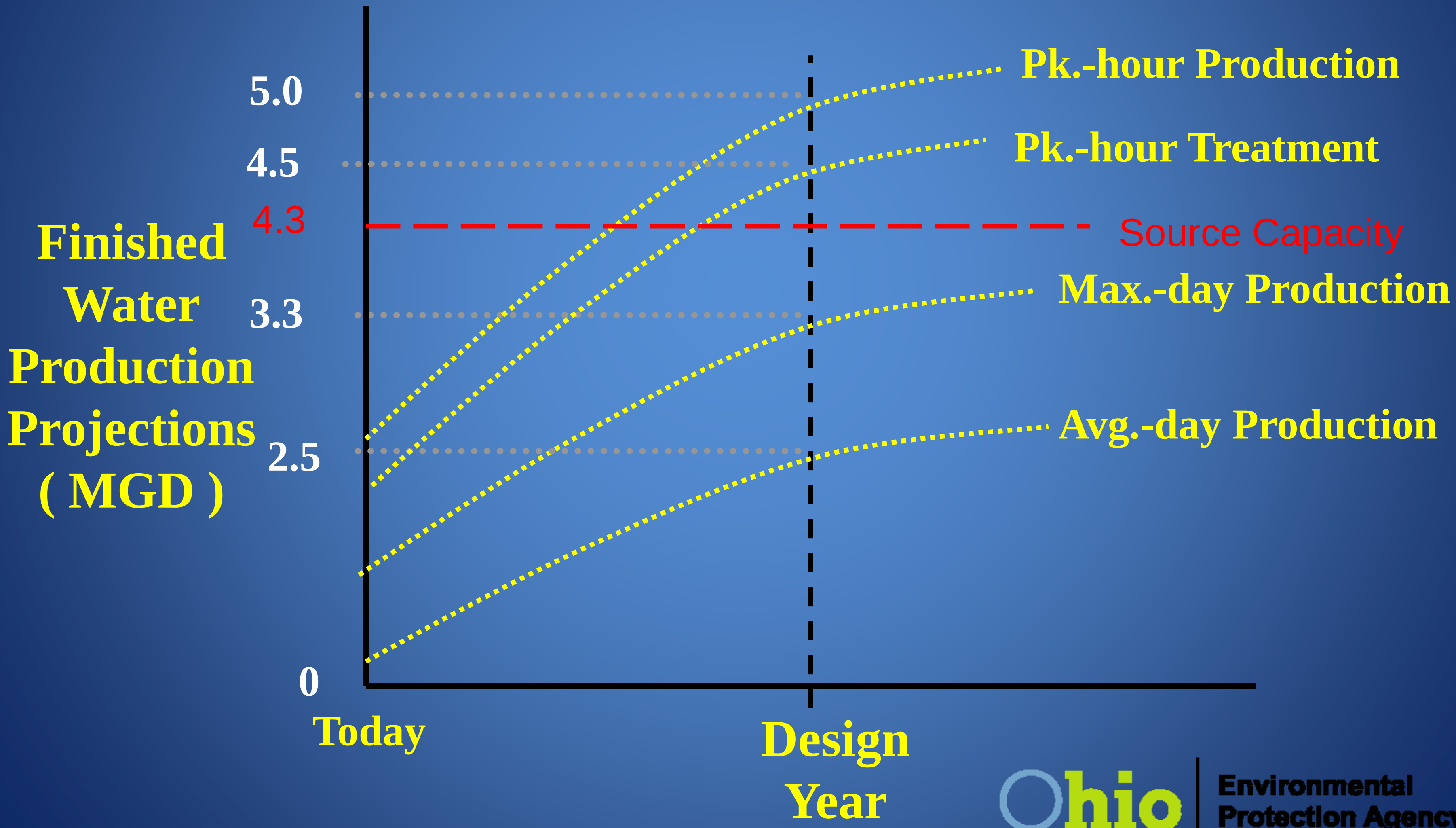
This Figure shows the Finished-water Production Projections for a Water System



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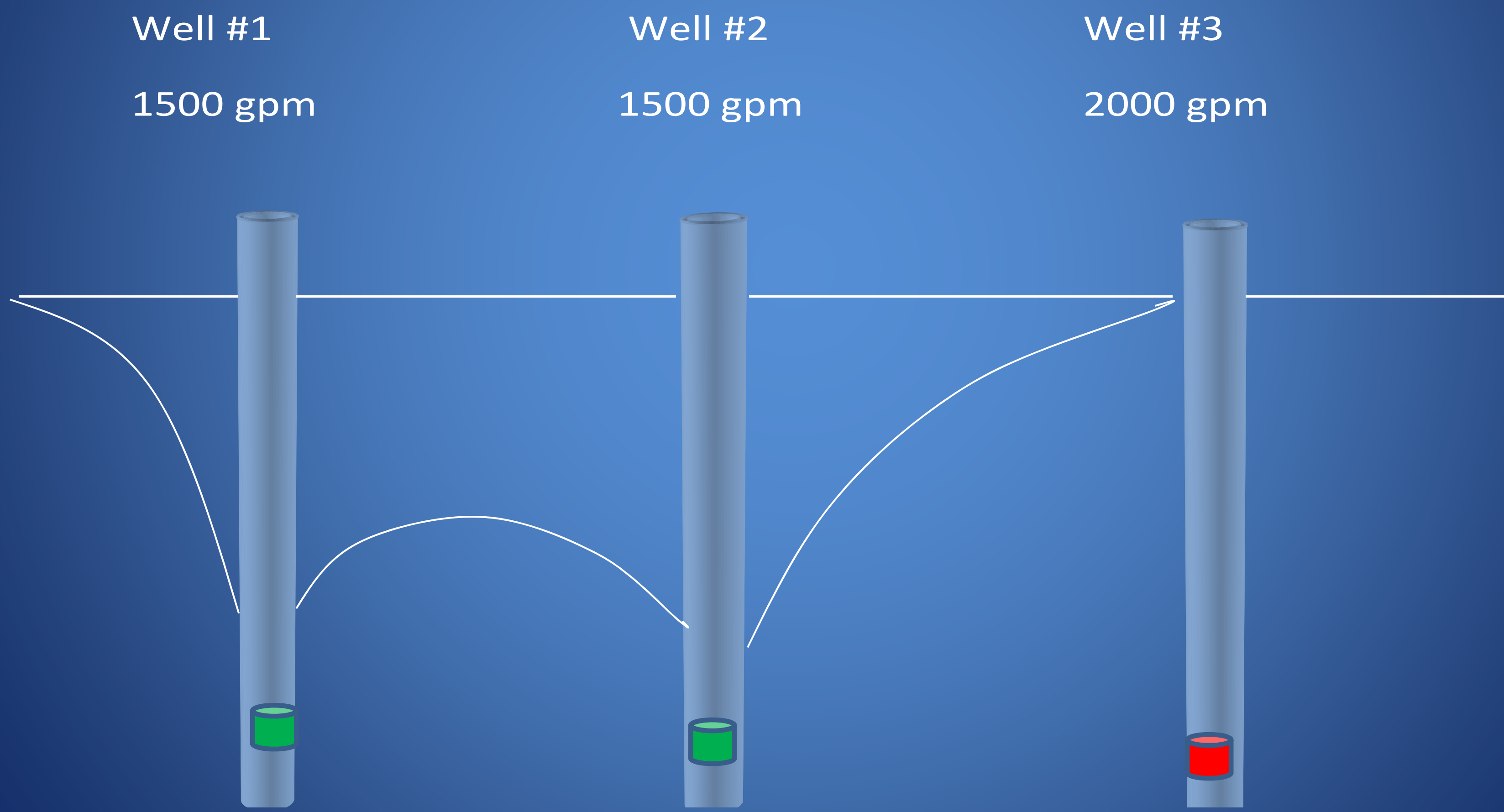
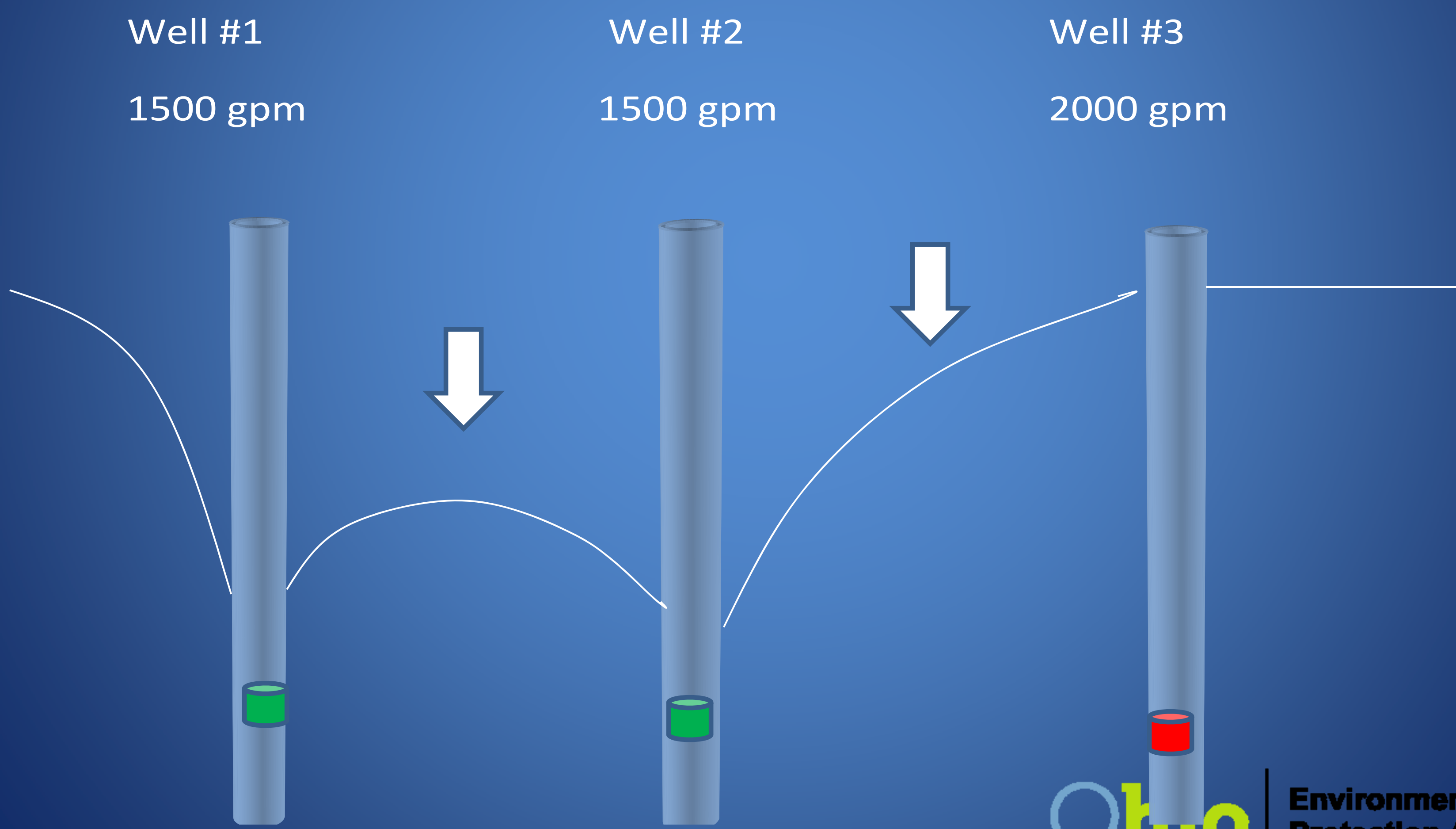
Problem with Determining Approved Capacity of a Ground Water Source



Problem with Determining Approved Capacity of a Ground Water Source



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Problem with Determining Approved Capacity of a Ground Water Source

Determining the Stable Yield of the Aquifer

- Determine the Equivalent Max Day for the Aquifer
- Resolve well interference problems
- Answer the questions about drought

(surface water criteria is a 50 year drought standard)

- Should the Average flow for the maximum month be evaluated?

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Determining Approved Capacity of a Ground Water Source

1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Aquifer	1	?	Avg. Day		3.27 MGD	1.32	4.32 MGD
Wells	3		Max. day w/o largest	Req'd	4.32 MGD	Max. Day 1.0	4.32 MGD

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Key Conclusions from the B-o-D Table for the Water-supply Source

1. The Approved capacity of the Water-supply source is 4.32 MGD

2. The water system will have to draw from a new source or construct an additional off-line storage reservoir(s) if another expansion is ever needed to meet an Avg.-day water production > 3.27 MGD or a Max.-day water production > 4.32 MGD

3. Wells 1, 2, and 3 must deliver Max.-day water production since they pump directly to the WTP

4. The Aquifer must be able to deliver Avg.-day water production on a continuous basis.

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1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Comp. Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Source-water Res.	One		Based on an Engrg. Submission (3)	Req'd	8.5 MGD	Avg. day 1.33	11.3 MGD
		Storage to Assist w/ Max. day		Rec	12.0 MGD	Max. day 1.0	
Source-water P.S. 2	Five Pumps		Max. day w/o largest	Req'd	12.5 MGD	Max. day 1.0	12.5 MGD
		Pk. hour Trtmnt w/ all in-service		Rec	16.5 MGD	Pk. hour Trtmnt 1.35	

(3) An Engineering submission must justify the River, Source-water P.S. 1 & Source-water Reservoir working closely together as a Single Component.

Determining Approved Capacity of a Ground Water Source

1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Aquifer	**1**	**?**	**Avg. Day**		**3.27 MGD**	**1.32**	**4.32 MGD**
Wells	**3**		**Max. day w/o largest**	**Req'd**	**4.32 MGD**	**Max. Day 1.0**	**4.32 MGD**

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Interconnect the Ground Water and the Surface Water System

1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Source -water Res.	One		Based on an Engrg. Submis sion	Req'd	8.5 MGD	Avg. day 1.33	11.3 MGD
Wells	3		Max. day w/o largest	Req'd	4.32 MGD	Max. Day 1.0	4.32 MGD

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Interconnect the Ground Water and the Surface Water Source

- Water Supply Source Capacity
  - Ground Water 4.32 MGD
  - Surface Water 11.3 MGD
  - Total Water Supply Source Capacity

15.62 MGD

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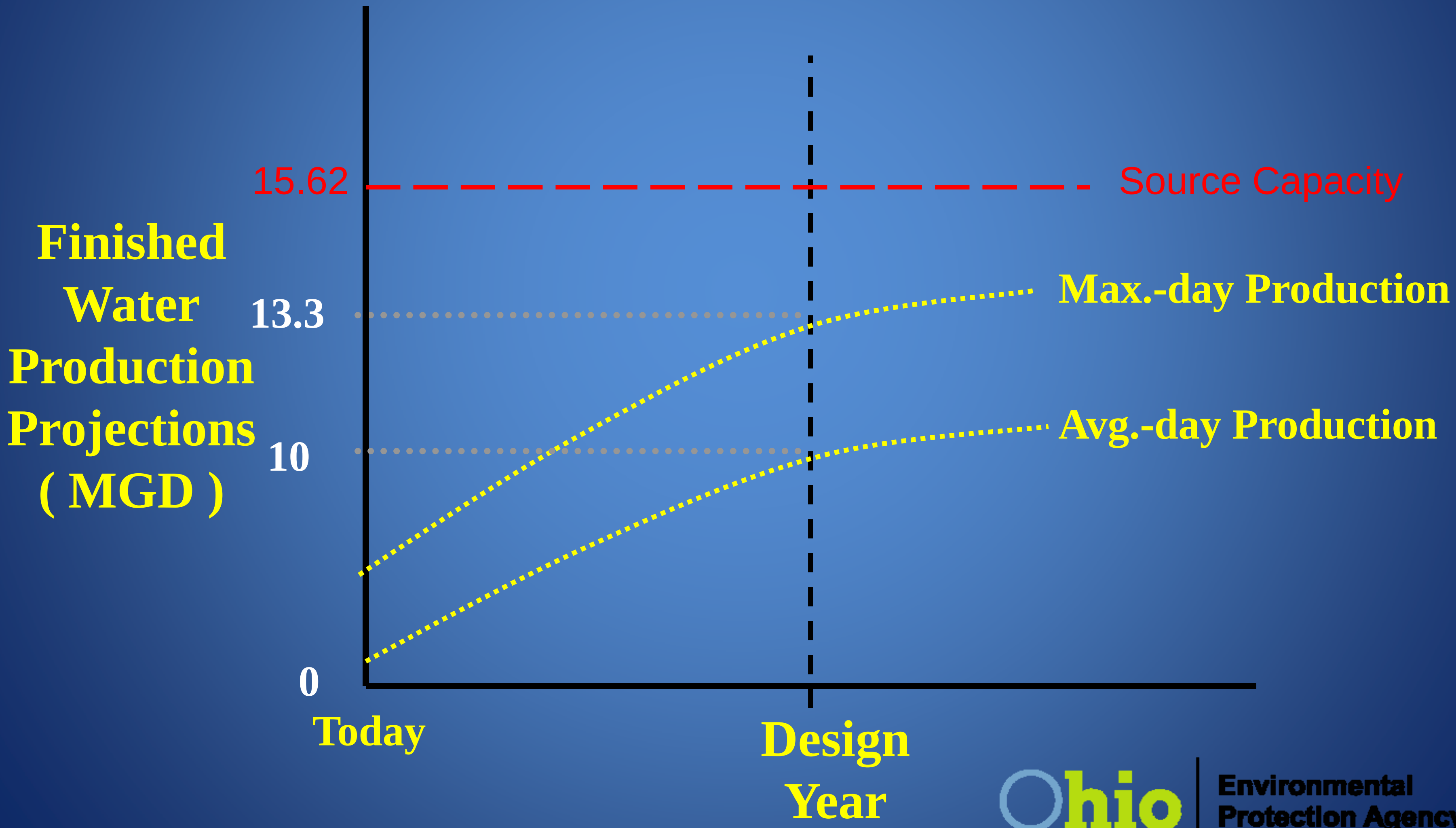
This Figure shows the Finished-water Production Projections for a Water System



Advantages to combining the Two Systems

- Reduction of Water age (Reduced TTHMs)
- Reduced peak hour of treatment at the Surface Water Plant (Improved CT)
- Operational Flexibility
- Economy of Scale
- Improvement of Distribution Pressures
- Improvement of Distribution Disinfection Residuals

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For More Information

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Approved Capacity
Planning and Design Criteria for Establishing Approved Capacity for: 1) Surface Water and Ground Water Supply Sources 2) Drinking Water Treatment (WTPs), and 3) Source/WTP Systems

Developed by the Ohio EPA/AWWA Technology Committee

Presented by John Arduini
3-10-11

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Presentation Content

- Approved Capacity of a water treatment plant
- Components of a water treatment plant
- Component capacity determination
- Redundancy requirements
- Residual streams

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Major Parts of a Water System

1 — **2** — **3**

Surface Water
Lakes
Reservoirs
Streams

Ground Water
Wells

→ **Water Treatment Plant** →

Homes
Businesses
Industries

1) **Water-supply Source**
2) **Water Treatment Plant**
3) **Distribution System**

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The Approved Capacity of a Water Treatment Plant. . .

. . . Must be large enough that finished water can be:

1. Processed at a flow rate equivalent to the design year maximum-day production,

2. Disinfected (CT) at a flow rate equivalent to the design year peak-hour of treatment for surface water treatment plants (and some ground water treatment plants) and,

3. Delivered to the distribution system at a flow rate equivalent to the design year peak-hour production

Production – is the water being pumped to the distribution system

Establishing The Approved Capacity of a WTP

The approved capacity of a WTP is determined by comparing the component capacities on an equivalent max-day basis. The component with the lowest capacity, defined by the document as the

limiting component

determines the WTP capacity

We have been doing all along, but the Approved Capacity document formalizes the criteria and makes the process more

Transparent

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Components of Ground Water Treatment Plant

- Treatment processes such as aeration, filtration, and softening.

  Note that a filter is not by itself a component, the whole process of filtration including all filters, all piping, valving, and backwash system is a component.

- A filter is a unit within the filtration component

- Softeners (as a set, not each individual unit)
- Intermediate pumps (as a set)
- Finished water pumps (as a set)
- Essential chemical feed and storage systems
- Disinfection facility, such as UV, chlorination, or chloramination

Components of Surface Water Treatment Plant

- Treatment processes such as coagulation, flocculation, sedimentation, and filtration; note that a filter is not by itself a component; the whole process of filtration including all filters, backwash system, all associated piping, and valving, make a component.
- Intermediate pumps (as a set, not each individual pump)
- Finished water pumps (as a set)
- Essential chemical feed and storage facilities
- Disinfection facility, such as UV, chlorination, chloramination

Component Capacity

Component capacity means the allowable rate not to be exceeded over a period of time.

WTP component capacities are based one of the following three criteria:

1. The ability to treat up to the maximum day (for most components) or,
2. The ability to process the maximum hour of treatment, for CT disinfection or,
3. The ability to supply the maximum hour of pumping (production) for finished water pumps.

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Example of Determination of Component Capacity

Filters in a surface water treatment plant

Filtration rate 4.0 gpm/ ft^2 ; 5 filters with dimensions of 20' X 20'

Total filtration area with one filter out of service:

4 x 20' x 20' = 1600 ft^2

Component Capacity

1600 ft^2 x 4.0 gpm/ ft^2 = 6400 gpm

= 9.22 MGD 24 hours/day operation

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Component Capacity of Filters at Surface Water Plants

- Most swtp's were historically approved with a maximum filtration rate of 2.0 gpm/sf, which has been recognized as being very conservative
- For these existing swtp's, the AC document defines a process for obtaining a filtration rate of up to 4.0 gpm/sf, with dual media filters and without having to through a demonstration period
- Must have a record of good operation (turbidity, CT, proper operator certification)
- Submit a general plan, request new filtration rate, no fee required
- Does not guarantee increase of AC of wtp.

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WTP Component Capacities

- WTP component capacities (with the exception of components based on one hour criteria) are based on the average water processed during either a 24 hour period or during the period of operation if a component is operated for less than 24 hours per day.

- For example, a component that has been rated at a capacity of 6 MGD is permitted to process a maximum of 6 MGD in a 24 hour period. If the component is operated for less than 24 hours, then that component is permitted to process a maximum of

$$X \div 24 \times 6 \text{ MGD}$$

- Where X is the number of hours of operation. As an example, for 12 hours of operation, a 6 MGD component would be permitted to process a maximum of 3 MGD.

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WTP Component Capacities

Note that during the operating period that same 6 MGD component is permitted to exceed the component capacity. As long as the total production allowed for the period of operation does not exceed the component capacity, and all water quality and treatment technique requirements are met, a component can temporarily operate at a higher rate.

For example, that 6 MGD component being operated for a full 24 hours could have this type of production schedule:

12 hours	4.0 MG	- a rate equivalent to 8 MGD
12 hours	2.0 MG	- a rate equivalent to 4 MGD

Total hours of operation - 24 Total production - 6.0 MGD

The component has been operated within its allowable capacity because it has not exceeded 6 MGD within a 24 hour period, assuming all water quality and treatment technique requirements have been met

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WTP Component Capacities cont'd

Example of a component operated less than 24 hours per day

Assume component has been rated for 6 MGD but is operated only 12 hours per day.

The maximum allowable production for this component is 3 MGD in a 12 hour period (1/2 day)

6 hours (1/4 day) 2 MG - a rate equivalent to 8 MGD

6 hours (1/4 day) 1 MG - a rate equivalent to 4 MGD

Total hours of operation – 12 hours (1/2 day)

Total production - 3.0 MG (1/2 component capacity of 6 MGD)

The component has been operated within its allowable capacity because it has not exceeded the equivalent of 6 MGD within a 24 hour period. This is an allowable production schedule, assuming all water quality and treatment technique requirements have been met.

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How Component Capacities Are Used to Determine WTP Approved Capacity

- Determine all component capacities of WTP applying all redundancy requirements.

- For a typical (basic) SWTP: raw water pumps (used to pump raw water into wtp; excludes pumps used to fill reservoirs), rapid mix, flocculation, settling, filtration, CT disinfection, high service pumping. Also review all chemical feed systems, again with required redundancy.

- Compare all component capacities; the lowest component capacity defines the AC of the WTP. The defining component is defined as the limiting component.

- In many SW TPs, the limiting component is the filtration process.

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Redundancy Requirements for SWTPs

The Approved Capacity document clearly defines redundancy requirements related to approved capacity determinations. Ten States Standards requires some redundancies, but is not always clear about when to take a unit out of service for capacity considerations

- Pre-treatment components (rapid mix, coagulation, settling) are are rated with all units considered to be in service. At least two units of each are required

- The filtration component is rated with one filter (largest) out of service

- Raw water, intermediate pumping and finished water pumping are rated with one pump (largest) out of service

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Redundancy Requirements for SWTPs cont'd

- Clearwells, at least two units required, but component capacity is based on both in service

- For water systems (GW or SW) with a source-water chronic contaminant (e. g. arsenic, THMs) concentration less than twice the Maximum Contaminant Level (MCL), redundant treatment is required (all treatment processes related to that contaminant) unless a contingency plan is submitted to describe how all necessary treatment units can be repaired or replaced within 30 days

- Examples of acceptable contingency plans: provide an additional unit-treatment process of adequate capacity to meet maximum-day production with the largest unit out of service, utilize blending, have an emergency connection in place with another public water system, have water use restriction capabilities in place, etc.

- For disinfection byproducts, use running annual average instead of MCL

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Redundancy Requirements for SWTPs cont'd

- For systems (GW or SW) with a source-water chronic contaminant concentration greater than or equal to twice the MCL, the system must submit a well-defined contingency plan describing the ability to consistently comply with the MCL (e.g., provide an additional treatment unit of adequate capacity to meet maximum-day production with the largest unit out of service, utilize blending, have an emergency connection in place with another public water system, have water use restriction capabilities in place, etc.).

- For disinfection byproducts, instead of MCL use running annual average

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Redundancy Requirements for SWTPs cont'd

- All essential chemical feed systems must have 30 days of storage and redundant feed pumps

- Essential chemical – any chemical necessary to meet a water quality requirement, or treatment technique requirement is considered an essential chemical

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Essential Chemicals for SWTPs

- Coagulant
- Polymer(s) if necessary to meet surface water treatment turbidity standards (or filterability, etc.)
- Corrosion control chemicals where required to meet water quality parameters for lead and copper corrosion control
- Oxidant , where required for removal of primary contaminants
- Disinfectant, for both CT and residual in distribution system

- Fluoride for public water systems required by law to maintain the required operating range of 0.8 to 1.3 mg/L

- Any chemical required during a demonstration study to obtain Ohio EPA approval of an alternative technology

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Redundancy Requirements for Ground Water Treatment Plants

- Redundancy requirements for treatment of specific chronic contaminants (such as volatile organics or disinfection byproducts), are identical to those of surface water
- At least two units are required for each component used in treatment of health-based MCL type contaminants. Note, redundancy is not required for iron and manganese treatment and softening.
- As with surface water treatment plants, any essential chemical (needed to satisfy a required treatment technique or MCL), will need to have redundant feed pumps.

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Redundancy Requirements for Treatment of Aesthetic Parameters

- Redundancy is not required for treatment of aesthetic contaminants such as hardness, taste and odor, hydrogen sulfide, etc.

- However redundancy will be recommended. If you are treating for some aesthetic contaminant such as hardness, then your customers probably expect this type of treatment to be fairly consistent.

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Essential Chemicals for GWTPs

- Corrosion control chemicals where required to meet water quality parameters for lead and copper corrosion control
- Oxidant , where required for removal of primary contaminants
- Disinfectant
- Fluoride for public water systems required by law to maintain the required operating range of 0.8 to 1.3 mg/L
- Any chemical required during a demonstration study to obtain Ohio EPA approval of an alternative technology

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Residual Streams

- “Residual stream” means the difference, over a specified period of time, between WTP influent flow rate and WTP production. Examples are: sludge, filter backwash water, RO membrane reject stream, ion exchange regeneration waste

- Residual streams must be considered in the design

- If the total flow of residual streams exceeds 5% of the desired approved capacity of the WTP, the design of effected components of the WTP must be adjusted to account for the residual streams. This also assumes the residual streams are not recycled either partially or in full

- Residual streams are especially significant with softening membranes (reverse osmosis - RO) that have residual streams of 15% - 25% of the influent.

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Residual Streams cont'd

Example of a residual stream consideration in the design of a ground water membrane softening wtp

Assume the desired approved capacity of the Source/WTP system is 4.0 MGD

Assume the proposed membrane rejects 20% of influent

The approved well field capacity must be at least 5.0 MGD

5.0 MGD - 20% of 5.0 MGD = 4.0 MGD

Also, the component capacity of all components upstream of the membranes must be at least 5.0 MGD. These include feed pumps, filters, and chemical feed systems.

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How Component Capacities Are Used to Determine WTP Approved Capacity

- Determine the component capacity of each component of a WTP applying all redundancy requirements, on an equivalent maximum-day basis.

- For a typical SWTP: raw water pumps (used to pump raw water into wtp; excludes pumps used to fill reservoirs), rapid mix, flocculation, settling, filtration, CT disinfection, high service pumping. Also review all chemical feed systems, again with required redundancy.

- Compare all component capacities; the lowest component capacity on an equivalent maximum-day basis, defines the AC of the WTP. The defining component is defined as the limiting component.

- In many SW TPs, the limiting component is the filtration process.

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How Component Capacities Are Used to Determine WTP Approved Capacity cont'd

- Components are evaluated on one of these three bases: average-day production, maximum-day production (design approved capacity) or peak-hour treatment (or production).

- Some components only need to able to deliver the average daily production. The main example of this type of component is raw water pumps used to transfer water from a stream to an off-stream reservoir, because these pumps do not deliver water directly to the wtp.

- Most components will need to be able to process water at the desired approved capacity of the wtp. Examples are pumps that deliver raw water directly to the wtp, chemical feed pumps, and filters.

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How Component Capacities Are Used to Determine WTP Approved Capacity cont'd

- Some components need to process water at some maximum hour, which is likely to be greater than the maximum day design capacity. The most familiar being clearwells used to meet CT requirements, and high service pumps.

- Clearwells used for CT disinfection need to be able to satisfy the peak hour of treatment, which is the rule requirement.

- High service pumps need to be able to meet the peak hour production – which is the water being pumped out to the distribution system. For some wtp's with large clearwells, this rate could be larger than the maximum day production.

Example of Determination of Equivalent Maximum-Day Component Capacity

- Assume these ratios:
- Max-Day to Avg-Day =1.3;   Peak-Hour Trtmnt to Max-Day = 1.2;
- Peak-Hour Production to Max-Day = 1.3
- Assume we are designing a 10 MGD swtp.
- Reminder: production is water pumped to the distribution system, which is not necessarily equal to water being treated.

- For raw water pumps being used to pump water from a stream to an off-stream reservoir, the equivalent max-day component capacity is found by multiplying the pumping capacity with the largest pump out of service by the Max-Day to Avg-Day ratio.

If we have 3 4 MGD pumps the EMDC =   2x4x1.3

= 10.4 MGD

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Determination of Equivalent Maximum-Day Component Capacity cont'd

- Most components in the plant will be rated on the Max-Day basis, with the required redundancies.   For example, all pre-treatment components in a typical swtp, the EMD capacity will involve a simple calculation based on required detention times or loading rates with all units in service.

- Clearwells for CT disinfection will have a component capacity based on the peak hour of treatment, as required by our rules.   For example, if the calculation of the CT capability of the clearwell shows an achievable CT of 50, then EMD component capacity will be calculated as 50/1.2 = 41.7.

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Detertmination of Equivalent Maximum-Day Component Capacity cont'd

High service pumps will have a component capacity based on the peak-hour production, which is the hour of maximum pumping, with the largest pump out of service. For our example wtp, if we have these high service pumps: 5, 5, 4, 4, or 13 MGD with the largest out of service.

- The Equivalent Maximum Day capacity of the high service pumps is:

13/1.3 = 10 MGD

- This is a new way of looking at high service pumps, recognizing that some wtp's have a need to pump water to distribution (production) at a higher rate than the ability of the wtp to produce it.

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Approved Capacity Determination For a GWTP

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Example - plans are submitted for a new gwtp which needs to provide, iron and manganese removal, fluoridation, and CT disinfection for viruses. The AC document will help us answer two basic questions.

1. Based on available information and future production projections, what approved capacity will be required?

2. What approved capacity can we assign to the WTP shown on the plans?

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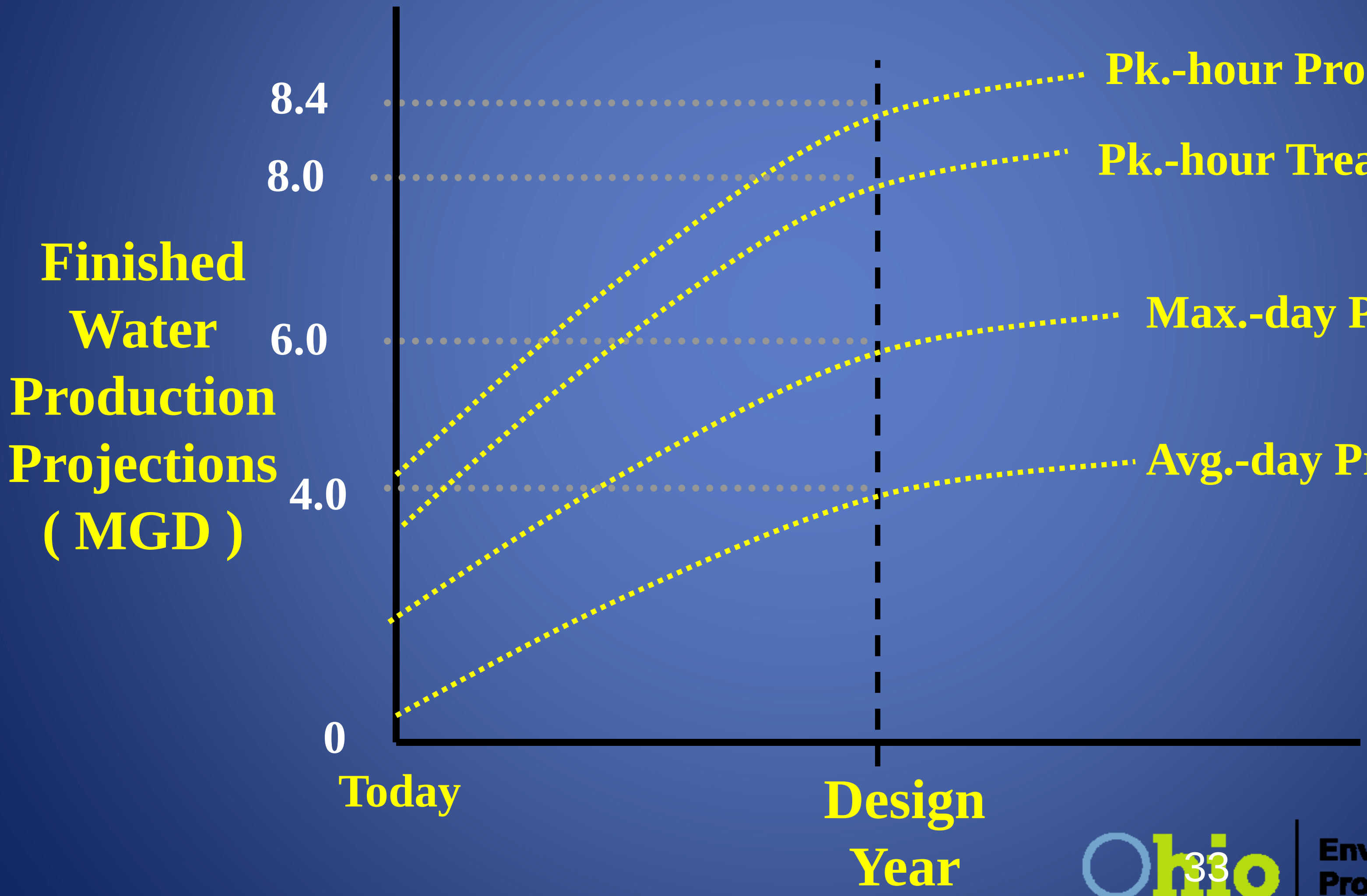
Useful Definitions

- Approved capacity – maximum rate allowed for a WTP or a raw water source, on a per day basis. This is defined by the limiting component
- Component capacity –maximum allowable throughput of a component (e.g. settling basins, filters), on an equivalent maximum-day production basis.
- Limiting component – component with the lowest equivalent maximum-day capacity
- Equivalent maximum-day capacity – the maximum-day production that a component would be able to support

Water Projections Supplied by Engineer



Design Considerations

- Average day ------------ 4.0 MGD
- Maximum day ------------ 6.0 MGD
- Peak hour treatment -- 8.0 MGD
- Peak hour production – 8.4 MGD
- Peak hour treatment to max day ratio $8 \div 6.0 = 1.33$
- Peak hour production to max day ratio $8.4 \div 6.0 = 1.4$

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Basis of Design Table

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1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Component Cap Ratio	8 Equiv. Max.-day Capacity
Aerators	2 3.1 MGD	5.0 gpm per sq ft	Max day with all in service	Req'd TSS	6.2 MGD	Max day 1.0	6.2 MGD
Aerator Reaction Basin	One	Reaction time 30 minutes	Max day with all in service	Req'd TSS	6.1 MGD	Max day 1.0	6.1 MGD
Filters	Four 1460 sf Total area	3.0 gpm per sq ft	Max day with all in service	Req'd TSS	6.3 MGD	Max day 1.0	6.3 MGD
Clear-wells	Two	Virus CT Table OAC	Peak hour treatment all in service	Req'd OAC	8.5 MGD	Pk hour Treatment 1.33	8.5 ÷ 1.33 6.4 MGD
Finished Water Pumps	4- 3 MGD 12 MGD total	Ac Document	Peak hour Production Lgst O/S	Req'd	9 MGD	Peak hour Production 1.4	9 .0 ÷ 1.4 6.4 MGD

1 Component	2 # of units	3 Design Standard	4 Design Criteria	5 Req'd / Rec	6 Component Capacity	7 Flow Basis of Comp. Cap. / Ratio	8 Equiv. Max.-day Capacity
Chlorin-ation System	Two feeders	TSS 5.0.3.g	Max day Lgst feeder O/S 30 day storage	Req'd	8.5 MGD	Pk hour Treatment 1.33	8.5 ÷ 1.33 6.4 MGD
Potass-ium Perm. System	One feeder	TSS 5.0.3.g	Max day	Req'd	6.5 MGD	Max day 1.0	6.5 MGD
Fluorida-tion System	Two feeders	TSS 5.0.3.g	Max day Lgst O/S 30 day storage	Req'd	6.5 MGD	Max day 1.0	6.5 MGD

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Summary of Basis of Design Table

- The limiting component is the aerator reaction basin with an equivalent maximum day component capacity of 6.1 MGD
- Therefore the Approved Capacity of the WTP as shown on the plans is 6.1 MGD, and is large enough to satisfy the production projections.

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Approved Capacity of the Source/WTP System

- Assuming this system has 7 wells, each with a capacity of 1 MGD, the approved capacity of the raw water sources is 6.0 MGD. That's according to the presently used methodology, unless there are indications of other limits. Aquifer testing may be required in the future, and is presently required in some instances.

- The approved capacity of the system, looking at both the raw water source and WTP is the lower of the two:

- AC of source – 6.0 MGD AC of WTP – 6.1 MGD
- AC of system will be 6.0 MGD

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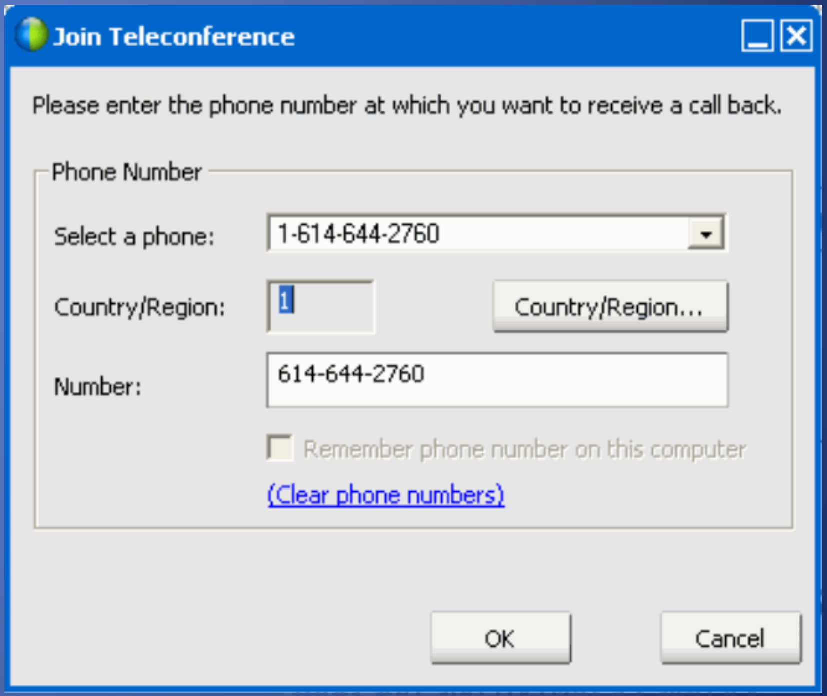
Questions?

During the Q&A session, you will have an option to join the teleconference to ask questions. (If you don't wish to call-in, you can continue to listen over your computer and ask questions via the Chat function).

To join the Q&A teleconference

This box will pop up
Enter your phone number, and you will receive a call placing you into the teleconference.



Again, if you are having trouble, please send a message to Helen Miller using the Chat function for assistance.

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