

*Qualitative Risk Evaluation*  
**Fillmore's Water Recycling and Irrigation  
Proposal**

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**Fillmore Unified School District**



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# Scope of Services

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## □ SCOPE:

Review **background information** from the City and the District relating to the SDI proposal.

Perform **additional research** (e.g., scientific studies, regulations, permits, other projects, etc.)

**Interview representatives** from regulatory agencies, City, and project engineering firm.

Present qualitative **risk evaluation** findings to the School Board.

# Regulatory Authority

## Three Key Agencies

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California DHS

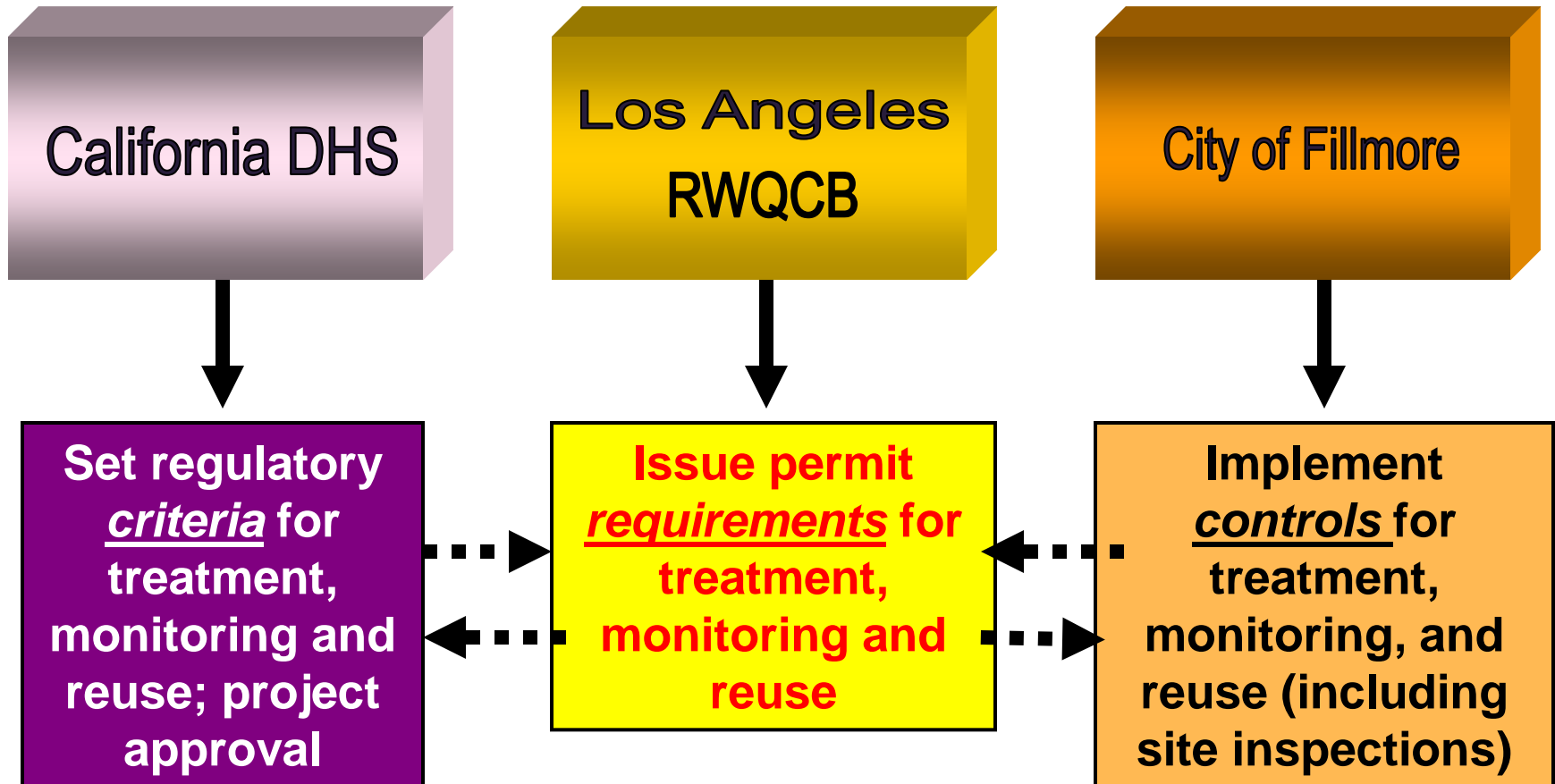
City of Fillmore

Los Angeles  
RWQCB

# Regulatory Process - Functions

Criteria, Requirements, and Controls are Key

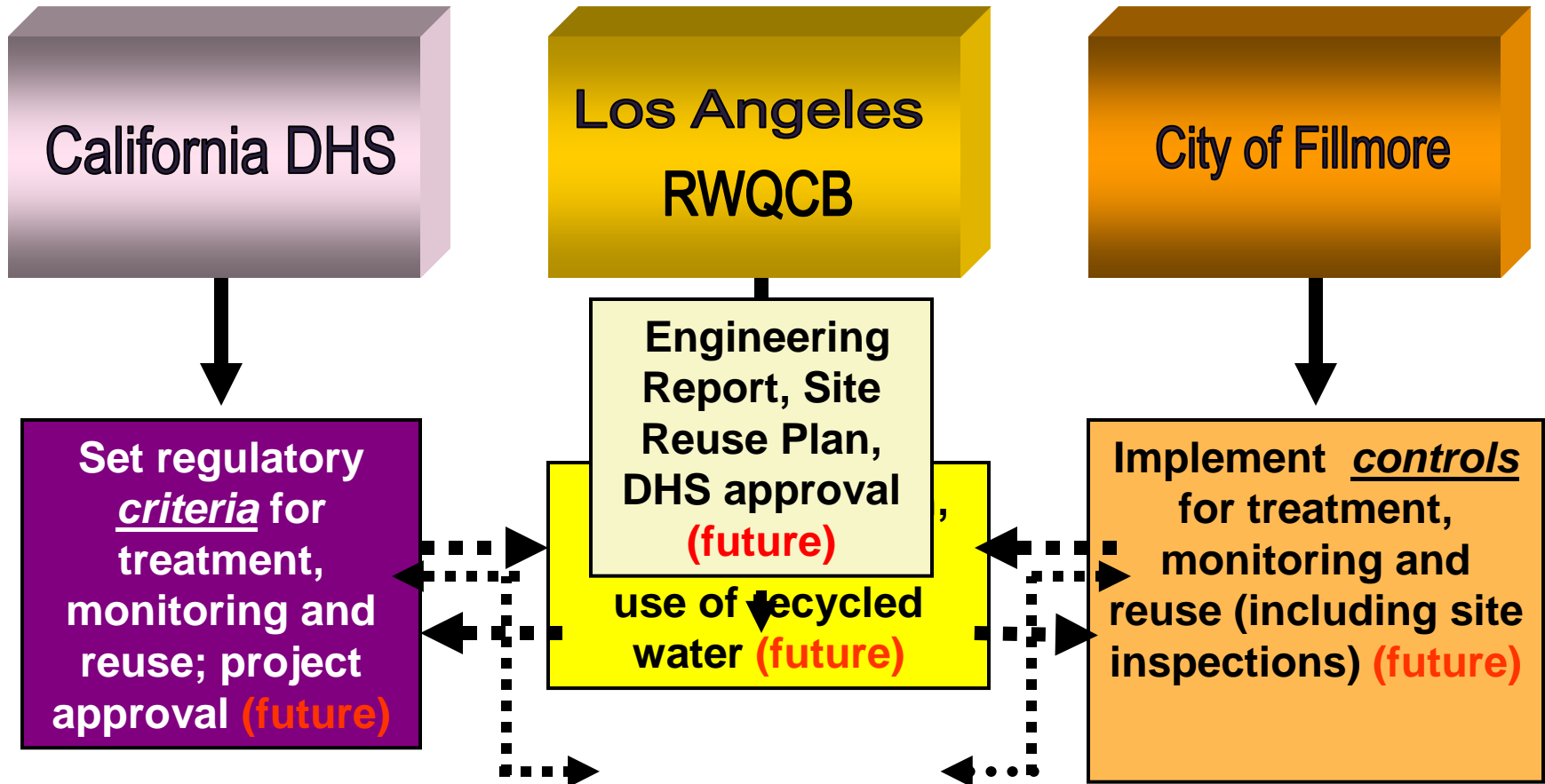
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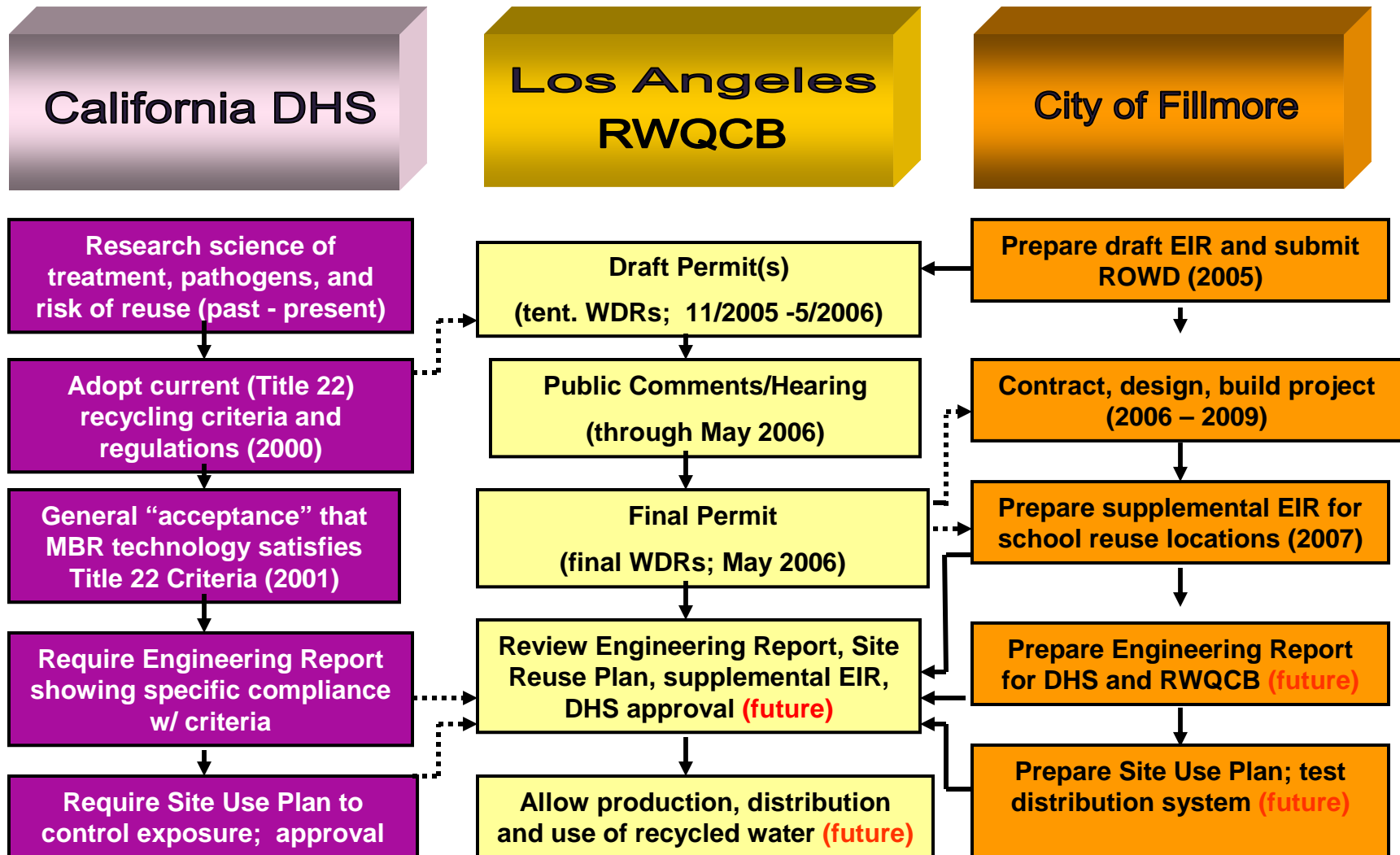
# Regulatory Process – Future agency controls

## Site-specific regulatory and operational controls

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# Regulatory Process - Overview



# Generic Risk Assessment Process Elements

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## □ Risk assessment requires four elements:

- (1) **Hazard Identification**. Identifying microbial pathogens or chemical contaminants that can be transmitted by recycled water.
- (2) **Dose-Response Assessment**. Determine relationship between ingested dose and effect on health (dose – response curve; probability of effect).
- (3) **Exposure Assessment**. Estimating the amount and duration of exposure to pathogens and chemicals.
- (4) **Risk Characterization**. Calculate risk of infection or effect based on exposure and dose-response; compare to “acceptable” risk level (i.e., 1 in 10,000/yr)

# Qualitative Risk Evaluation

## Hazard Identification - Candidates

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**Bacteria**

**Toxic chemicals**

**Viruses**



# Qualitative Risk Evaluation

## Hazard Identification

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### □ Qualitative hazard evaluation:

- (1) **Bacteria**. Assume treatment renders effluent “essentially” -- but not absolutely – pathogen free.
- (2) **Viruses**. Assume treatment renders effluent “essentially” – but not absolutely – pathogen free.
- (3) **Toxic chemicals**. Assume treatment achieves drinking water standards (per WDRs); no hazard.
- (4) **Other parameters**. Assume no hazard due to treatment efficiency (e.g., protozoa; 2 – 15 microns) and minimal health concerns (e.g., odors, nitrates, etc.)

# Qualitative Risk Evaluation

## Dose response assessment - Bacteria

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### □ Qualitative dose-response evaluation:

- (1) **Types**. Many bacterial pathogens. Size range 0.2 to 10 microns
- (2) **Infectious Dose**. In theory 1. In practice, scientific studies show wide variability: <10 to > million.
- (3) **Response**. Many responses (gastroenteritis, fever, respiratory).
- (4) **Variables**. Individual susceptibility. Infectious dose hard to determine

# Qualitative Risk Evaluation

## Dose response assessment - Viruses

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### □ Qualitative dose-response evaluation:

- (1) **Types**. Many viral pathogens. Size range 0.01 to 0.3 microns
- (2) **Infectious Dose**. In theory 1. In practice, scientific studies show variability: 1 to > 10.
- (3) **Response**. Many responses (fever, hepatitis, respiratory, etc.).
- (4) **Variables**. Individual susceptibility. Infectious dose harder to determine.

# Qualitative Risk Evaluation

## Exposure assessment – Viruses and Bacteria

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### □ **Multiple barriers to exposure:**

- (1) **Treatment criteria**. Title 22 and WDRs limit E.coli indicator bacteria and turbidity to “safe” levels; tertiary treatment at 5 log (99.999%) pathogen removal.
- (2) **Site Use controls**. Title 22 and WDRs prescribe site Use Controls and contingencies to prevent exposure .
- (3) **Monitoring and testing**. Water quality; treatment O&M and fail safe diversion plans; site use inspections.
- (4) **Variables**. Influent quality variability; treatment process upset; site use controls upset; indicator parameter adequacy (?) for all possible pathogens.

# Qualitative Risk Evaluation

## Risk characterization – Viruses and Bacteria

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### □ Risk summary:

- (1) **Hazard Identification**. DHS considers tertiary treated wastewater to be “essentially” pathogen free.
- (2) **Dose response**. Dose response curves are difficult to determine, and vary by study estimate and organism.
- (3) **Exposure assessment**. Title 22 and WDRs prescribe criteria and controls to prevent exposure. Exposure to an infectious dose is very unlikely. No known cases.
- (4) **Risk of Infection**. Generally, equivalent to the “acceptable” risk for drinking water (<1 in 10,000/year), based on *quantification* of risk for a golf course recycled spray irrigation project (Tanaka, et al., 1998).

# Qualitative Risk Evaluation

## Risk reduction beyond conventional standards

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### □ **Additional risk reduction elements:**

- (1) **State of the art technology**. The proposed MBR technology is “state-of-the-art” tertiary treatment.
- (2) **Stringent turbidity criteria**. The “ultra-filtration” membrane technology (0.04 micron pore size) is required (and able) to meet Title 22 turbidity levels 10x more stringent than “conventional” tertiary treatment.
- (3) **Drinking water standards for toxics**. The WDRs effluent limits for toxic chemical priority pollutants are set at drinking water standards.
- (4) **Subsurface Irrigation**. SDI precludes exposure, except under upset scenario (e.g., ponding, spray drift)

# Uncertainty Issues

## Worst case concerns

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### □ What factors could lead to health concerns?

- (1) **Treatment Process Upset.** Treatment variability or upset yielding undetected pathogen release to pipe.
- (2) **Indicator Parameter Inadequacy.** Does the E. coli indicator parameter test account for all pathogens?
- (3) **Site Use Upset.** Irrigation system use variability or upset, yielding unexpected exposure (ingestion).
- (4) **No Quantified Risk Assessment.** A quantitative risk assessment was not performed for the Fillmore SDI proposal (beyond scope); nor was one available for an identical project.

# Basis for Going Forward

## Support for no significant risk conclusion

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### □ Confidence in:

- (1) **DHS Recycled Water Criteria**. Title 22 criteria were developed by DHS – in charge of health protection.
- (2) **Regulatory Process**. DHS, RWQCB, and the City of Fillmore are directly involved.
- (3) **Treatment Process**. Engineering firm managing the project has experience – and a stake in ensuring no nuisance or infection results from the project.
- (4) **Site use controls**. To be implemented for the distribution system by both FUSD and the City WRP contractor (per Boyle Engineering).



# Recommendations

## Other possible considerations

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### □ If concerns persist, possibly consider:

- (1) **Subsurface irrigation only**. Eliminating potential exposure concerns from spray irrigation.
- (2) **Research similar projects**. The scope of services did not include identification or detailed assessment of any identical -- or substantially similar -- reuse projects.
- (3) **Additional analytical data**. Microbiological results for MBR reuse system end-of-pipe effluent.
- (4) **Track agency actions**. Future regulatory actions, approvals and control of the recycling proposal will involve DHS, RWQCB, and the City of Fillmore.



# Thank You

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□ Questions?