

SATELLITE TREATMENT FOR OPTIMIZATION

Sewer Infrastructure Advisory Group
April 4, 2013



MSA Murray, Smith & Associates, Inc.
Engineers/Planners

WHY ARE WE DISCUSSING THIS?

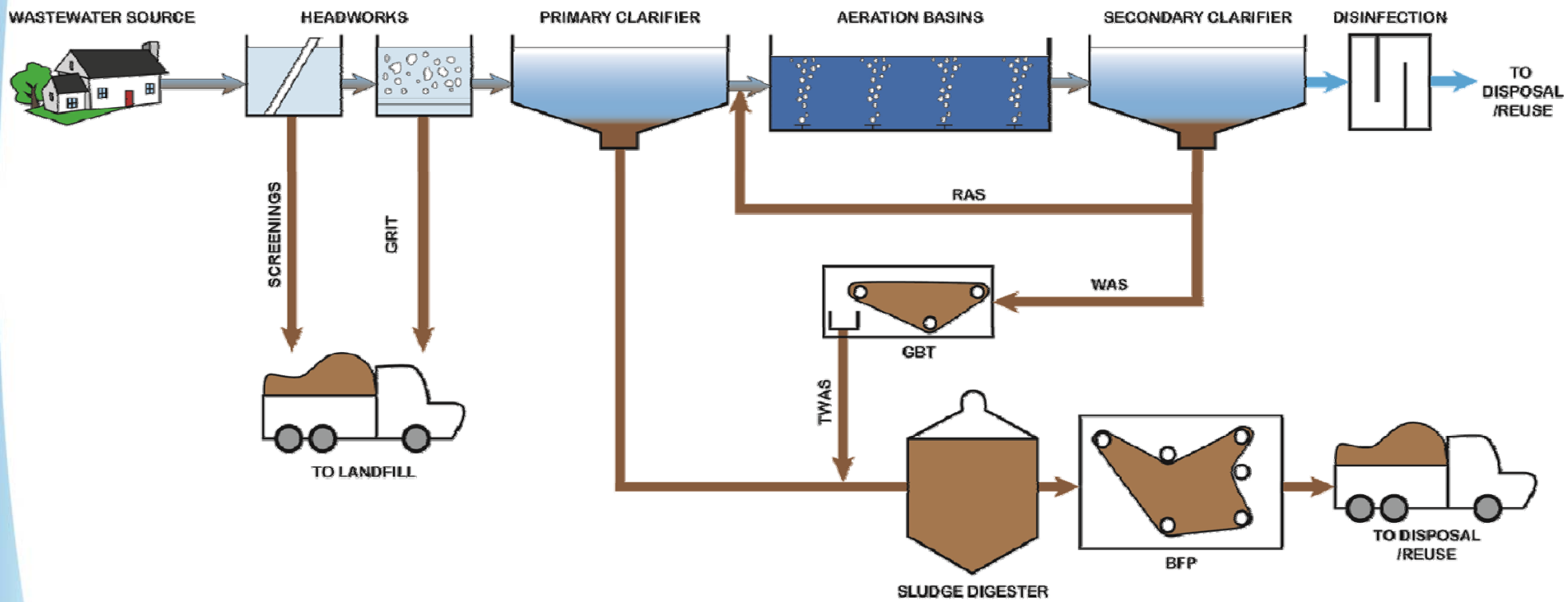
- Wastewater Treatment is complex/challenging subject
 - Very few treatment plants are the “same”
 - Satellite Treatment selection factors include:
 - Need for year round use
 - Treatment vs collection costs
 - Economy of Scale/Size
 - Proximity to development
 - Regulations & Treatment Levels
 - Required land
 - Existing plant to accommodate 20 years growth

PRESENTATION STRUCTURE

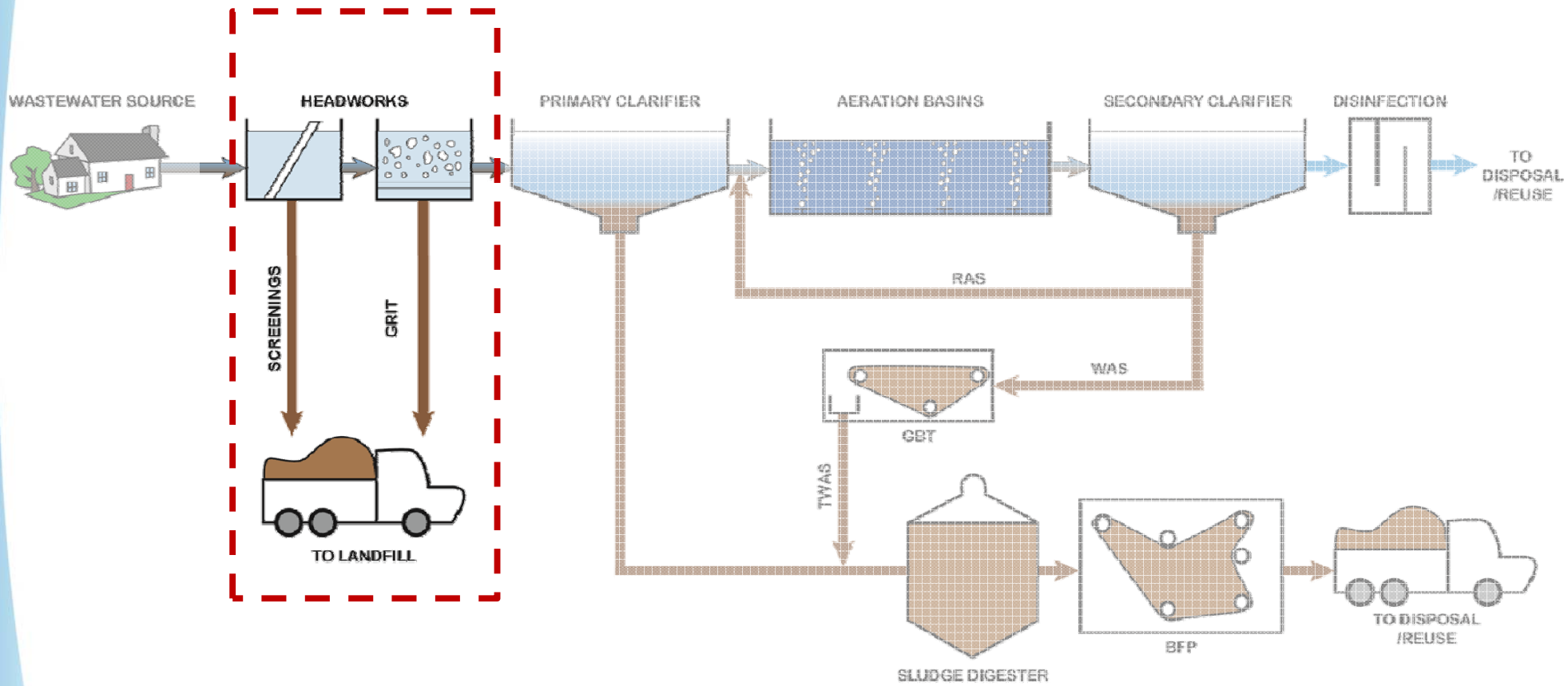
- ◆ General wastewater treatment review
- ◆ Satellite Treatment Factors
 - Optimization role
 - Economics
 - Liquid Disposal & Treatment Overview
 - Solids Disposal & Treatment Overview
- ◆ Summary
- ◆ Discussion
 - Next Steps
 - Community Values

GENERAL WASTEWATER TREATMENT REVIEW

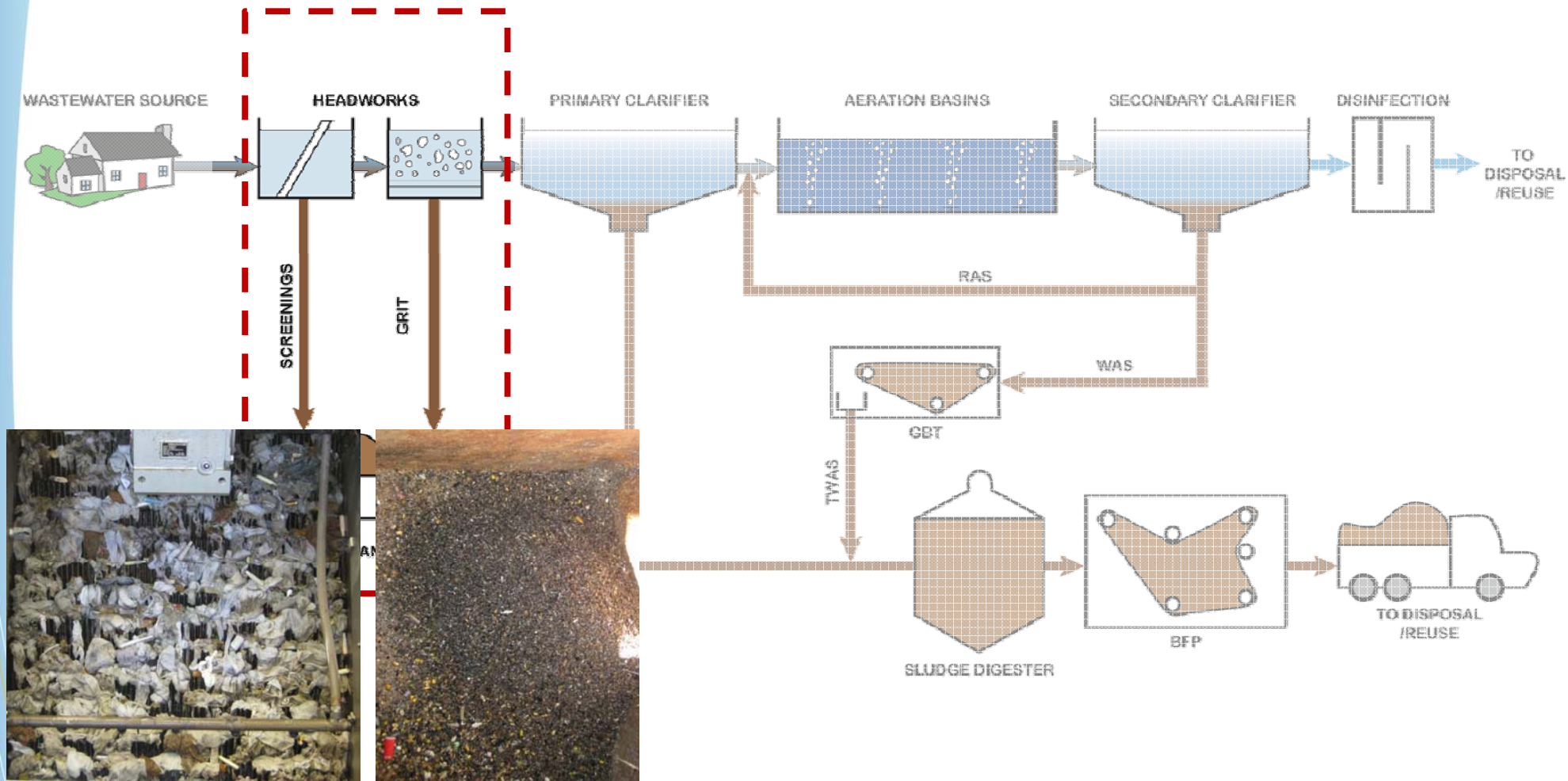
WASTEWATER TREATMENT PROCESS



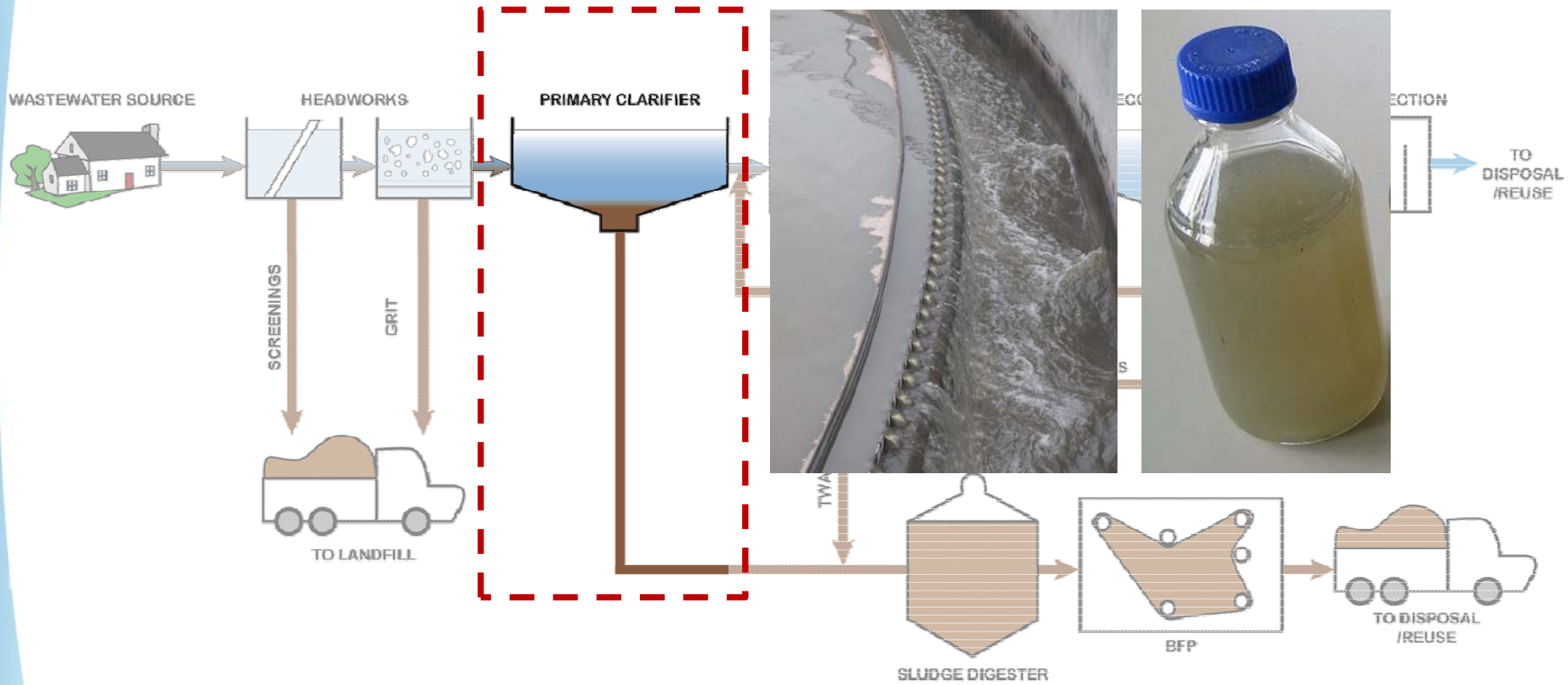
PRELIMINARY TREATMENT



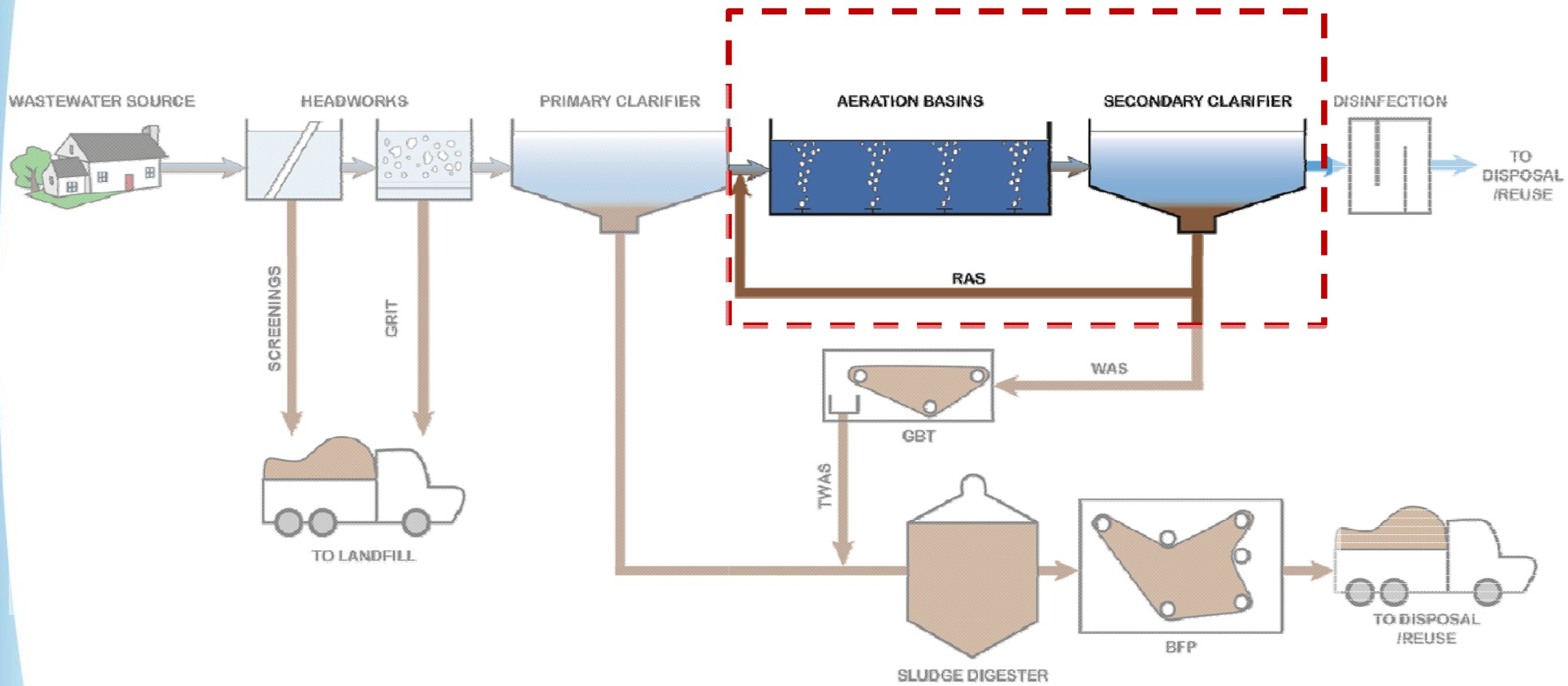
PRELIMINARY TREATMENT



PRIMARY TREATMENT



SECONDARY TREATMENT

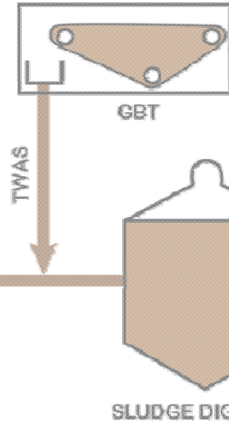
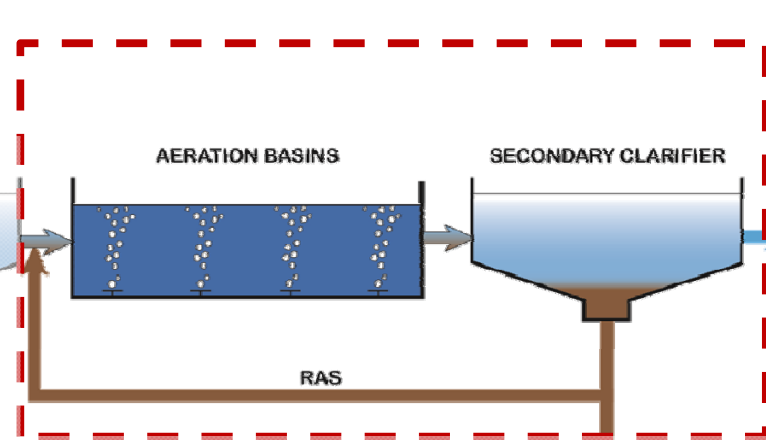
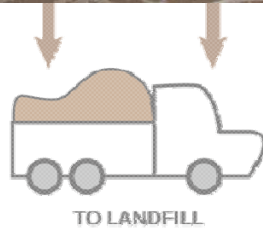


SECONDARY TREATMENT

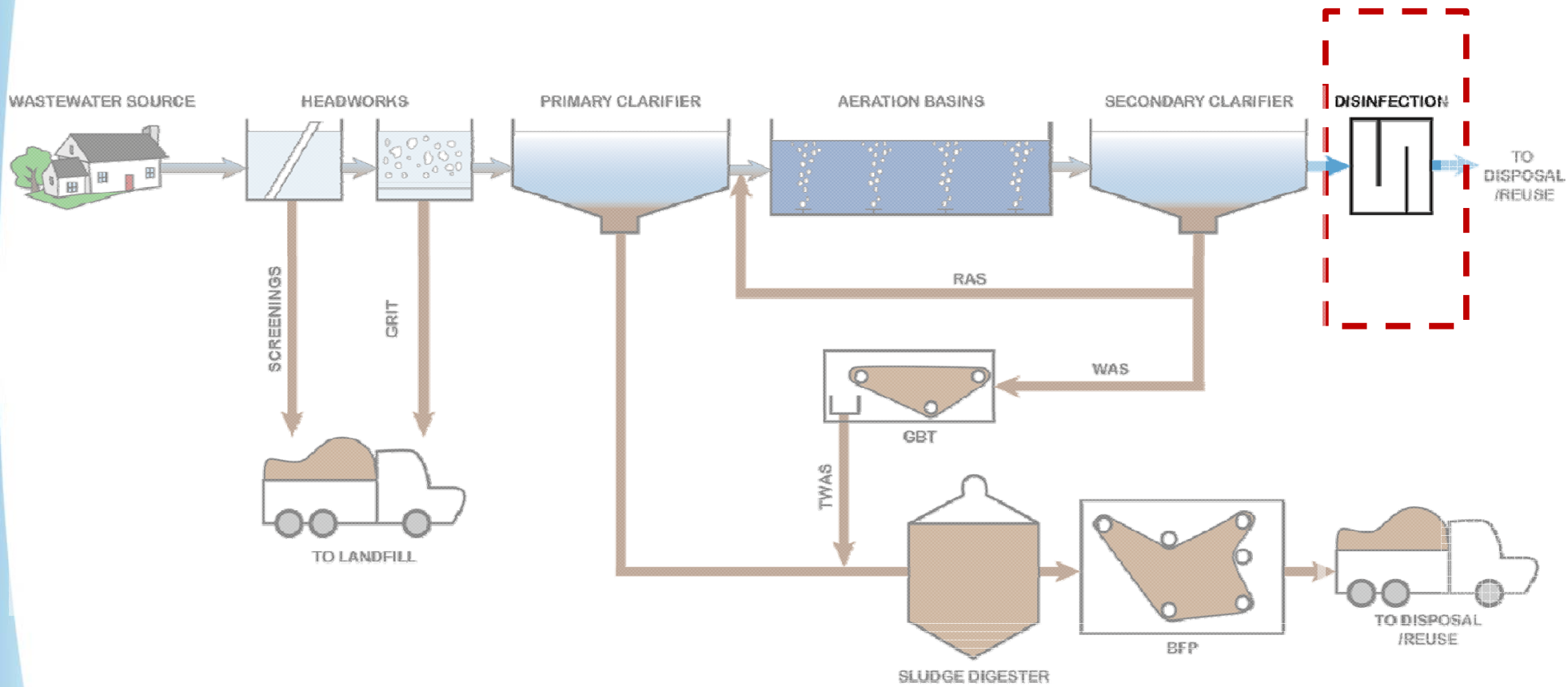
WASTEWATER SOURCE



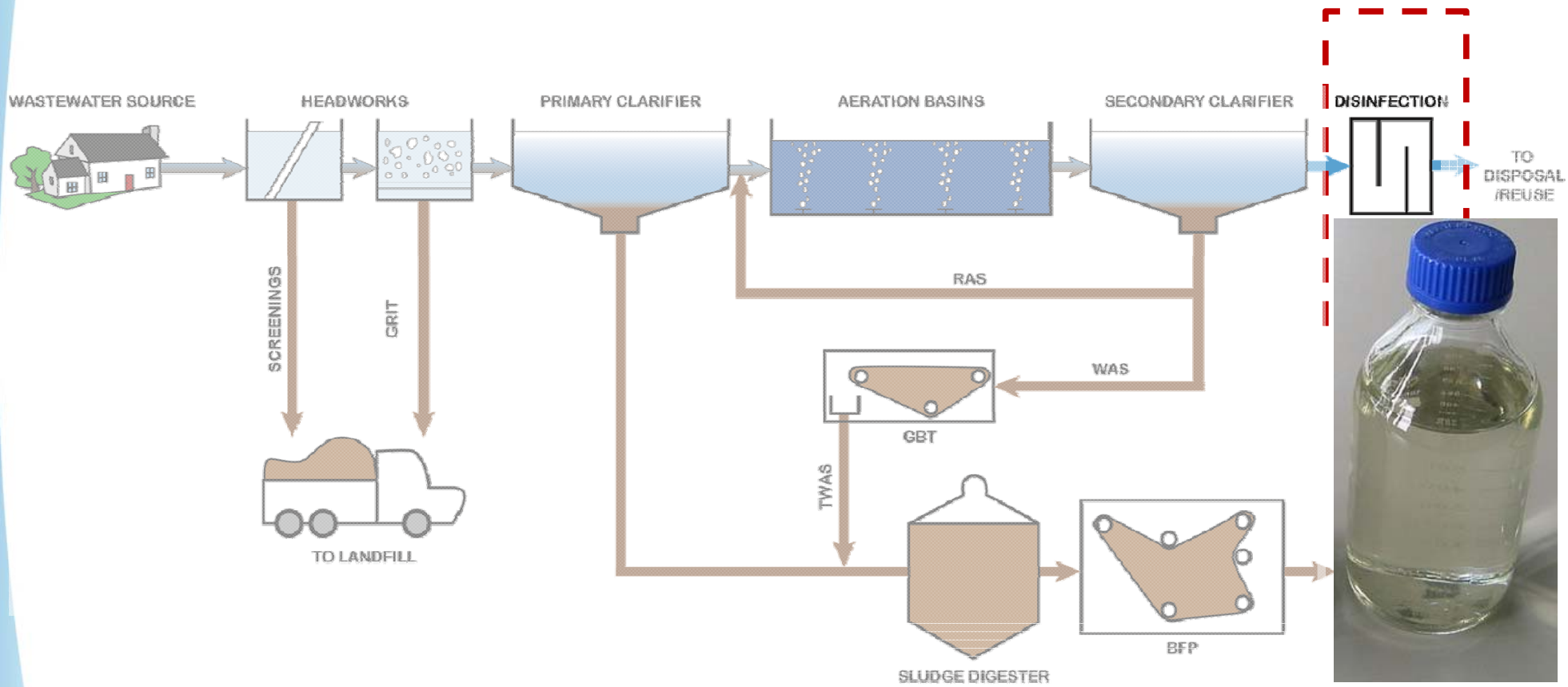
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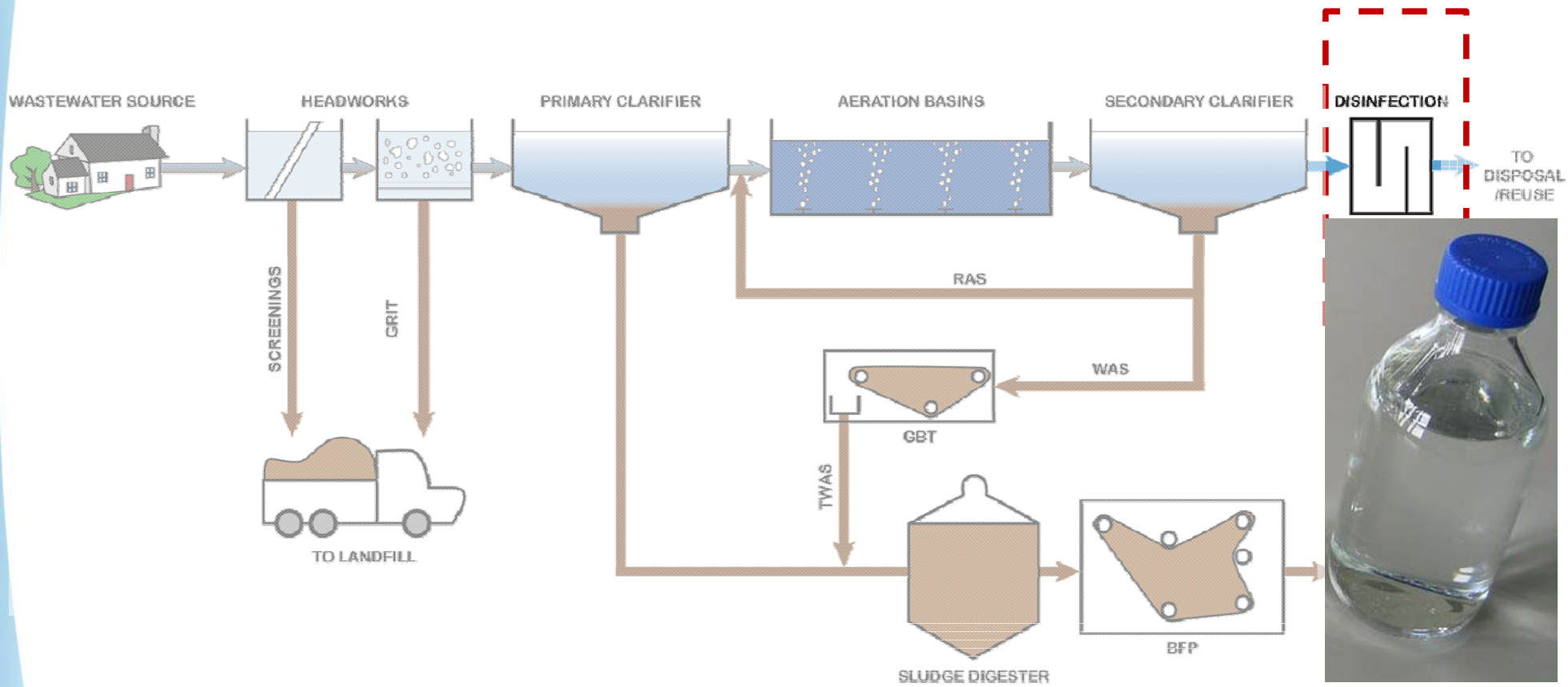
DISINFECTION/TERTIARY TREATMENT



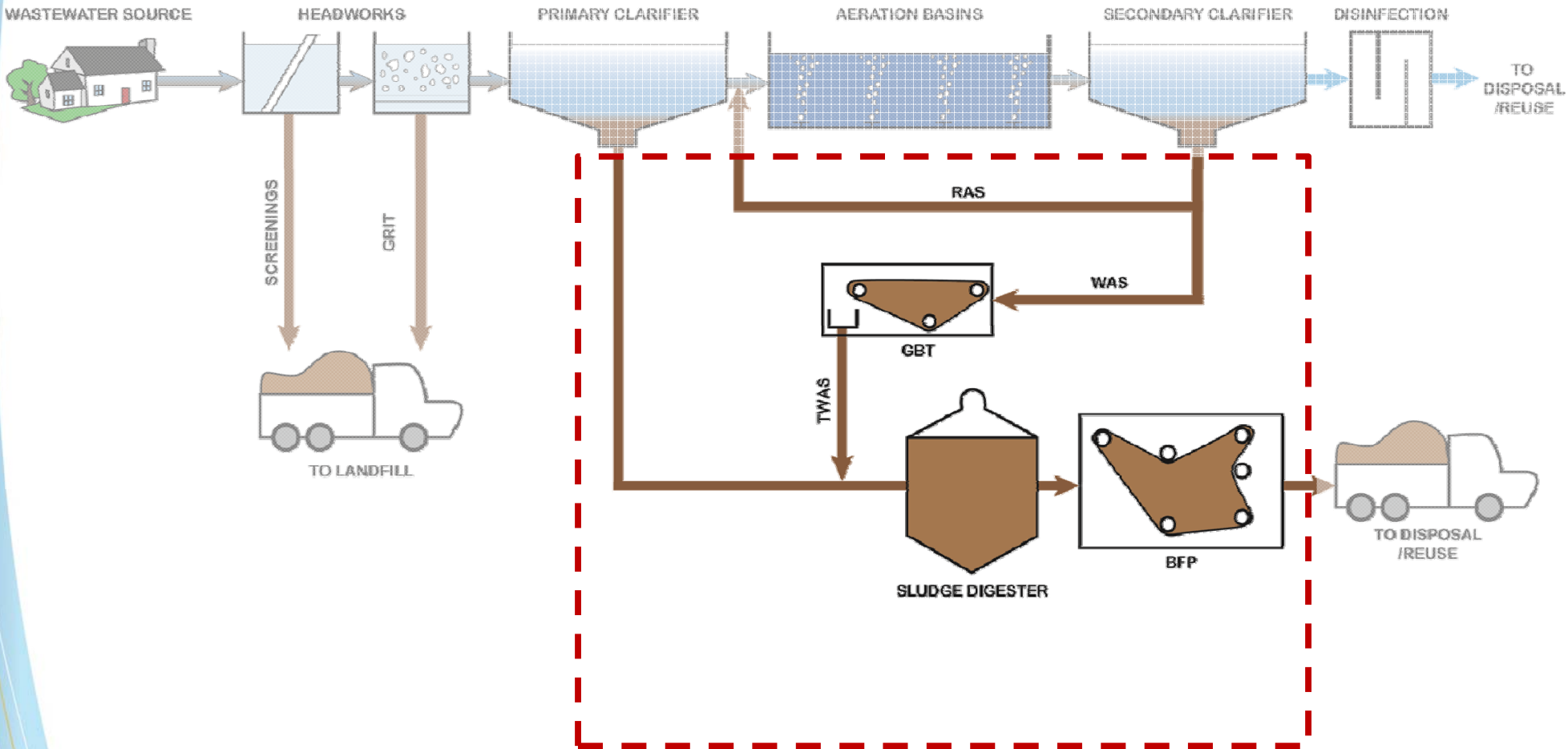
DISINFECTION/TERTIARY TREATMENT



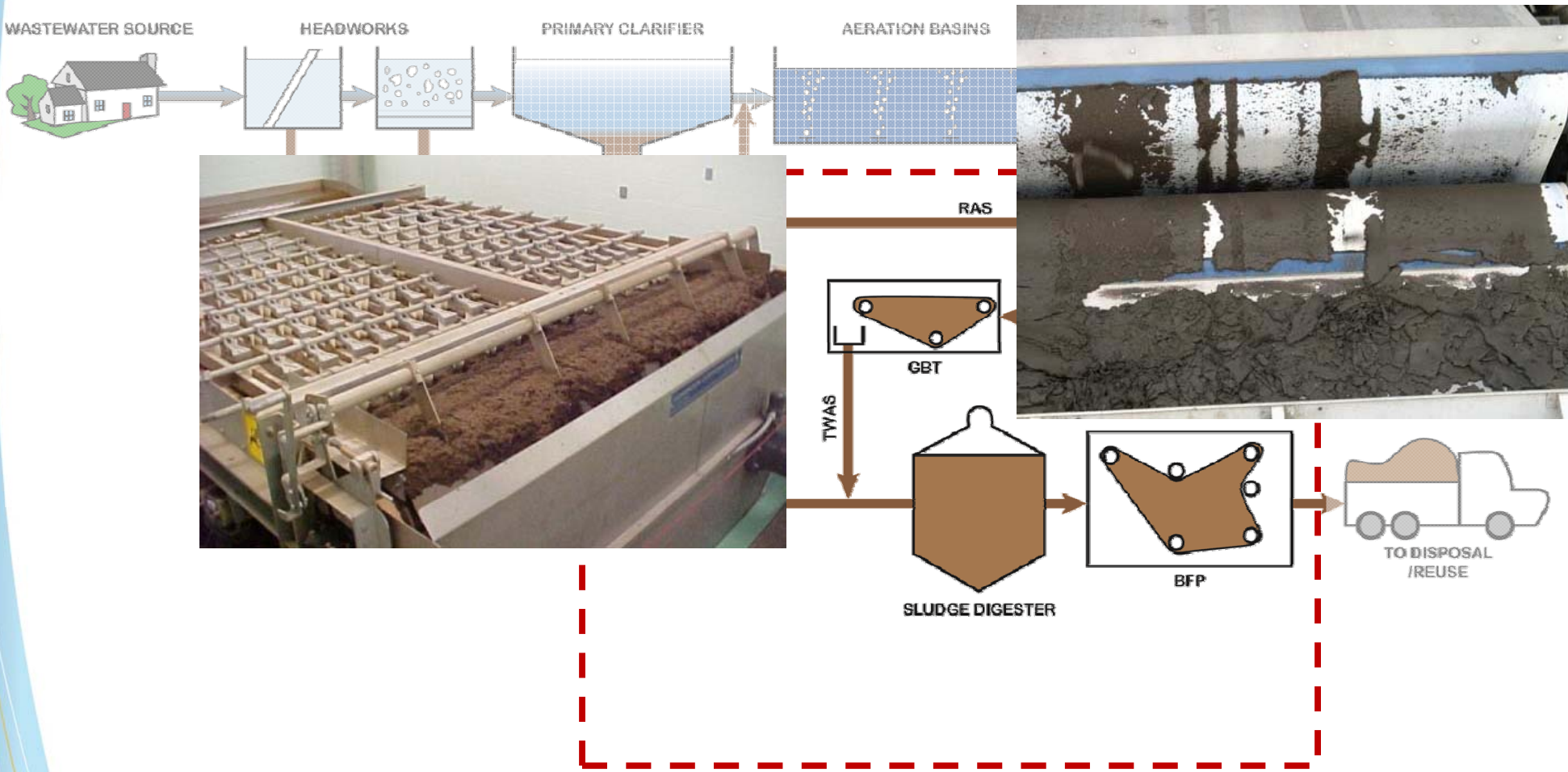
DISINFECTION/TERTIARY TREATMENT



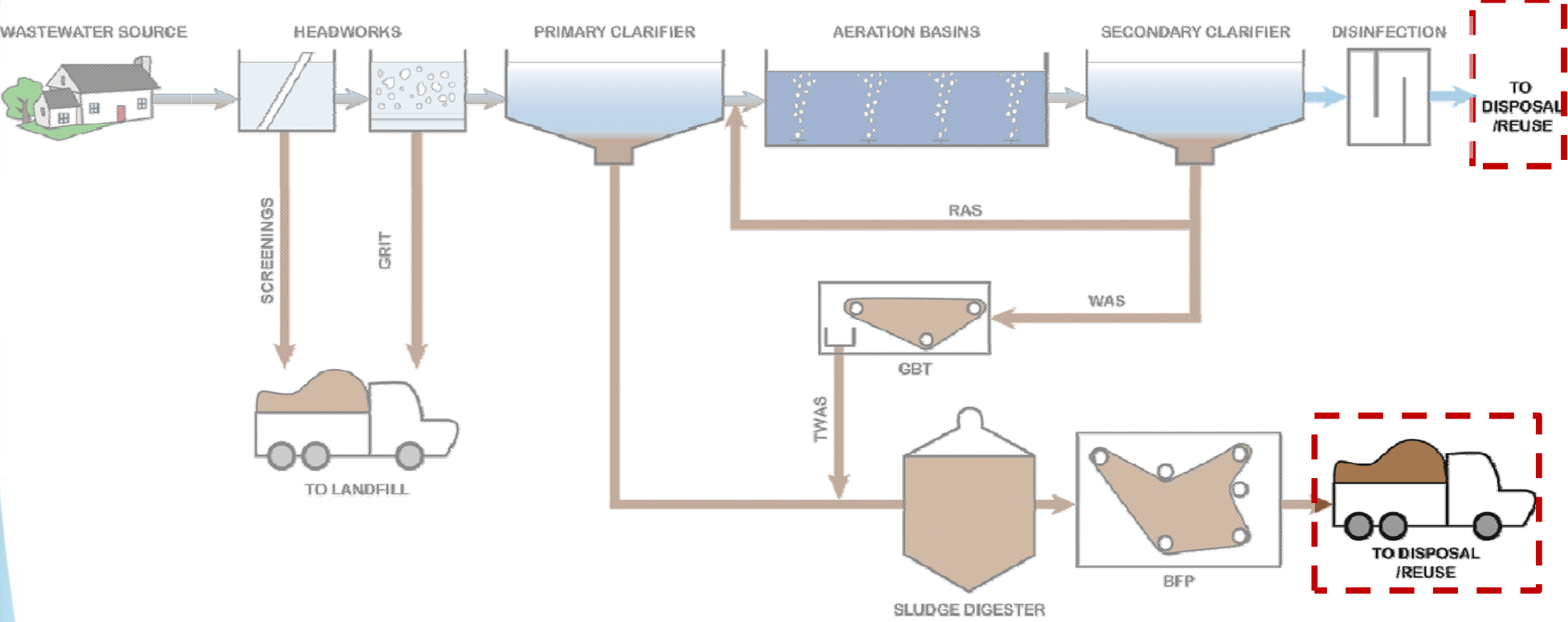
SOLIDS TREATMENT



SOLIDS TREATMENT



REUSE/DISPOSAL

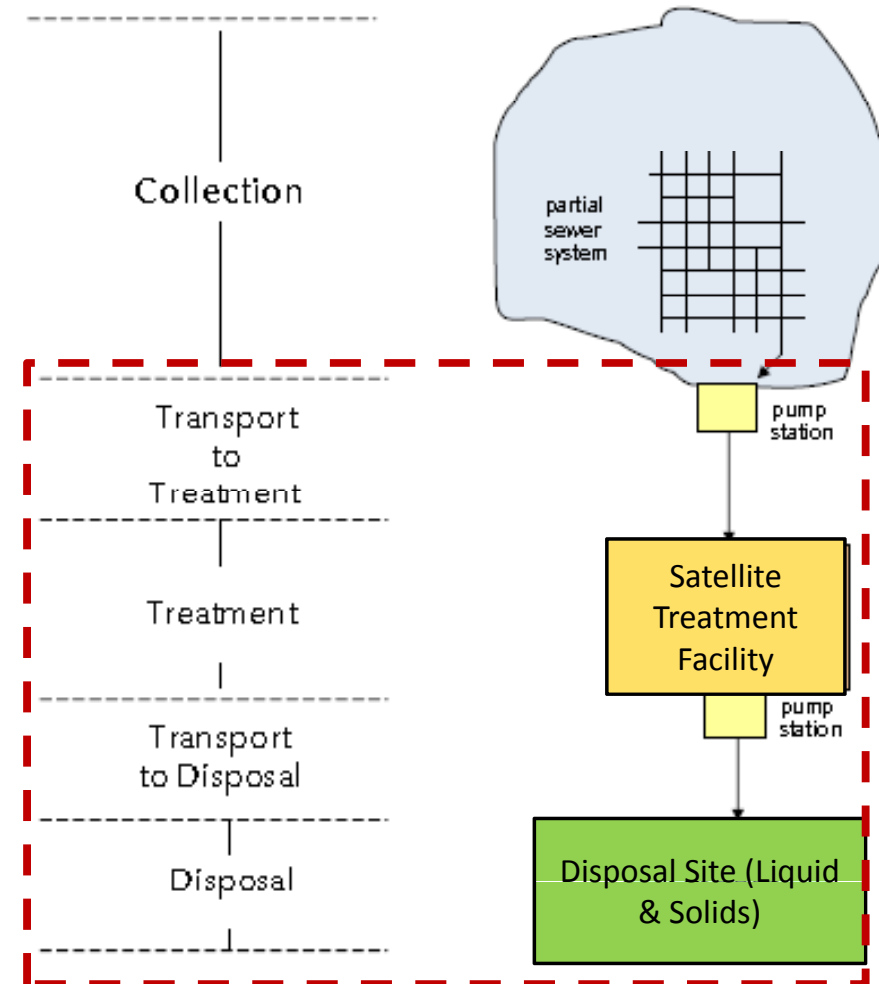


QUESTIONS & BREAK

SATELLITE TREATMENT FACTORS

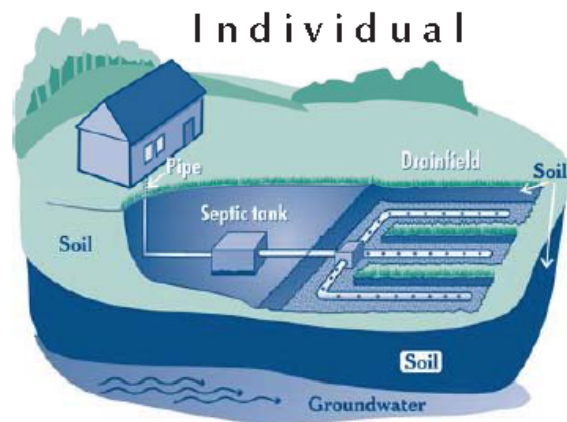
OPTIMIZATION ROLE

- Satellite treatment must operate year-round to offset collection system capacity needs
- Collection system deficiencies and available land determine satellite treatment sites



ECONOMICS

Treatment Options



Satellite <1,000 houses

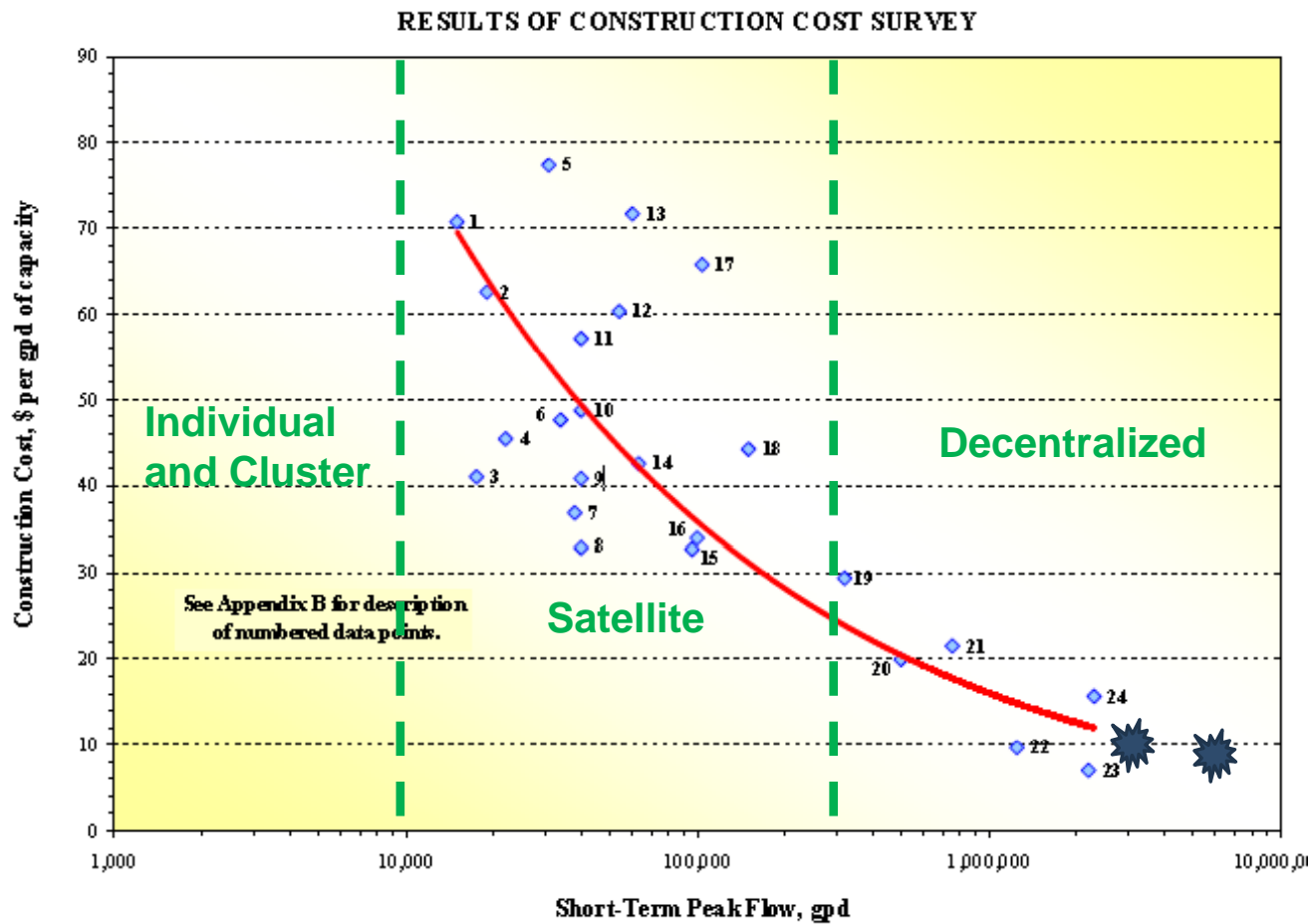


Decentralized >1,000 houses



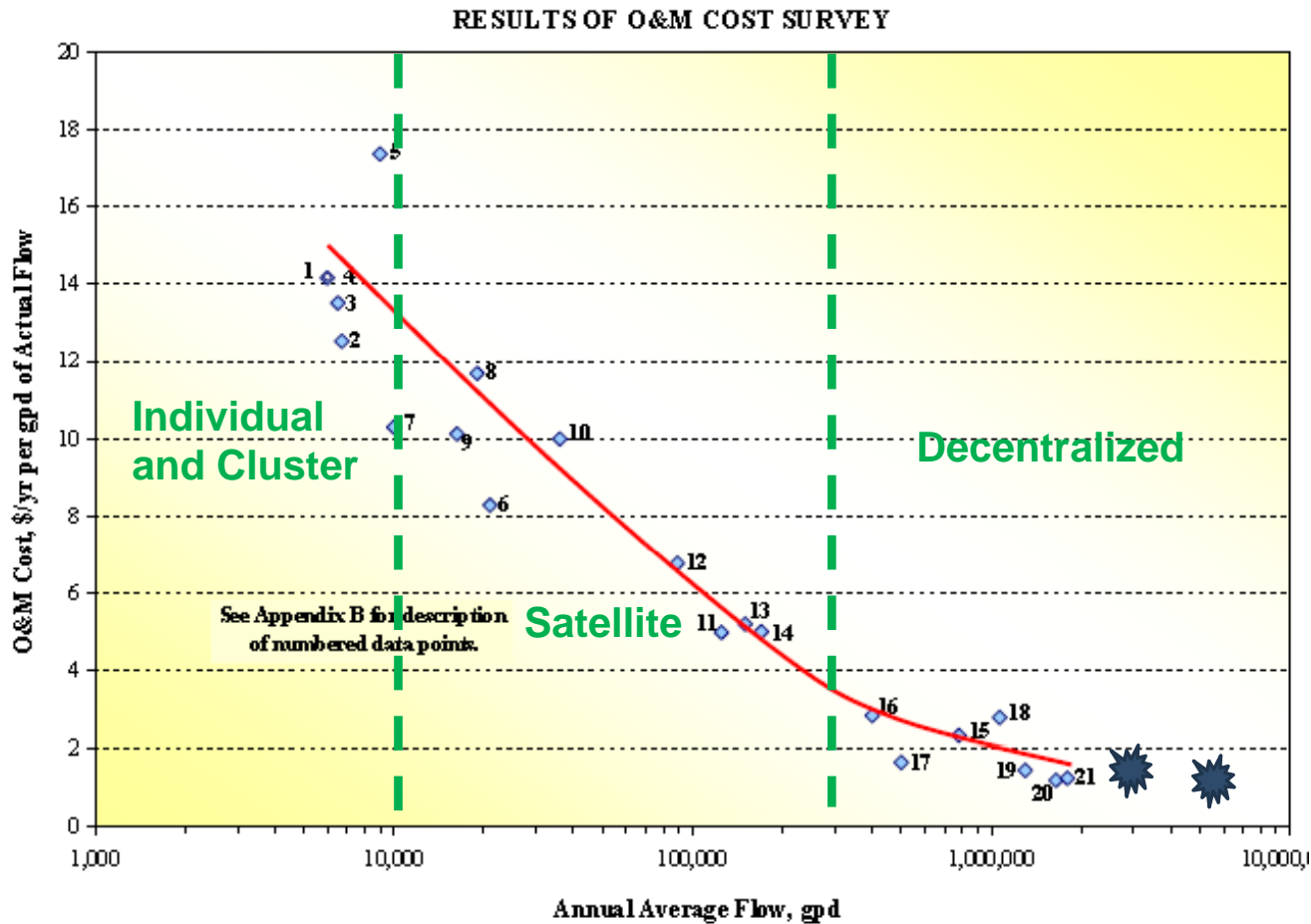
ECONOMICS

Construction costs decrease with size



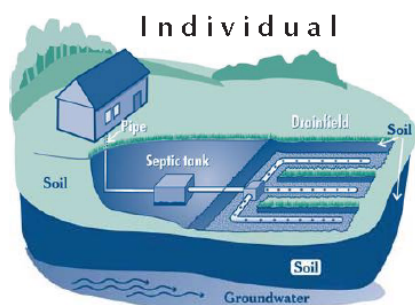
ECONOMICS

Annual operational costs decrease with size



ECONOMICS

Limited advantage to individual or cluster systems



💧 Economic Disadvantage

- Capital & Annual Costs
- *Limited Conveyance Offset*

💧 Private vs Public

- Individual vs City decision
- Ownership & Maintenance
- Operational Control
- Permitting Approval
- Permit Compliance
- Number/Distribution

ECONOMICS

- **Accurate costs critical, so forms developed**
- **Life Cycle Costs required :**
 - Capital
 - Operations
 - Maintenance
 - Energy
 - Replacement
- **System information being received now**
- **Wrapping up this month**

REVISED 2/15/13

**SATELLITE WASTEWATER TREATMENT OPTION
INFORMATIONAL PACKET**

for the

OPTIMIZED SEWER COLLECTION SYSTEM MASTER PLAN UPDATE

The completion of this information, as a minimum, must meet the Viability Criteria of the Master Plan Update. Cost information requested. Satellites will not be considered.

GENERAL INFORMATION

The ability to infiltrate the effluent is desired. In order to achieve effluent with low levels of TN, your system's capabilities to achieve effluent with a TN < 10 mg/l is considered potentially viable.

Satellite Treatment Option N: _____

Satellite Treatment Option D: _____

12-1354
February 2013

EXHIBIT A

**SATELLITE WASTEWATER TREATMENT
REFERENCE FORM**

for the

CITY OF BEND, OREGON
OPTIMIZED SEWER COLLECTION SYSTEM MASTER PLAN UPDATE

Facility Name: _____

Construction Contract Cost (\$): _____

Year Constructed: _____

Facility Design Capacity (Max Month MGD): _____

Design Engineer (Firm Name & Phone Number): _____

Facility Lead Operator (Name & Phone Number): _____

List the number of O&M staff and work schedule required at the facility:

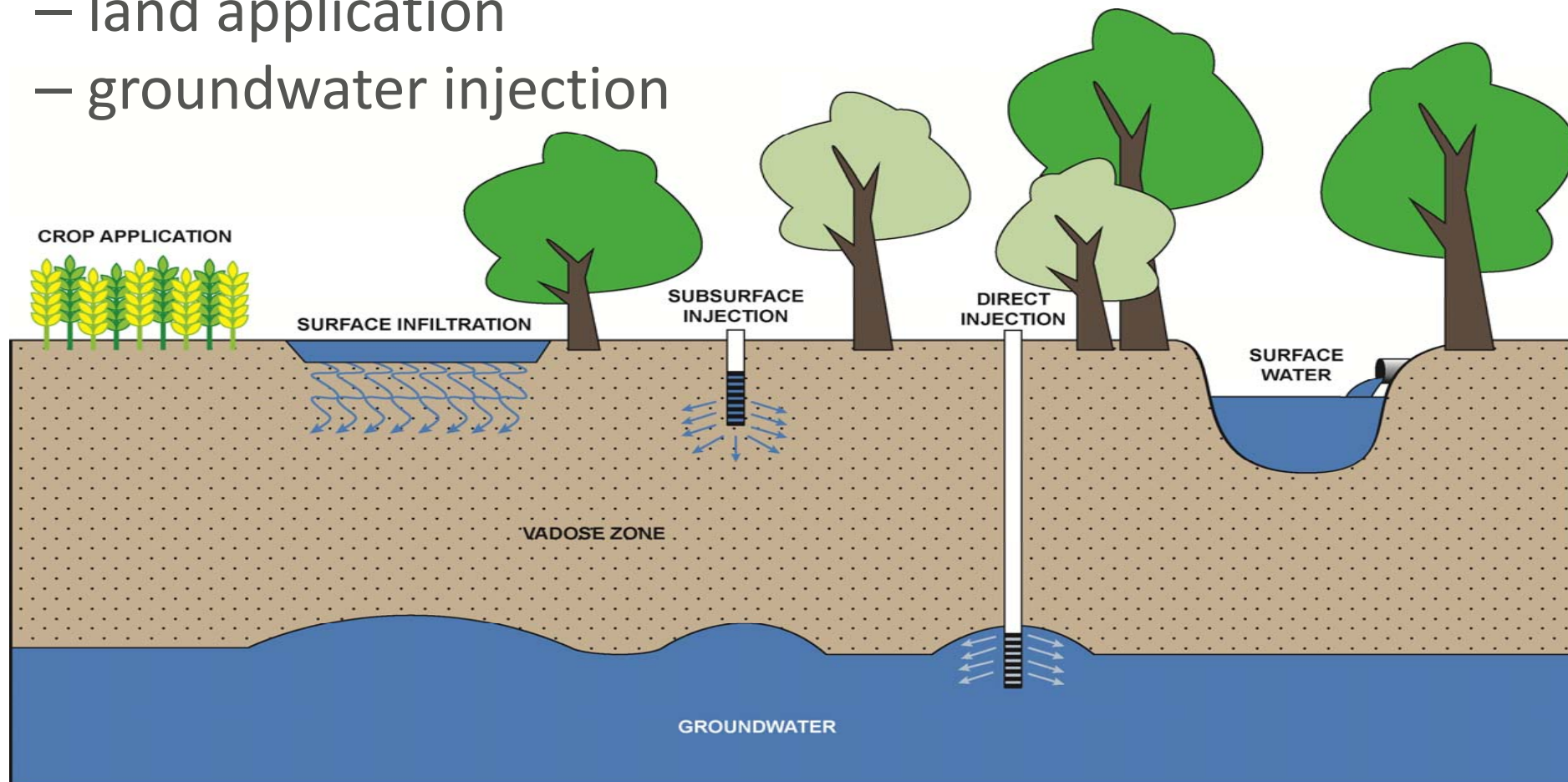
Land Area Requirements:
Provide a scalable site map of the existing facility and identify each unit process.

12-1354
February 2013

Page 1 of 9
Optimized Sewer CSMP Update
City of Bend

LIQUID DISPOSAL

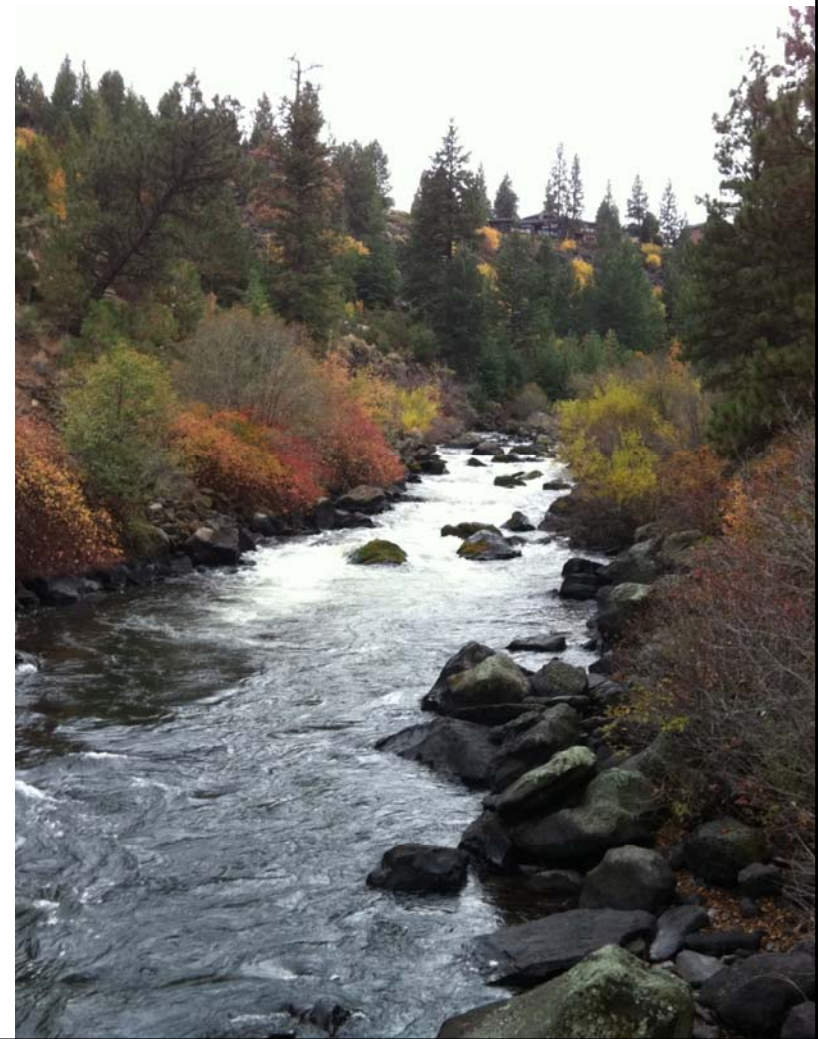
- Disposal Options
 - surface water
 - land application
 - groundwater injection



LIQUID DISPOSAL

Surface Water

- Aquatic life protection typically controls treatment
 - Nutrients (N & P), Temperature, Endocrine Disruptors, etc...
- Permit difficult to get
 - Not used by Redmond & Bend
 - Significant work required
 - Deschutes listed on 303d list
 - TMDL on hold (litigation)
 - ***Long schedule with no guarantee***
- Lowest land requirement



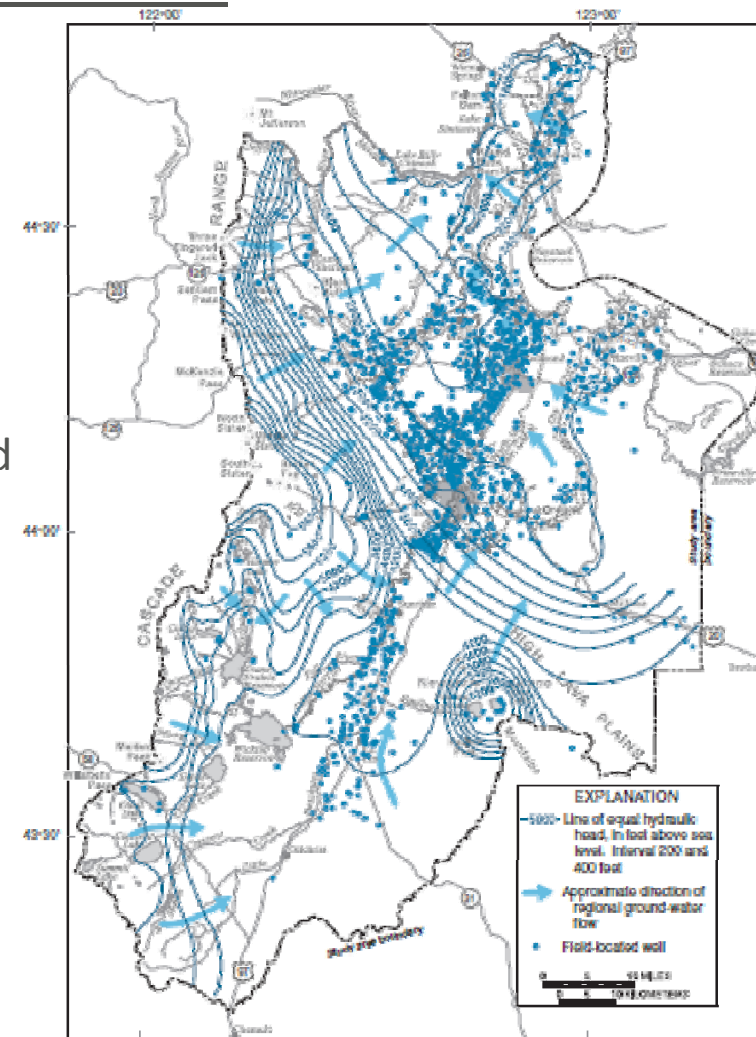
LIQUID DISPOSAL

Land Disposal vs Treatment Requirements

- ◆ Nearby wells & groundwater quality impact treatment level
- ◆ Regulations (OAR 340-040) - New vs existing

Total Nitrogen (TN) Ranges

- ◆ TN > 10 mg/L (*easy*) – crop nitrogen uptake needed
- ◆ TN < 10 mg/L (*moderate to hard*)
 - Presently done by Bend and Redmond
- ◆ TN << 10 mg/L (*difficult*)
 - Nearby wells and/or high quality GW
 - Significant added treatment/cost



LIQUID DISPOSAL

Land Disposal (slow rate/crop application)

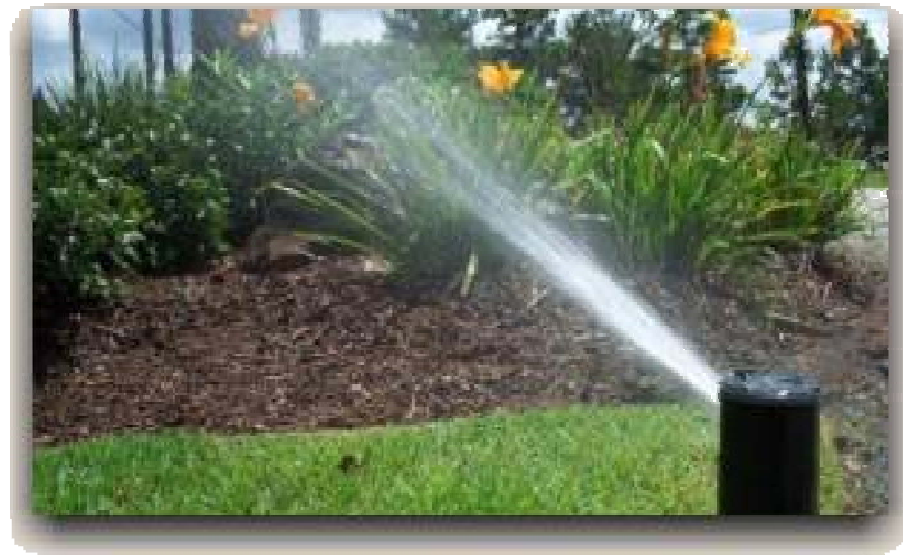
- Crop needs and human consumption of water governs treatment level
 - Crop agronomic nutrient and water needs
 - Safe Drinking Water Act (Nitrate (NO₃-N) < 10 mg/L at GW)
- **“Easier”** to permit
- Largest land area needs
- Not year-round solution
 - Storage
 - Alternate Winter Discharge



LIQUID DISPOSAL

Land Disposal (slow rate/residential reuse)

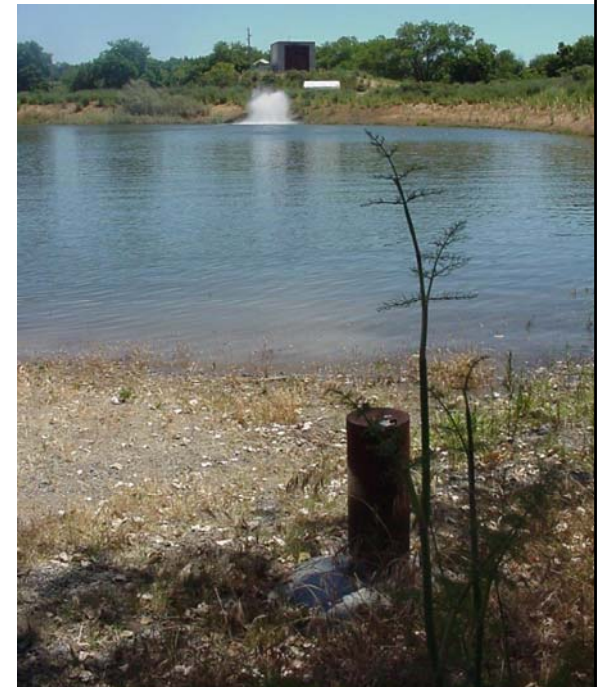
- ◆ Human contact & use governs treatment
 - Human contact concerns elevates treatment requirements
 - Safe Drinking Water Act (Nitrate (NO₃-N) < 10 mg/L at GW)
- ◆ Seasonally done by Bend
- ◆ Not as “easy” to permit
- ◆ Largest land area needs
- ◆ Significant distribution costs
- ◆ Not year-round solution
 - Storage
 - Alternate Winter Discharge



LIQUID DISPOSAL

Land Disposal (high rate/infiltration)

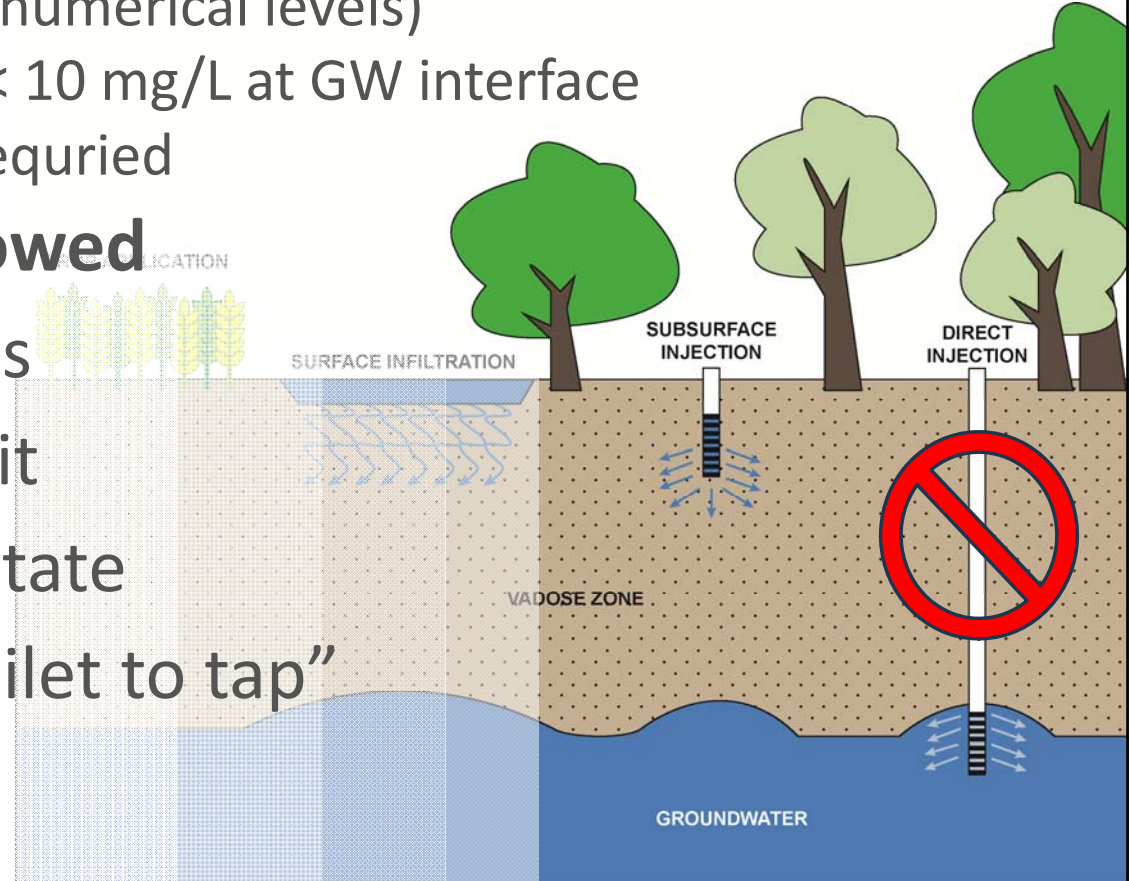
- ◆ Groundwater regulations governs treatment
 - Safe Drinking Water Act (numerical levels)
 - Nitrate ($\text{NO}_3\text{-N}$) at least $< 10 \text{ mg/L}$ at GW interface
- ◆ Used by both Bend and Redmond
- ◆ Known permitting requirements
- ◆ Moderate land needs
- ◆ Year-round solution



LIQUID DISPOSAL

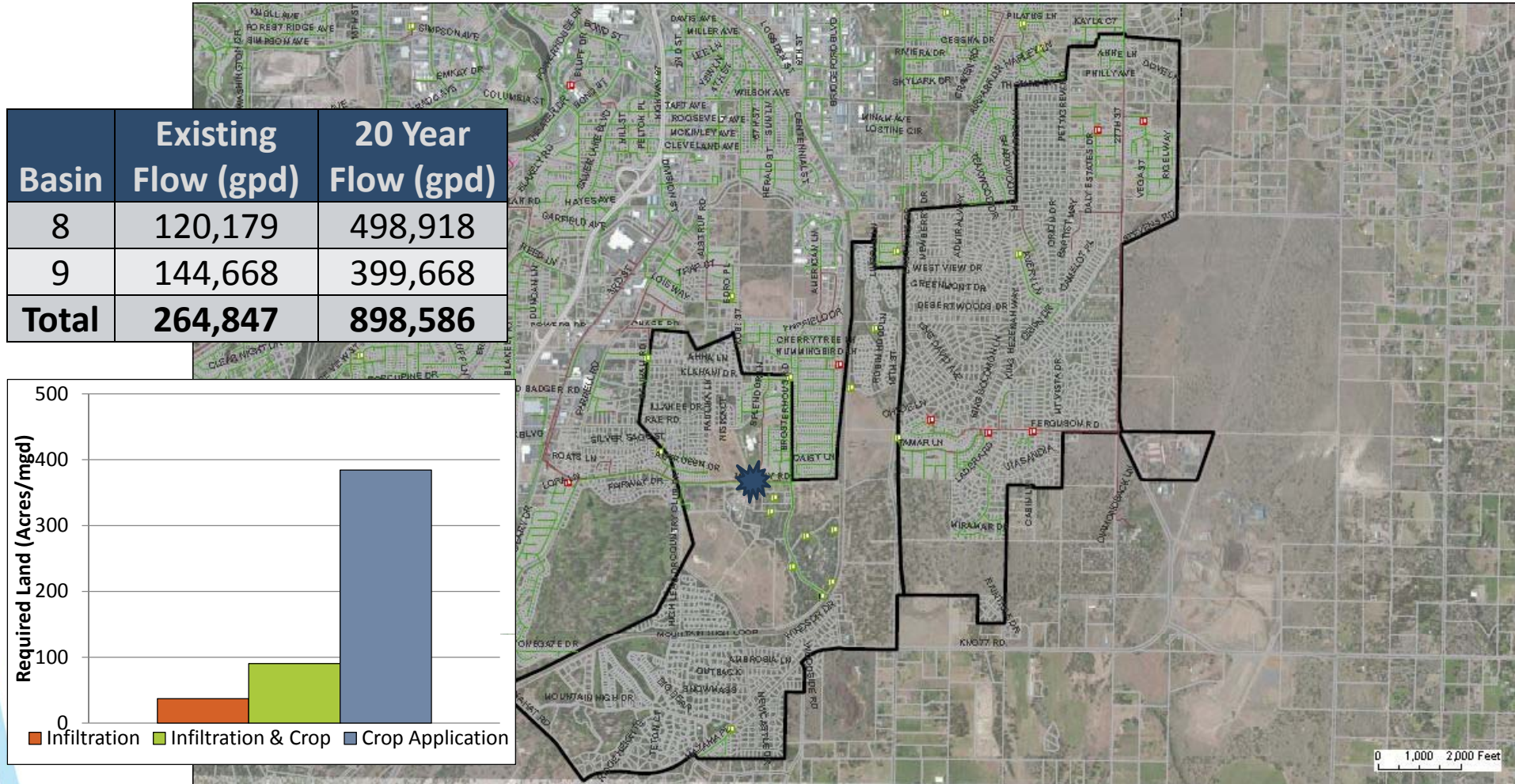
Disposal by Injection

- ◆ Groundwater and UIC regulations governs treatment
 - Safe Drinking Water Act (numerical levels)
 - Nitrate ($\text{NO}_3\text{-N}$) at least $< 10 \text{ mg/L}$ at GW interface
 - Drinking Water Quality required
- ◆ **Direct injection not allowed**
- ◆ SI can reduce land needs
- ◆ Highly scrutinized permit
- ◆ No real track record in state
- ◆ Public perception of “toilet to tap”
- ◆ Year-round solution

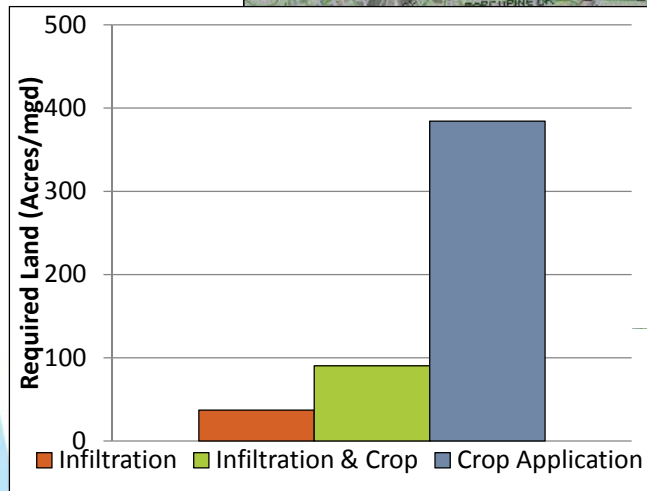


LIQUID DISPOSAL

Murphy Lift Station Area Example



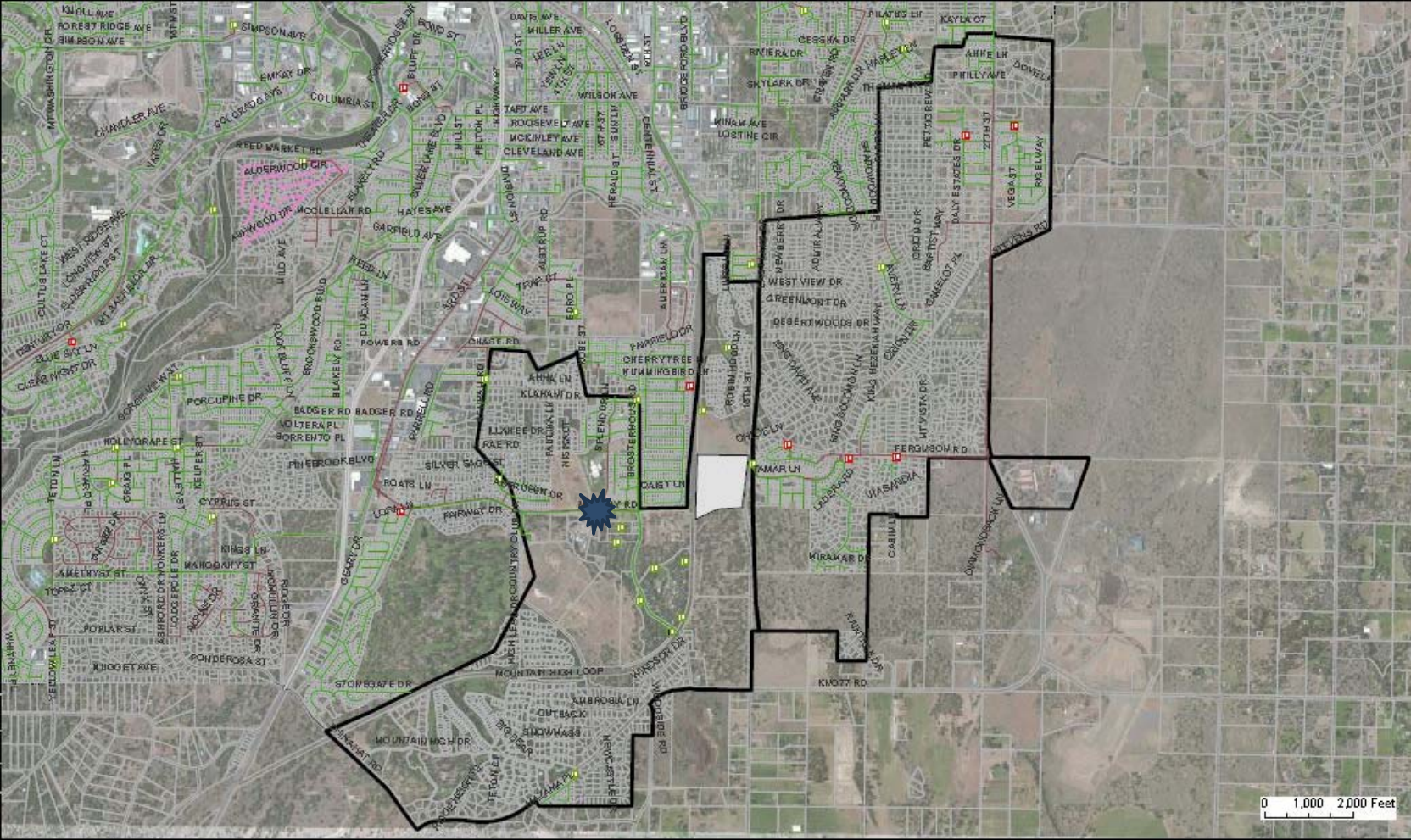
Basin	Existing Flow (gpd)	20 Year Flow (gpd)
8	120,179	498,918
9	144,668	399,668
Total	264,847	898,586



0 1,000 2,000 Feet

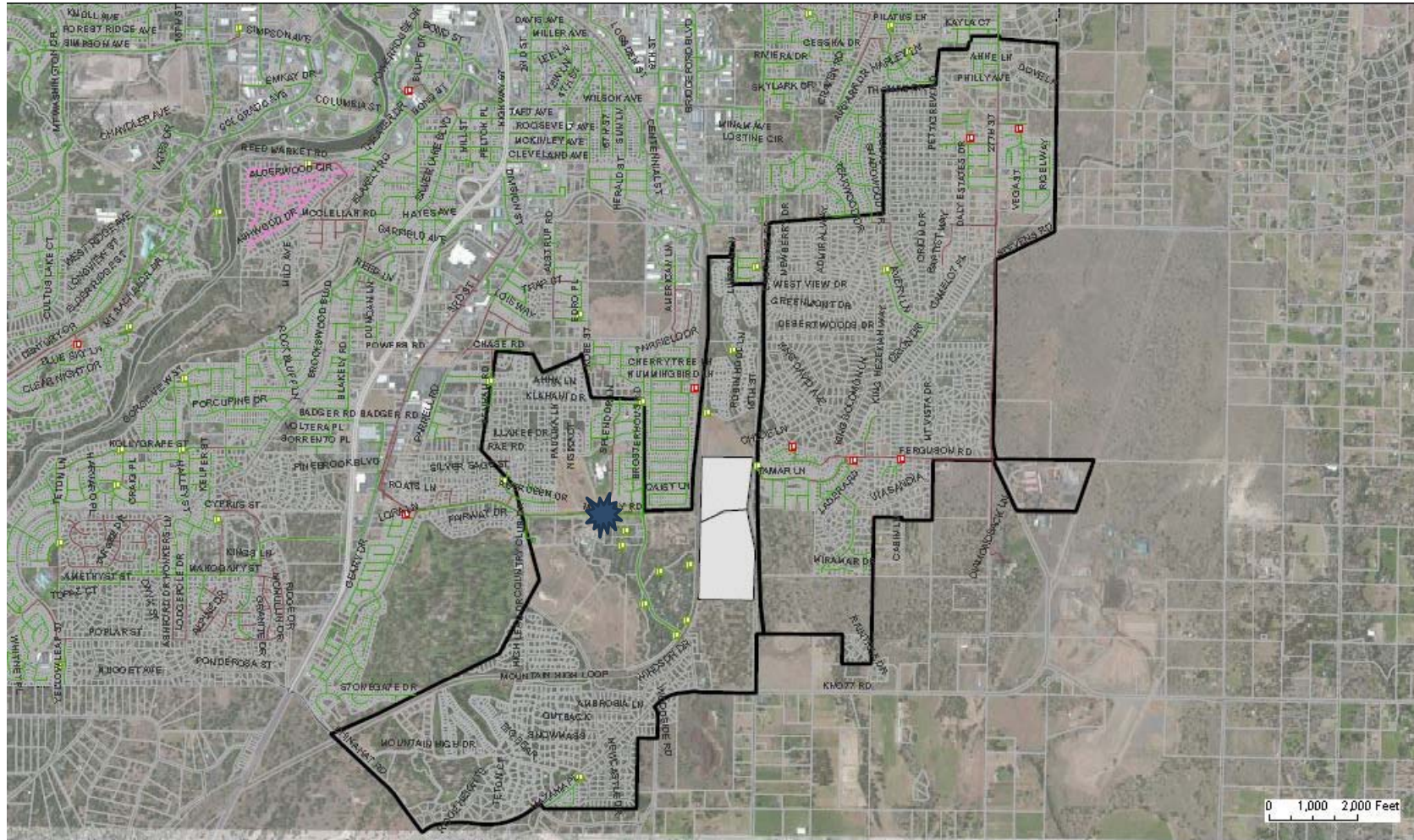
LIQUID DISPOSAL

Infiltration Disposal (33 Acres)



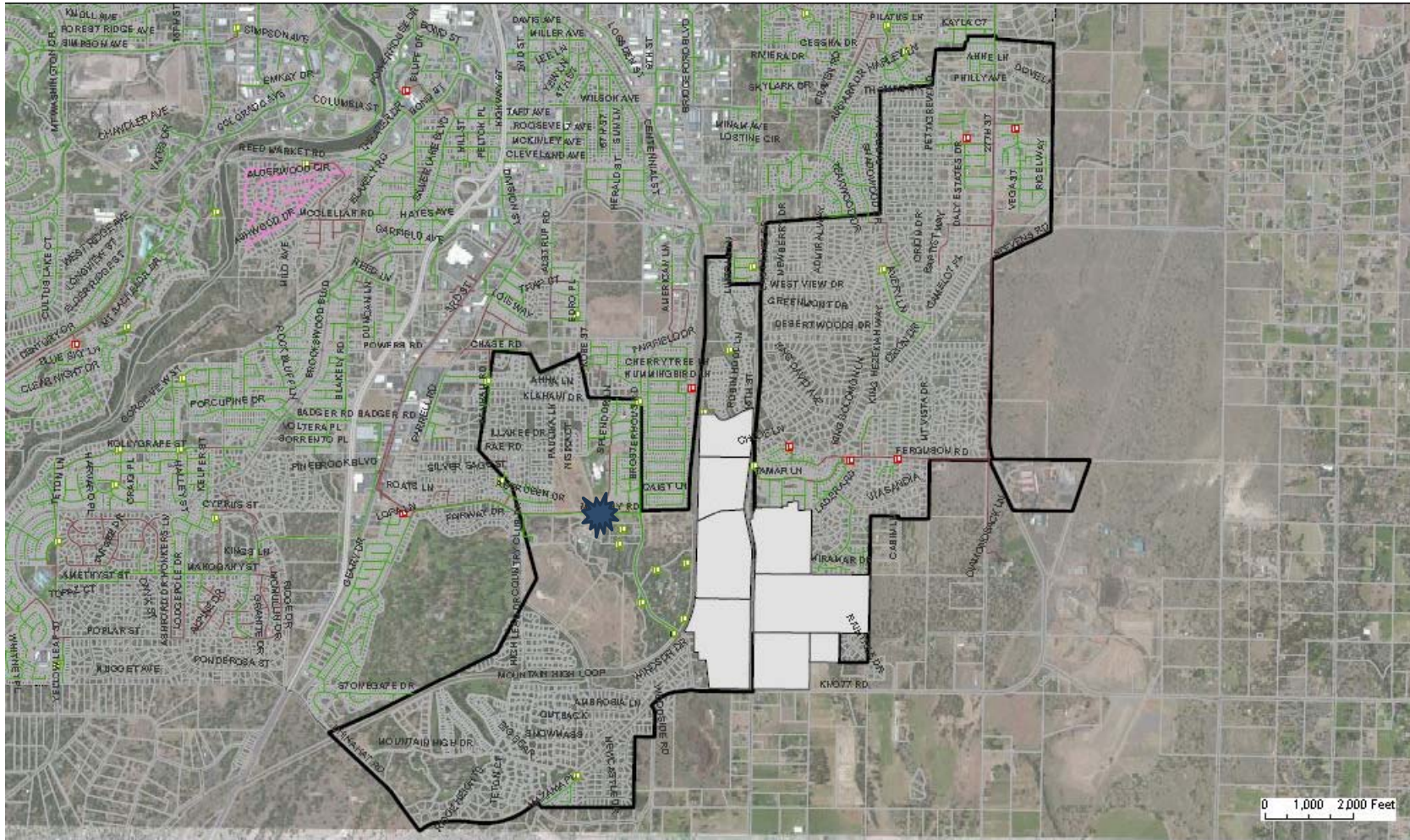
LIQUID DISPOSAL

Infiltration & Crop Disposal (81 Acres)



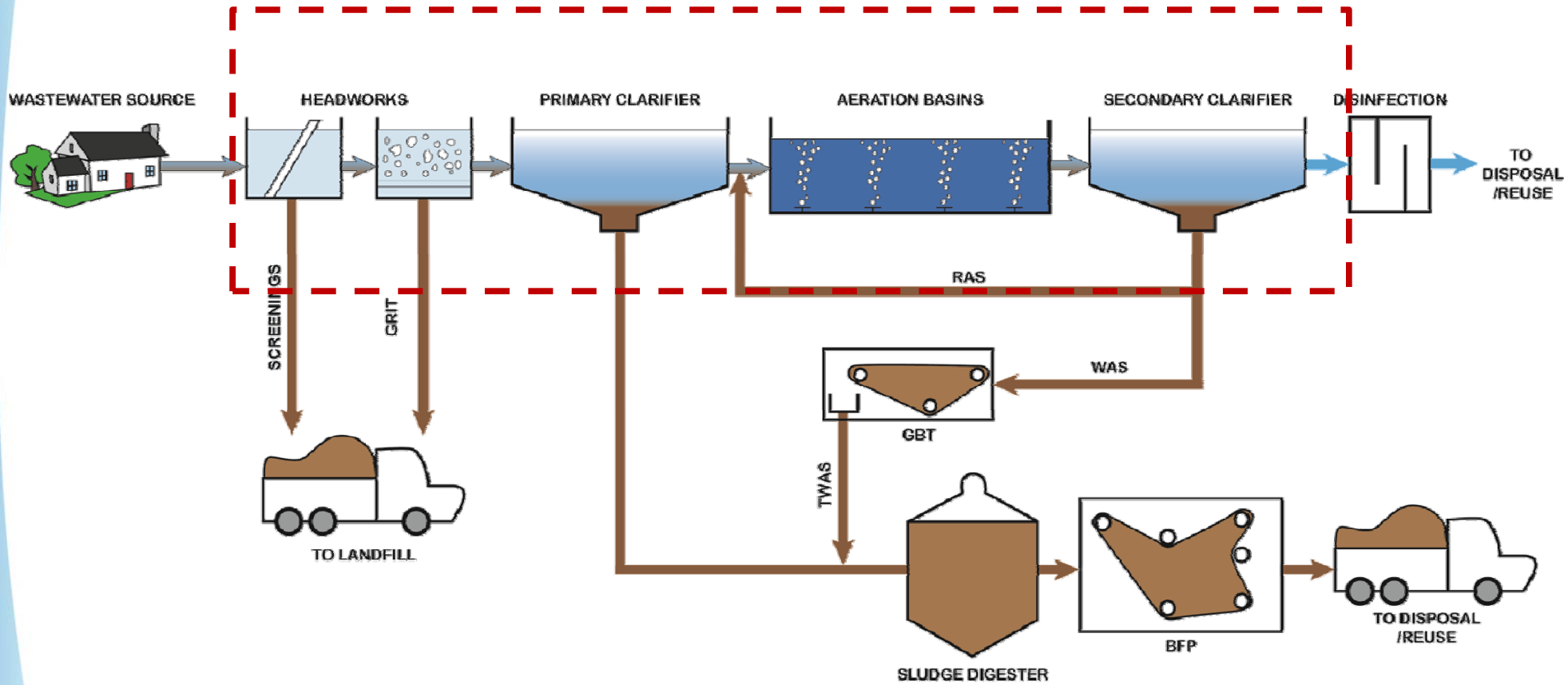
LIQUID DISPOSAL

Crop Disposal (346 Acres)



QUESTIONS & BREAK

LIQUID TREATMENT



LIQUID TREATMENT

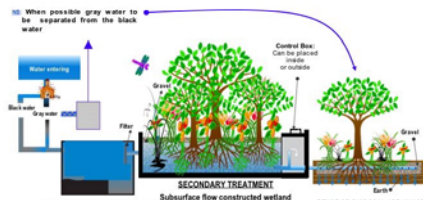
GENERAL TRENDS

Lagoons



- Treatment \$ - *LOW*
- Complexity - *LOW*
- Treatment Level - *LOW*
- Land - *HIGH*

Wetlands/"Natural"



- Treatment \$ - *LOW+*
- Complexity - *LOW+*
- Treatment Level - *LOW +*
- Land - *HIGH*

Oxidation Ditch Activated Sludge (2⁰)



- Treatment \$ - *MODERATE*
- Complexity - *MODERATE*
- Treatment Level - *MODERATE*
- Land - *MODERATE*

Activated Sludge (3⁰)



- Treatment \$ - *HIGH*
- Complexity - *HIGH*
- Treatment Level - *HIGH*
- Land - *MODERATE +*

Membranes



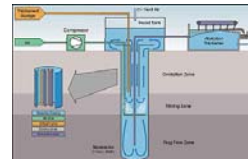
- Treatment \$ - *HIGH*
- Complexity - *HIGH*
- Treatment Level - *HIGH*
- Land - *LOW*

IFAS



- Treatment \$ - *HIGH*
- Complexity - *MODERATE +*
- Treatment Level - *MODERATE +*
- Land - *LOW*

Deep Shaft



- Treatment \$ - *MODERATE ?*
- Complexity - *MODERATE ?*
- Treatment Level - *MODERATE*
- Land - *LOW*

DW Standards



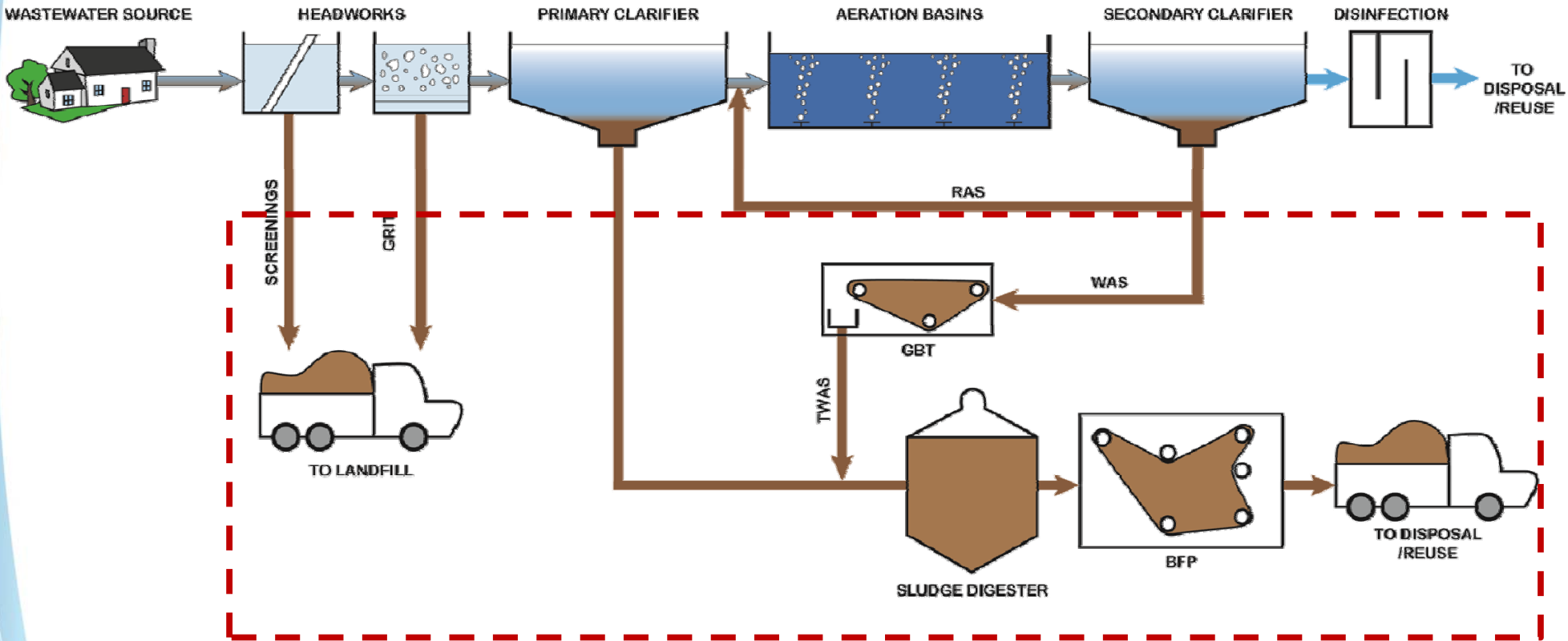
- Treatment \$ - *HIGH +*
- Complexity - *HIGH +*
- Treatment Level - *HIGH ++*
- Land - *MODERATE +*

LIQUID TREATMENT

Overview

- ◆ **Smallest** portion of overall land requirements
- ◆ Treatment level linked to disposal method &/or site
- ◆ Technology used linked to size and treatment level
- ◆ Other factors:
 - Odors
 - Traffic
 - Buffers
 - “not in my backyard”

SOLIDS TREATMENT



SOLIDS TREATMENT

Solids Treatment Options

- 💧 Truck Haul to existing WRF for treatment
- 💧 Pump to existing WRF for treatment
- 💧 Collection system to existing WRF (limits)
- 💧 **On-Site Treatment and off-site haul/disposal**

Other Factors

- 💧 Odors
- 💧 Traffic
- 💧 Buffers
- 💧 “not in my backyard”

SOLIDS DISPOSAL

Solids Disposal Options

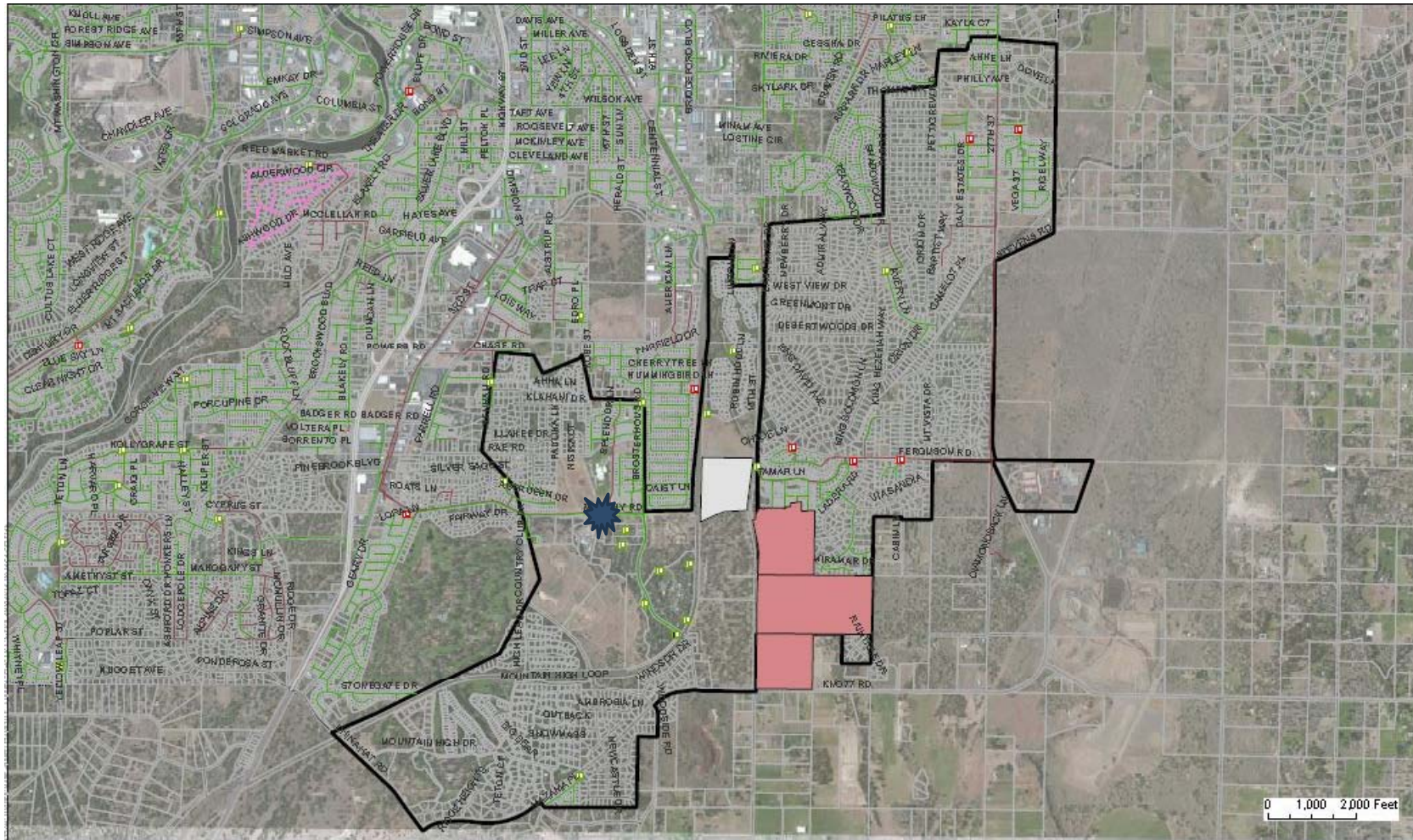
- Land Application – City Property
- Land Application – Private Property/Contracted
- Landfill – Costly & decreasing support

Other Factors

- Odors
- Traffic
- Buffers
- “not in my backyard”

SOLIDS DISPOSAL

Murphy Lift Station Area Example (200 total acres)



SUMMARY

• **Satellite Treatment System(s) must be:**

- Year-round solution
- Lower cost than collection system
- Have known costs
- Tailored to location
- Include treatment AND disposal

• **Satellite Treatment System(s) should also consider:**

- Odors
- Traffic
- Public Acceptance

DISCUSSION

Next Steps

- ◆ Identify Collection System Deficiencies with model
- ◆ Identify alternatives and locations to address deficiencies (pipes, pumps, treatment, storage)
- ◆ Run Initial Optimization
- ◆ SIAG Regroup
 - Review of results
 - Discuss impacts

DISCUSSION

Community Value Considerations

- ◆ Lower Cost?
- ◆ Wetland/Habitat Creation
- ◆ Water Reuse
- ◆ Odors
- ◆ Buffers
- ◆ Landscaping/Shielding
- ◆ Water Quality
- ◆ Public Health