LYON & GERRISH TOWNSHIP PROPOSED HIGGINS LAKE PUBLIC SEWER SYSTEM

October 28, 2019

Presenters: Fleis & VandenBrink | John DeVol, PE; Ian Neerken, PE; Ben Kladder, PE; Bob Wilcox, PE

AGENDA

- Project Process
- Evaluate need for public sanitary sewer system
- Alternatives explored
- Proposed public sanitary sewer system
- Financial considerations
- Not detailed individual costs

PROCESS

General Milestone	Est. Completion
Public Joint Meeting with Lyon/Gerrish	October 2018
SEARCH Grant Application	Winter 2019
SEARCH Grant Award	Spring 2019
Feasibility Study	October 2019
Public Information Meeting	October 2019
Townships determine to proceed and begin preparation for making a funding application	Winter 2019-2020
Prepare applications for funding	Spring 2020
Receive funding commitments	Summer 2020
Townships determine to proceed with funding option	Summer 2020
Begin engineering design	Fall 2020
Advertise for bids	Fall 2021
Construction	Spring 2022 - Fall 2023

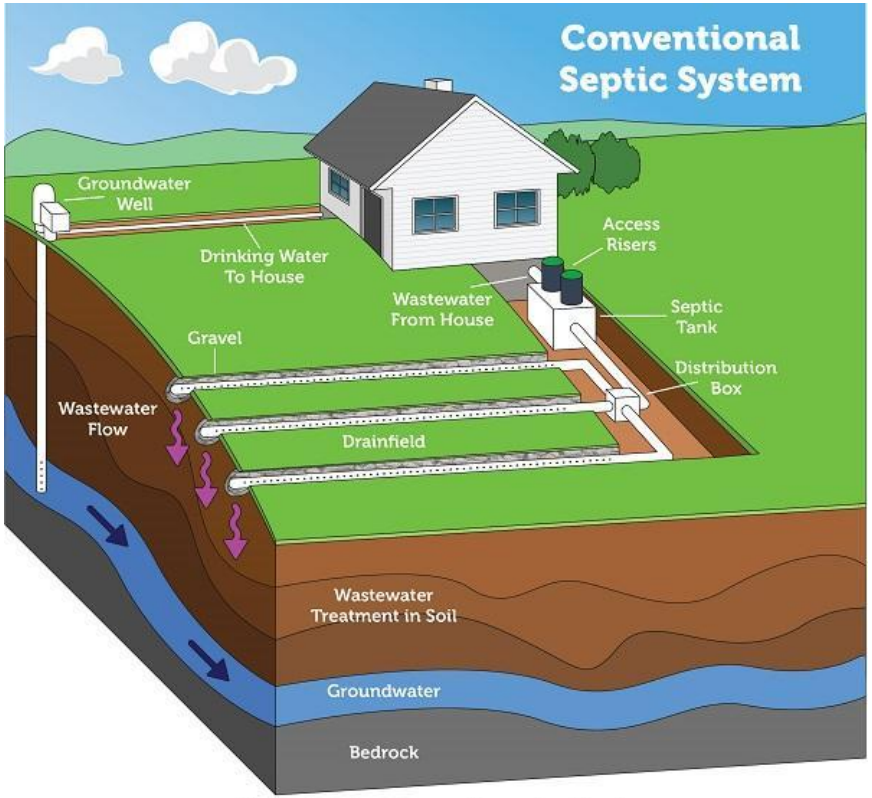
EVALUATE NEED

PRESENTER: IAN NEERKEN, PE
FLEIS & VANDENBRINK

IDENTIFYING THE PROBLEM

Typical Septic System and connecting conditions

- High (shallow) water table
- Soil type – generally sandy, highly permeable
- Dense Development
- Proximity to lake

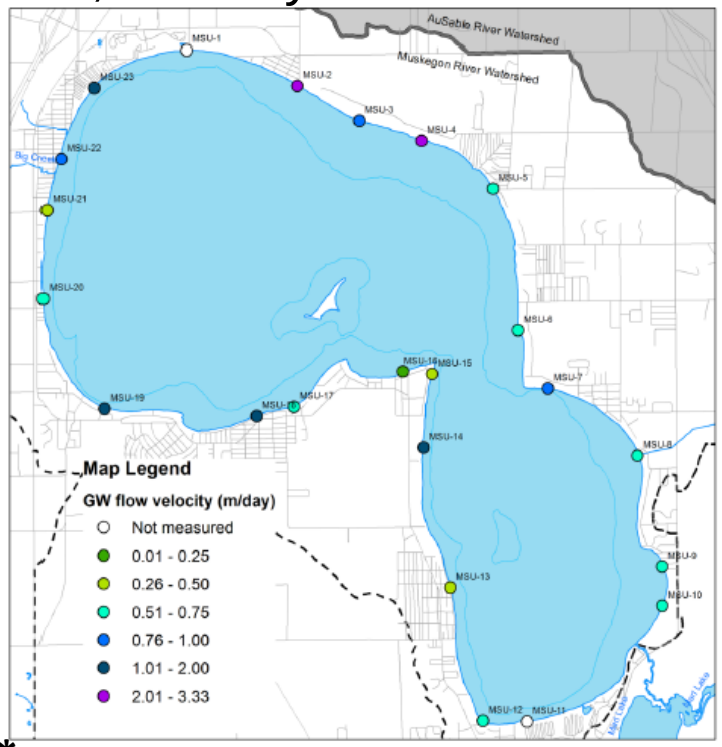


Please note: Septic systems vary. Diagram is not to scale.

IDENTIFYING THE PROBLEM

Problems with septic systems

- Water quality conditions
  - Nutrient loading
  - Average Groundwater flow into lake, >1ft/day *
  - System life expectancy: 20yrs
- Continued use of septic systems
  - Nutrients in surface water
  - Seasonal use
  - Expansion/replacement



* *Figure 4. Map of measured groundwater flow velocities from seepage meters.*

*** Changes in Nearshore water quality from 1995 to 2014 and associated linkages to septic systems in Higgins Lake , MSU 2014**

POLLUTANTS IDENTIFIED

- **Phosphorus (TP and TDP)***
  - Nutrient from septic system effluent and fertilizers
- **Nitrogen (Nitrate NO_3 and Nitrite NO_2)**
  - Nutrient from septic system effluent and fertilizers
- **E-coli**
  - A fecal colloform bacteria indictive of sewage contamination
- **Chlorophyll (Chl)***
  - An indicator of phytoplankton (algae)
- **Boron (B)**
  - Found in soaps, detergents, bleach, cosmetics, etc.
- **Other Tests:**
  - Secchi Disk (SD)*
  - Specific Conductivity
  - Dissolved Oxygen (DO)

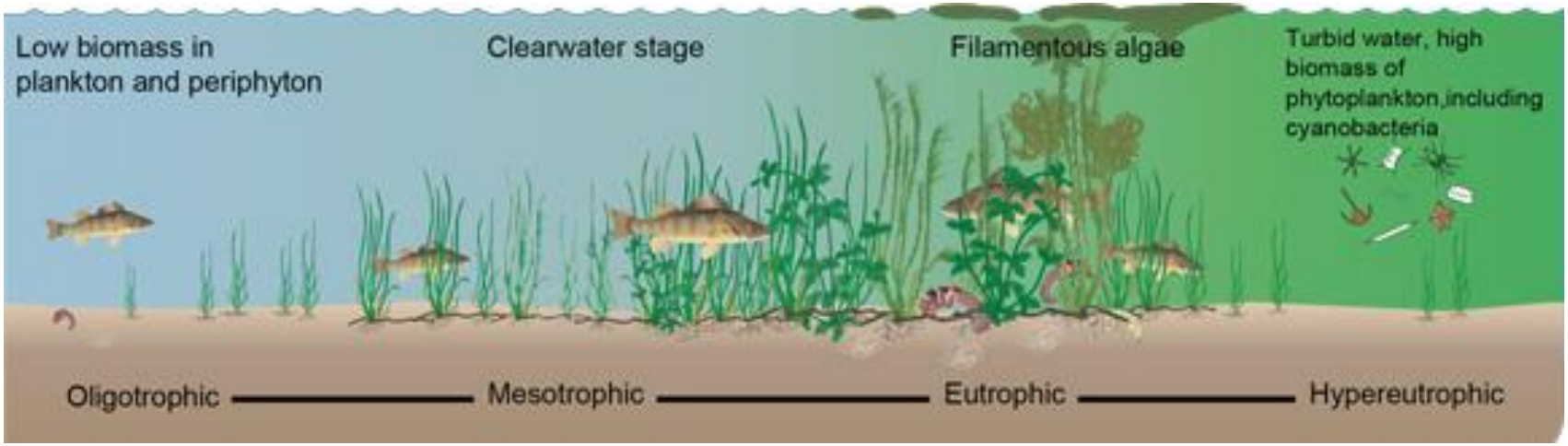
* **Used in calculating Trophic State Index (TSI)**

TROPHIC STATE INDEX (TSI)

- Indicator of perceived lake water quality
- Basic TSI Summary:

TSI	Chl (ug/L)	SD (ft)	TP (ug/L)	Attributes	Fisheries & Recreation
<40	<2.6	>13.1	<12	**Oligotrophy** – clear water through year, deep cold water	Trout fisheries dominate, walleye present
40-50	7.3-2.6	13.1-6.6	12-24	**Mesotrophy** – moderately clear through most of summer	No oxygen at lake bottom, loss of trout
50-70	56-7.3	6.6-1.6	24-96	**Eutrophy** – algae and aquatic plant issues, blue-green algae present, green water	Warm-water fish only, bass; dense algae and plants discourages swimming and boating
>70	>56	<1.6	>96	**Hypereutrophy** – dense algae, algal scum	Water is not suitable for recreation, rough fish (carp) dominate, summer fish kills possible

TROPHIC STATE INDEX



TROPHIC STATES

Oligotrophic Hypereutrophic

NUTRIENT SOURCES AND LOADING

	Raw Wastewater	Drainfield Discharge
Nitrogen	60 ppm	60 ppm
Phosphorus	10 ppm	8.1 ppm

Source: EPA Onsite Wastewater Treatment System Manual, 2002 EPA/625/R-00/08 Crites and Tchobanoglous, Small and Decentralized Wastewater Management Systems, McGraw-Hill,1998.

ESTIMATED NUTRIENT LOADING

Table 31: Higgins Lake Watershed Pollutant Loading Estimates			
Nutrient Source	**Sediment** *Tons Per Year*	**Phosphorus** *Lbs. Per Year*	**Nitrogen** *Lbs. Per Year*
Shoreline Erosion	94	80	158
Road/Stream Crossing Erosion	33	28	56
Road End Erosion	123	105	209
Septic Systems (Conventional System)	N/A	98,710	371,296
Fertilizer Usage	N/A	225	4494
Totals	**250**	**99,148**	**376,213**

Septic Systems are estimated to account for:

- Over 99% of the total phosphorus load
- Over 97% of the total nitrogen load

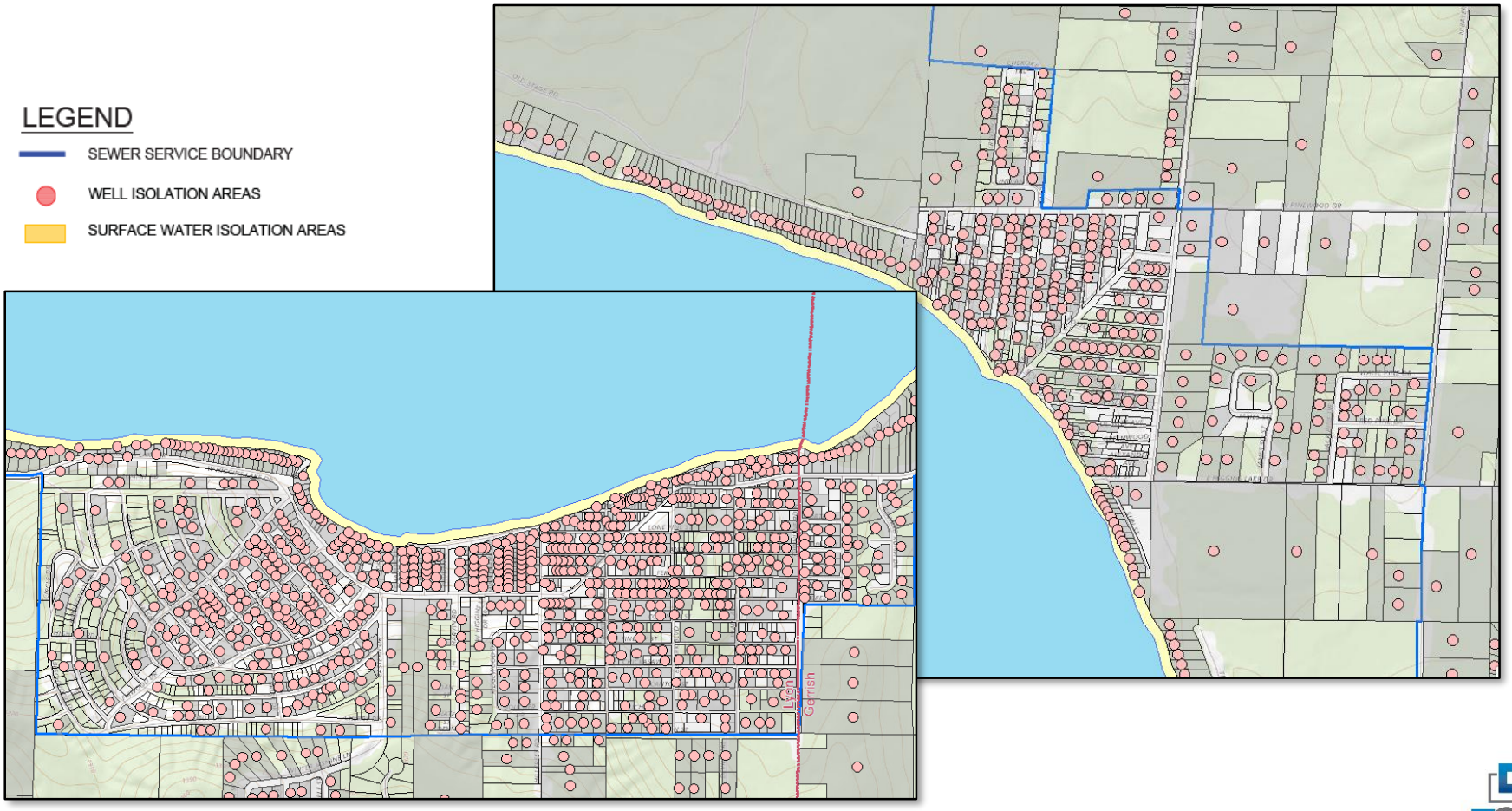
Source: Higgins Lake Watershed Management Plan, Updated 2007, Huron Pines, Inc.

CONTINUED USE OF SEPTIC SYSTEMS

- Factors that impact expansion and replacement:
  - Small lot size (especially near lake)
  - Distance to wells (50’ isolation around wells)
  - Distance to surface water (50-100’ minimum required)
  - High groundwater table (24-36” required drain field to groundwater)
  - Shallow drinking water wells drawing from same aquifer as drain field discharge

FACTORS IMPACTING SEPTIC SYSTEMS

- 100’ minimum distance from lake and creek
- Distance to wells: 50’ for residential, 75’ for commercial



PRIOR LAKE STUDIES

Timeline of notable lake studies

- Maintaining the High Water Quality of Higgins Lake; (Bosserman, 1969)
- US EPA Natural Eutrophication Survey – Higgins Lake #195; (US EPA, 1975)
- A Water Quality Study of Higgins Lake, Michigan; (UofM, 1984)
- Effects of Residential Development on the Water Quality of Higgins Lake, Michigan 1995-99 (USGS, 2001)
- Changes in nearshore water quality from 1995 to 2014 and associated linkages to septic systems in Higgins Lake, MI; (MSU, Martin, Kendall, Hyndman, 2014)
- Algae and Water Chemistry Sampling Project; (UofM BS, Lowe, Kociolek, 2016)
- Higgins Lake Water Analysis (Raven Analytical - Roscommon High School Students, 2018, 2019)
- Three Prior sewer feasibility studies

COMMON FINDINGS OF PRIOR STUDIES

Documentation that lake is impacted by septic systems

- Continually increasing nitrogen and phosphorus levels in Higgins Lake
- Changes in Trophic State Index indicators (Total P, blue-green algae, anoxic conditions, etc.)
- Septic drain field seepage is likely the largest controllable source of phosphorus loading in Higgins Lake

CAMP CURNALIA – CASE STUDY

- Camp Curnalia wastewater collection and treatment constructed in 2009
- The 2014 MSU study analyzed pre- and post-construction sampling with USGS/MSU sampling locations
- Results show:
  - Significant reduction in Total Phosphorus
  - Nitrate and Nitrite levels dropped below detection levels
  - Boron levels exhibited significant declines
  - Specific conductivity measurements were lowest at the Camp area of the lake

An update, with 2018 and 2019 sampling data, is expected to be released soon

BENEFITS OF PROPOSED PUBLIC SEWER SYSTEM

- Reduces risk of contamination of shallow drinking water wells
- Lake water quality improvements
  - A controllable way to reduce nutrient loading impacting lake health
- Removal of septic systems
  - Eliminates aging, undersized and improperly functioning septic systems
  - Eliminates impractical control for inspection/enforcement of privately owned septic systems
  - Eliminates performance concerns due to seasonal use

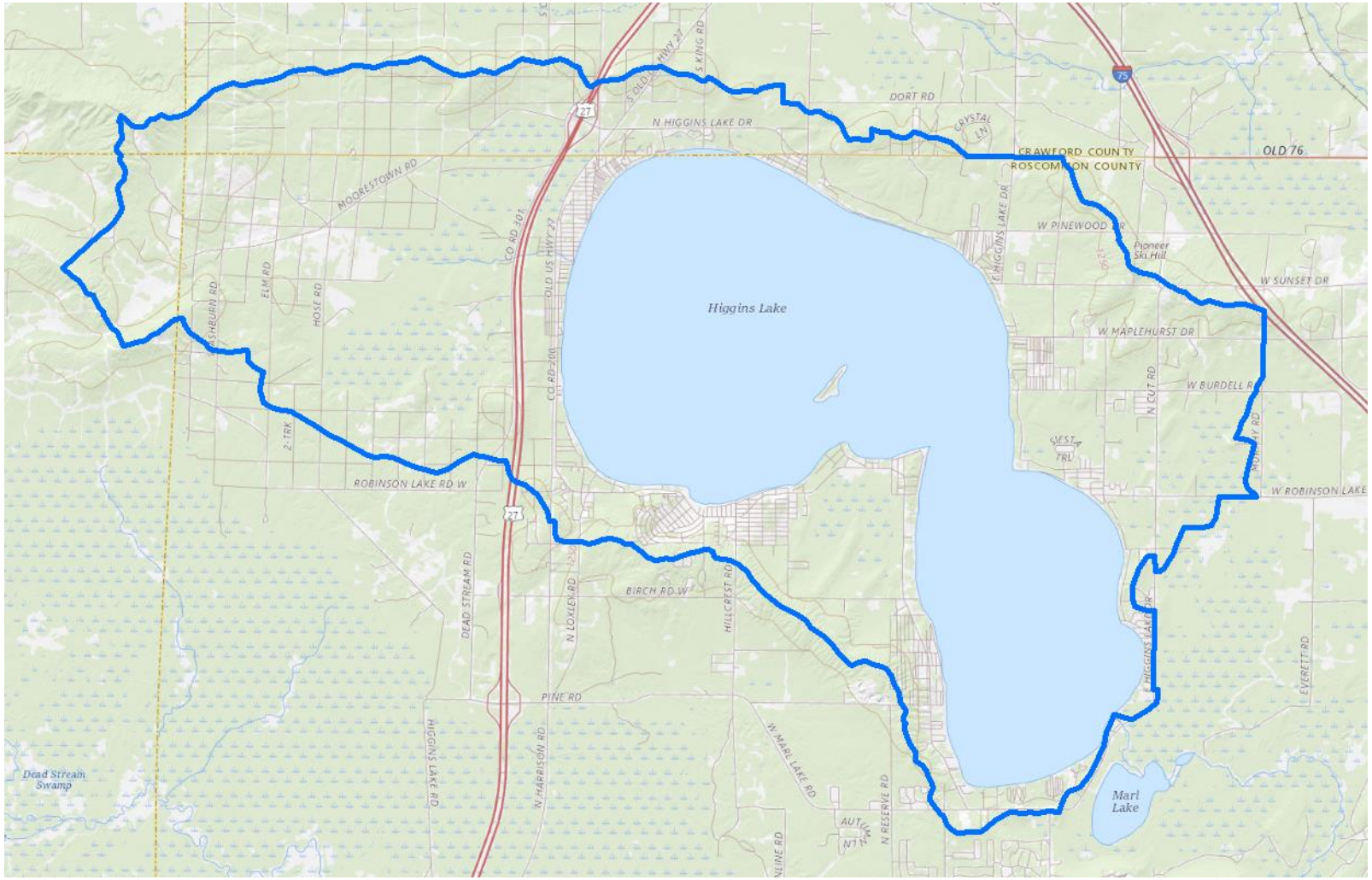
BENEFITS OF PROPOSED PUBLIC SEWER SYSTEM

- Allows the community to better manage the sustainability of Higgins Lake
- Helps to protect property value

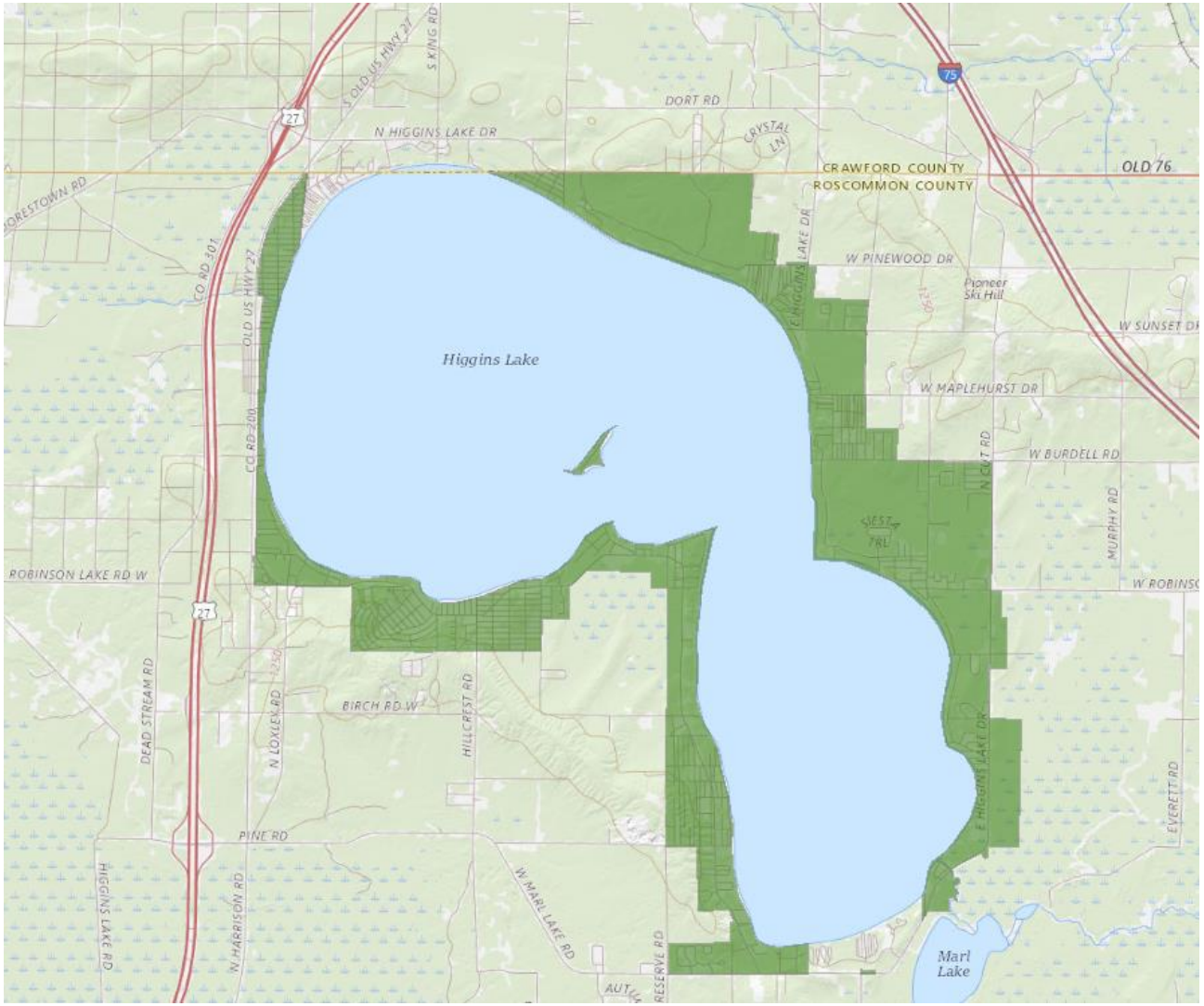
ALTERNATIVES EXPLORED

PRESENTER: BEN KLADDER, PE
FLEIS & VANDENBRINK

HIGGINS LAKE WATERSHED

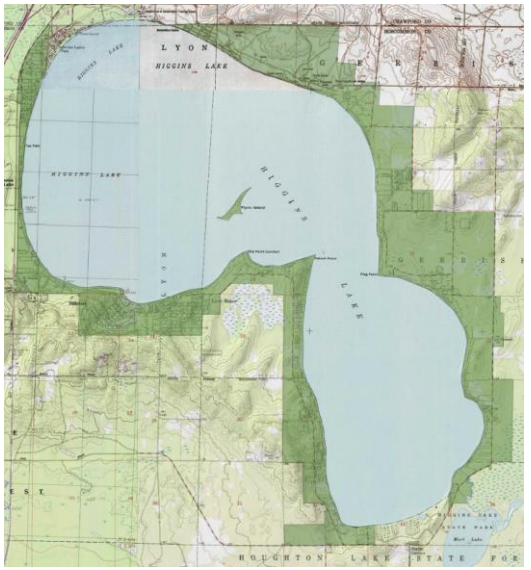


STUDY AREA


Higgins Lake
Marl Lake
N HIGGINS LAKE DR
DORT RD
CRYSTAL LN
CRAWFORD COUNTY
ROSCOMMON COUNTY
OLD 76
W PINEWOOD DR
Pioneer Ski Hill
W MAPLEHURST DR
W BURDELL RD
ROBINSON LAKE RD W
BIRCH RD W
PINE RD
DEAD STREAM RD
HILLCREST RD
N LOXLEY RD
W MARL LAKE RD
HIGGINS LAKE RD
N HARRISON RD
EVERETT RD
MURPHY RD
CO RD 200
CO RD 301
OLD US HWY 27
S KING RD
75
27

STUDY AREA

- How was the Study Area identified:
  - Potential areas influencing water quality
  - Health and safety
- Areas that will benefit from community sewer due to:
  - Isolation distances, lot size/density
  - Poor soils (clay, excessively drained)
  - Depth to groundwater
  - Lot density
- What about State Parks? Camp Curnalia?
  - Currently served by sewer
  - Could unify or join



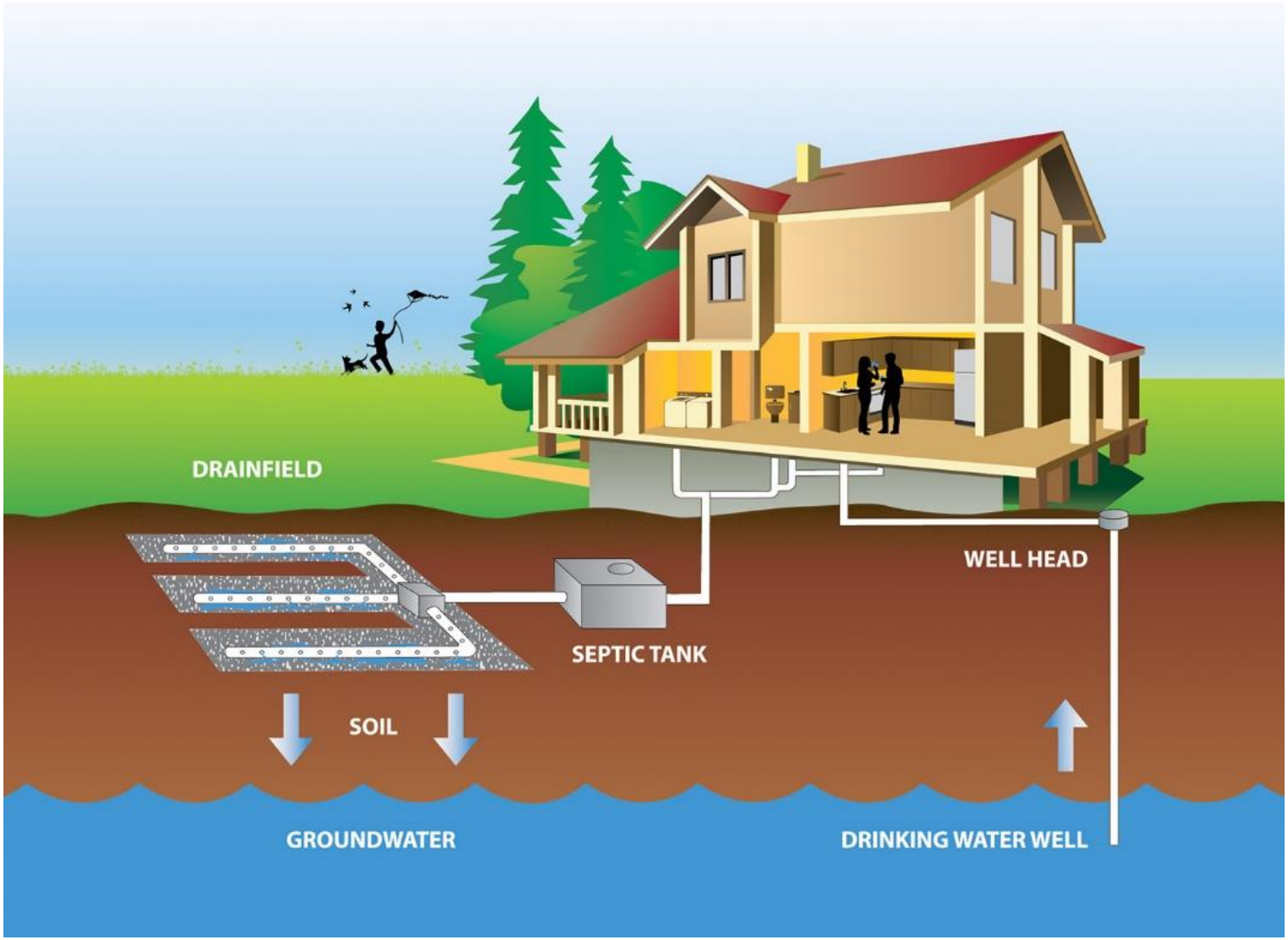
ALTERNATIVES EXPLORED

- Preliminary Engineering Report
  - Collection System
    - Gravity Sewer with Low Pressure component
    - Complete Low Pressure System
  - Treatment Options
    - Regional Treatment
    - Lagoon WWTF
      - Large earthen lagoons and rapid infiltration basins
    - Mechanical WWTF
      - Concrete treatment and settling tanks with rapid infiltration basins
- Conclusion:
  - Low Pressure collection with Mechanical WWTF is the least costly, best solution to provide sewer service.

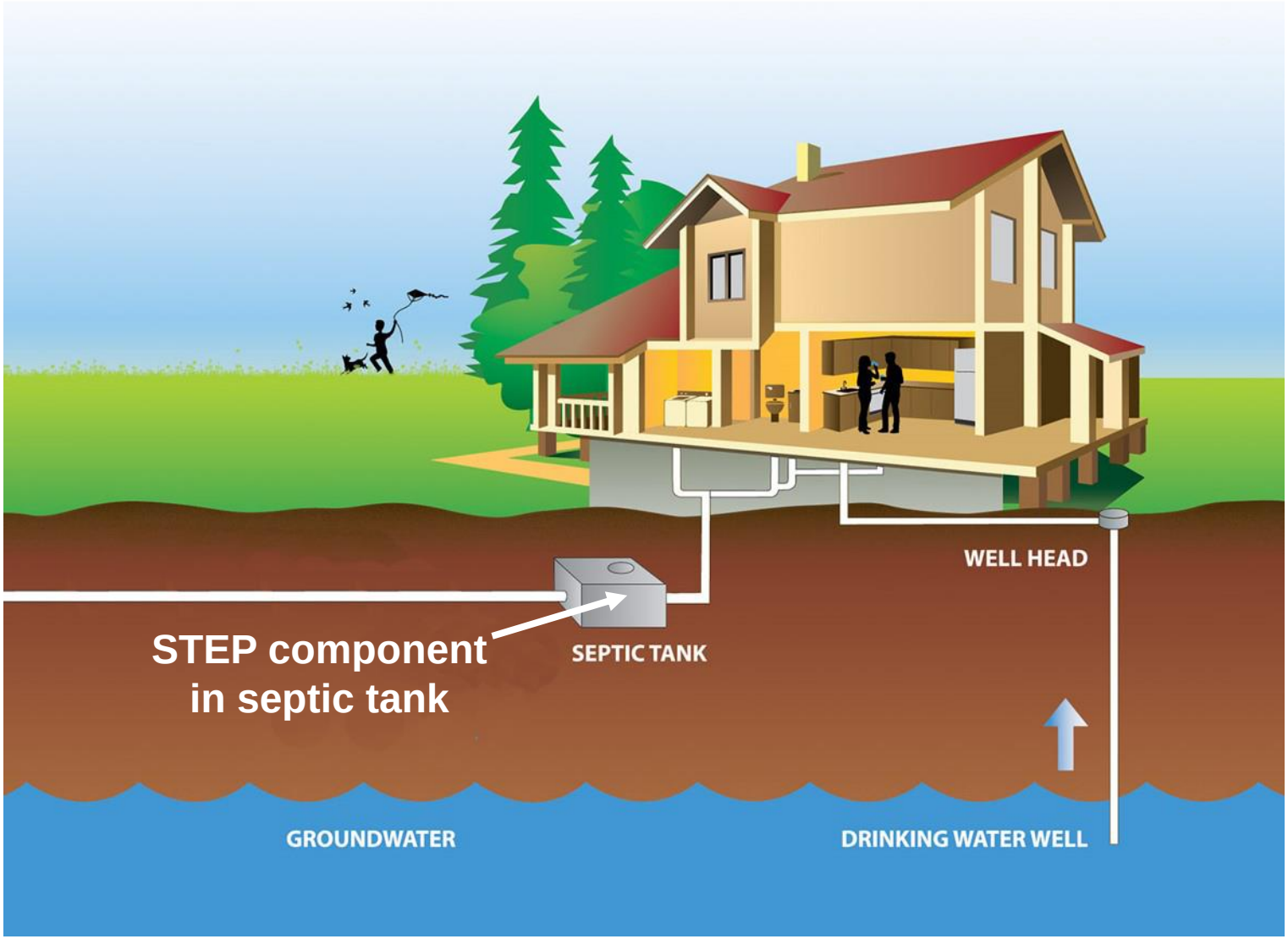
PROPOSED PUBLIC SANITARY SEWER SYSTEM

PRESENTER:
BEN KLADDER, PE
FLEIS & VANDENBRINK

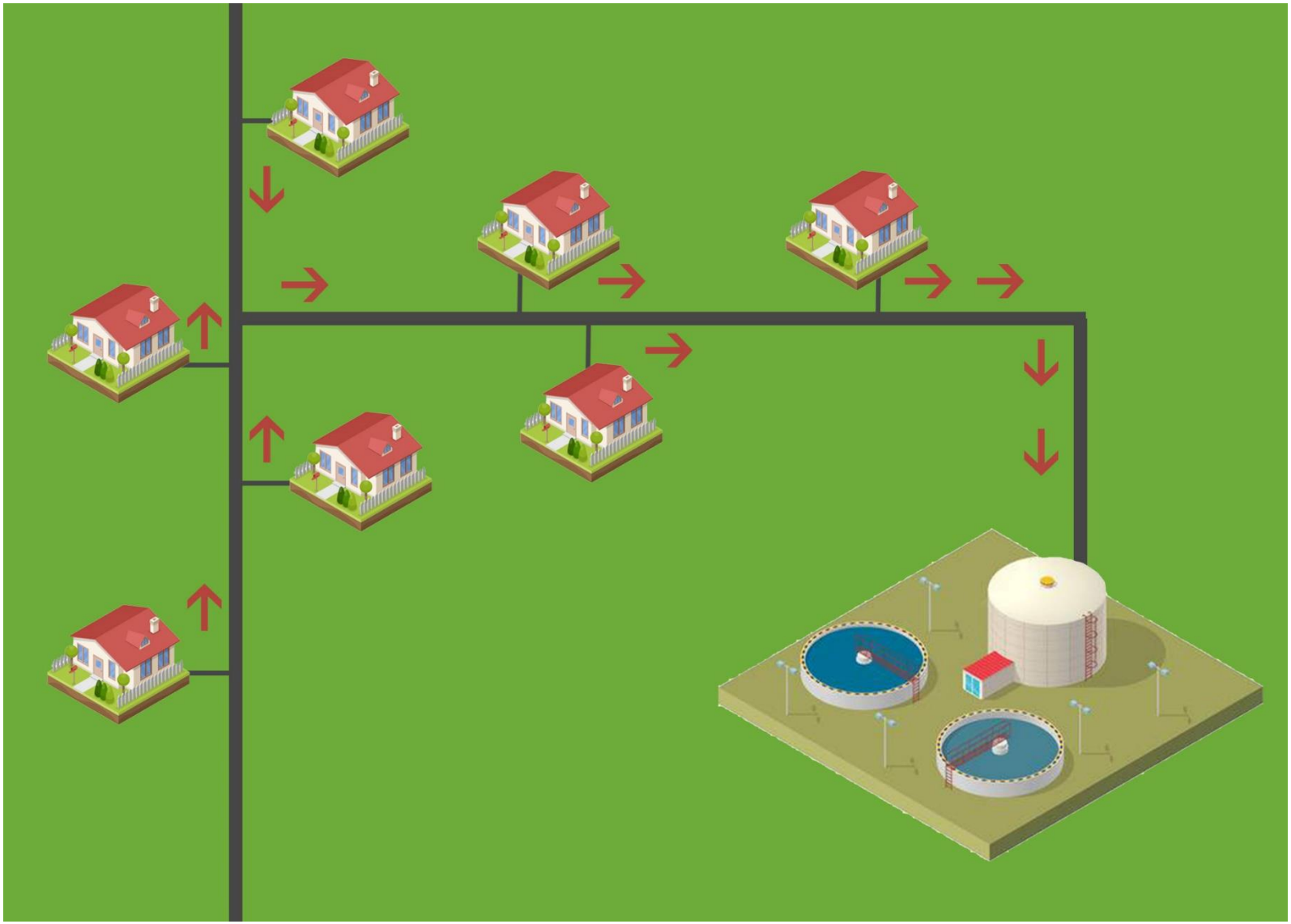
EXISTING SEPTIC SYSTEM



PROPOSED STEP COMPONENT



PROPOSED SEWER SYSTEM



STEP SYSTEMS

STEP

- Eliminates Drainfield
- Pumps to WWTP
- Municipal Ownership
- Maintenance by municipality
- Wastewater treated to EGLE standards
- Oversight & reporting with EGLE
- Not affected by seasonal use

Advanced On-site Treatment

- Requires Drainfield
- Discharges on-lot
- Individual Ownership
- Maintenance by property owner
- No treatment standards
- Affected by seasonal use
- No oversight, self regulated

PROPOSED SEWER SYSTEM

STEP component visibility

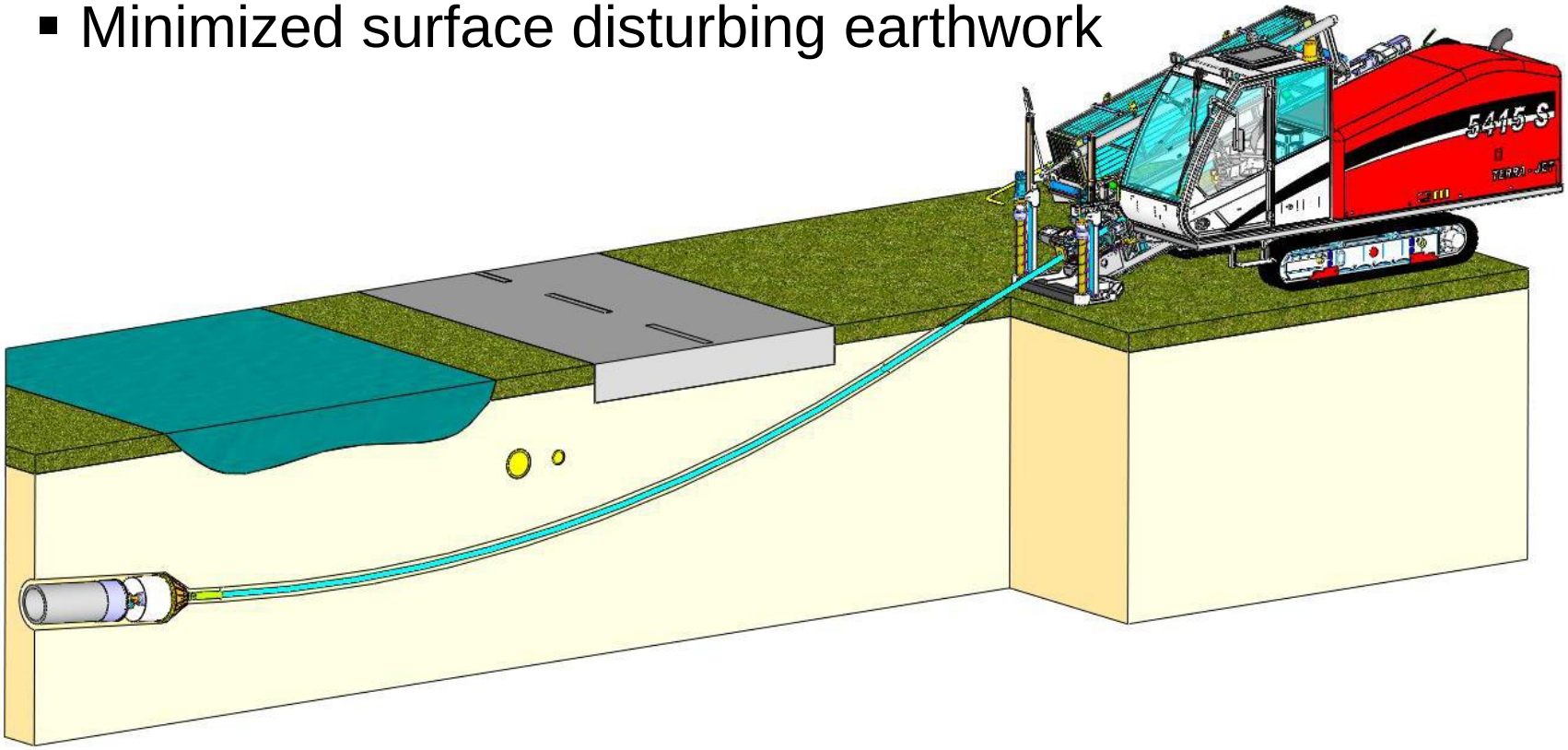
CONSTRUCTION

Maximize this

Minimize this

CONSTRUCTION

- Utilize Trenchless Technology
- Directional Drilling
- Minimized surface disturbing earthwork



PROPOSED SEWER SYSTEM

- Responsibility & Maintenance:
  - Property Owner:
    - Pipe from house to tank,
    - Electric cost for pumping, Est. at <$1.50/month
  - Utility:
    - Tank, pump, pump controls and all downstream piping
    - Utility will periodically pump tanks, operate, maintain & replace system
- Life of System:
  - 75 -100 years for most infrastructure
  - 15+ years on pumps and misc. components (built into the annual operation of system)

PROPOSED TREATMENT SYSTEM

PRESENTER:
BOB WILCOX, PE
FLEIS & VANDENBRINK

EXISTING SEPTIC SYSTEM

Water Quality Conditions

	Raw Wastewater	Drainfield Discharge	Municipal WWTP Treated Water
Nitrogen	60 ppm	60 ppm	<5 ppm
Phosphorus	10 ppm	8.1 ppm	<1 ppm

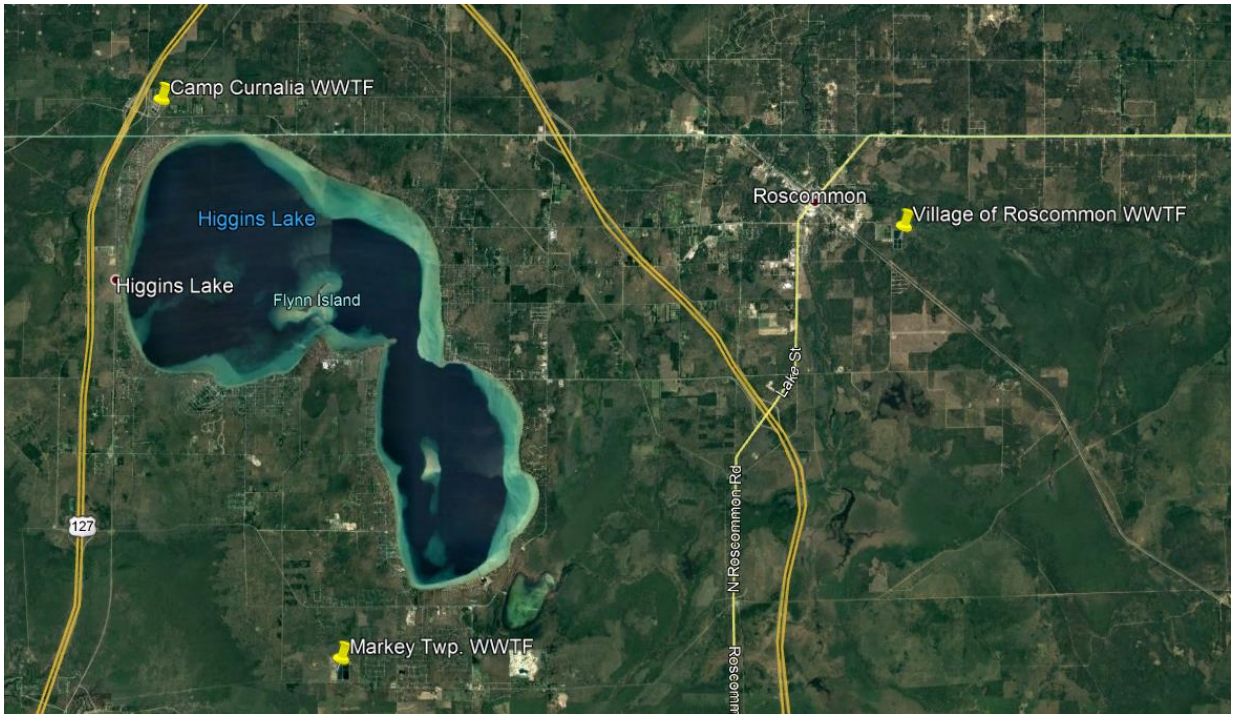
Source: EPA Onsite Wastewater Treatment System Manual, 2002 EPA/625/R-00/08 Crites and Tchobanoglous, Small and Decentralized Wastewater Management Systems, McGraw-Hill,1998.

PROPOSED TREATMENT SYSTEM OVERVIEW

- Designed to treat summer time flow rates
- Certified Operator in charge of treatment
- Effluent quality monitored for compliance by EGLE
- High quality effluent discharged to groundwater far away from the Lake
  - Nitrogen <5 ppm
  - Phosphorus <1 ppm

ALTERNATIVE 1: REGIONAL TREATMENT SYSTEM

- Collection system delivers flow to an existing regional WWTF.
  - Camp Curnalia
  - Markey Township
  - Village of Roscommon
- Significant expansion of existing facilities would be required.



Regional WWTF Locations

ALTERNATIVE 2: LAGOON TREATMENT FACILITY

- Collection system delivers flow to large earthen basins.
- Large land area required.
- Potential for seasonal odors
- Higher capital costs vs Mechanical WWTF
- Lower operating costs vs Mechanical WWTF

Lagoon Treatment Overview

PROPOSED ALTERNATIVE: MECHANICAL TREATMENT FACILITY

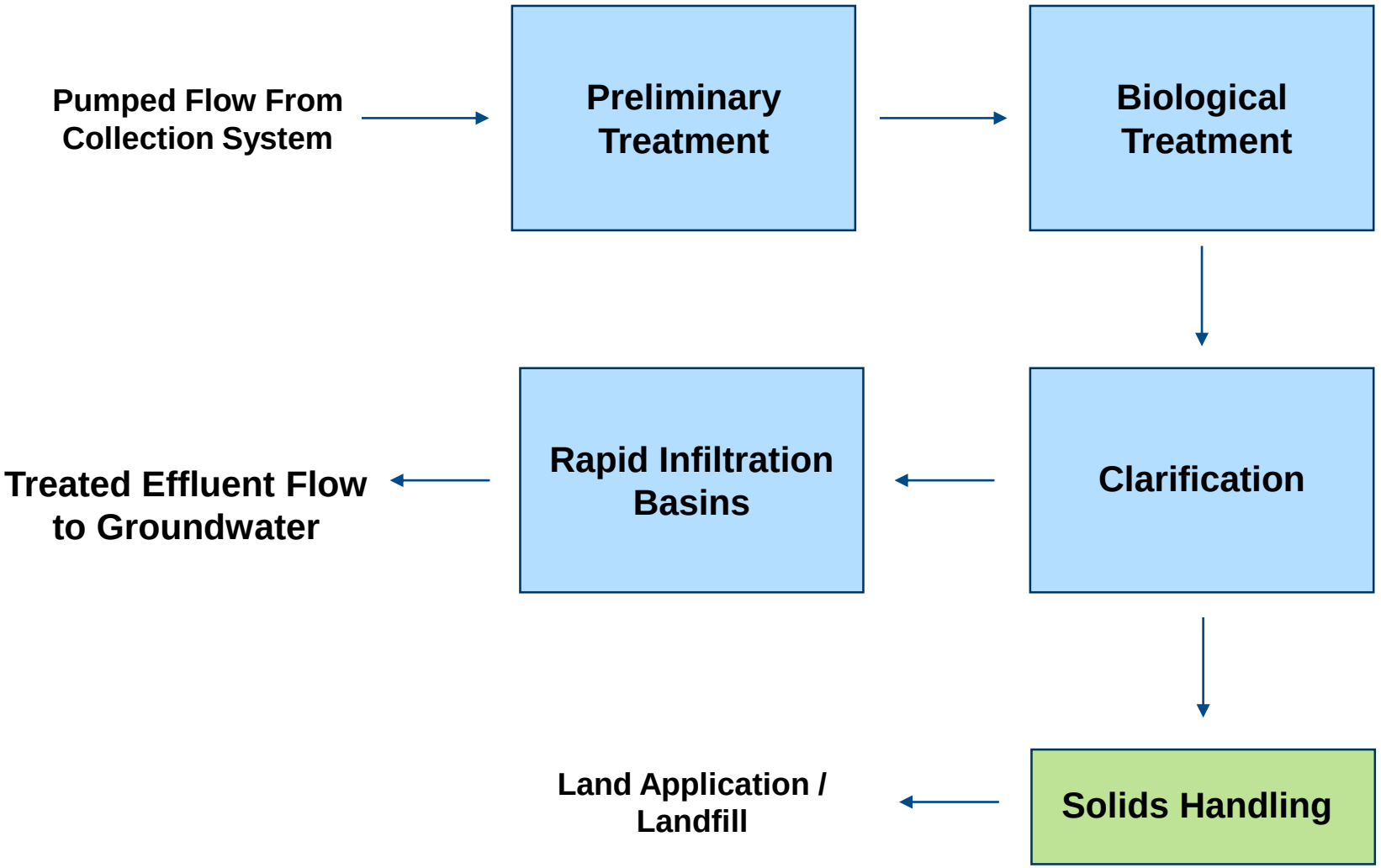
- Collection system delivers flow to concrete treatment and settling tanks
- Small treatment facility footprint
- Operational flexibility for seasonal flows
- Tanks can be covered to minimize odors

Oxidation Ditch

Mechanical Treatment Overview

Rapid Infiltration Basin

PROPOSED TREATMENT SYSTEM



POTENTIAL WWTF LOCATIONS

FINANCIAL/LEGAL CONSIDERATIONS

PRESENTER: JOHN DEVOL, PE
FLEIS & VANDENBRINK

NEXT STEPS

- Feasibility Study will provide conclusions as to the most cost-effective alternatives for the Townships to consider
- There are many funding options, including a combination of special assessments, grants, loans and participation by state and federal partners
- There will be several opportunities for the Townships and public to determine whether to proceed throughout the process
- The funding applications do not involve a commitment to continue the project

LEGAL CONSIDERATIONS

- Although there are many legal structures that could be utilized to own, operate and finance a system, the most likely will include:
  - Creation of sewer authority
    - Board will be appointed by townships
    - Will own and operate the sewer system
    - May hire staff and contractors

FINANCIAL CONSIDERATIONS

- State & Federal Programs finance construction of water and sewer systems with loan and grant programs
- Must go through application process to know loan terms and potential grant awards
- USDA Rural Development
- EGLE SRF (State Revolving Funds)
- Residential Assistance Programs
  - USDA Rural Development
  - Loan and Grant opportunities
  - MI Treasury Programs

EGLE
MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

USDA Rural Development
Committed to the future of rural communities.

PROJECT COST ESTIMATE

Collection System

Summary Table: Engineer's Opinion of Probable Capital Costs						
Alternative	Capital Cost	Annual OM&R Cost	Net Present Worth of OM&R Cost (1)	Total Present Worth	Salvage Value	Net Present Worth
Alternative 2 - Gravity & LP Combined	**$101,936,000**	$933,000	$16,020,000	**$ 117,956,000**	$36,721,000	**$81,235,000**
Alternative 3 - Low Pressure STEP System	**$82,559,000**	$692,000	$11,880,000	**$ 94,439,000**	$39,825,700	**$54,613,300**

Treatment System

Summary Table: Engineer's Opinion of Probable Capital Costs						
Alternative	Capital Cost	Annual OM&R Cost	Net Present Worth of OM&R Cost (1)	Total Present Worth	Salvage Value	Net Present Worth
Alternatives						
Alternative 1 - Lagoon WWTP	**$26,840,000**	**$860,000**	**$14,770,000**	**$41,610,000**	**$2,800,000**	**$38,810,000**
Alternative 2 - Mechanical WWTP	**$23,130,000**	**$980,000**	**$16,800,000**	**$39,930,000**	**$3,800,000**	**$36,130,000**

Note: This table represents budgetary estimates for planning purposes. Further definition of the scope of the projects through preliminary and final design will provide details necessary to improve the accuracy of the costs.

(1) Net Present Worth calculated using the real discount rate for a 20-year period (i = 1.5%) based on USDA guidance for FY2019.

NEXT STEPS

General Milestone	Est. Completion
Public Information Meeting	October 2019
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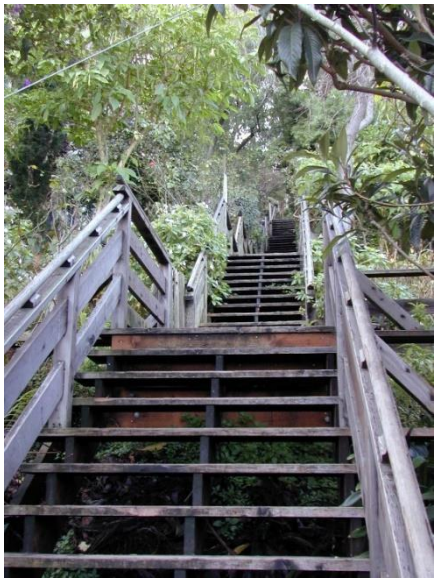

QUESTIONS