Sewer It!

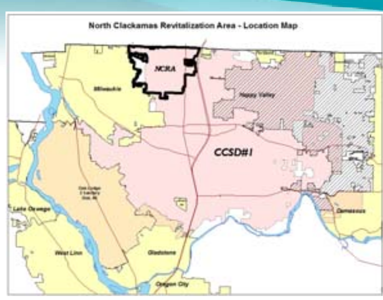
E.coli Reduction Strategy For Willamette TMDL Implementation Plan

Water Environment Services
Beyond clean water.

Overview

- North Clackamas Revitalization Area (NCRA)
  - Location/Context
  - Sewer Project
- Watershed Action Plans
  - Link between NCRA Sanitary Project and *E.coli* TMDL
  - Texas Study/EPA Equation
- E.*coli* Load Reduction Methodology
  - Hydrogeology
  - Reference Studies
- Willamette TMDL
- E.*coli* Load Reduction Estimates
- Next Steps

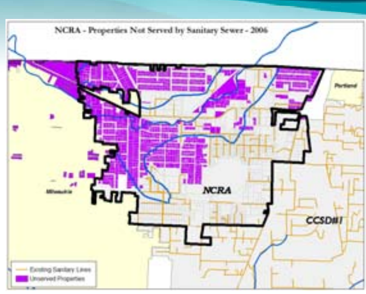
North Clackamas Revitalization Area (NCRA)



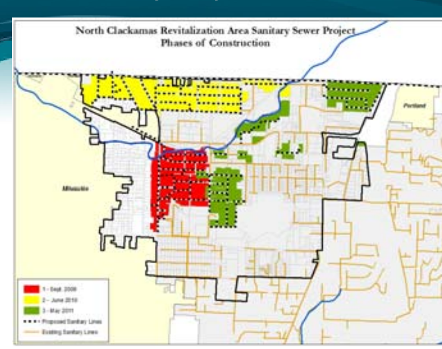
North Clackamas Revitalization Area (NCRA)

- Formed in 2006 as an Urban Renewal Area by Clackamas County BCC
- Drains to Johnson Creek which is a tributary to the Willamette River
- 952 On-Site Systems: Primarily Cesspools/Septic Tanks
- Long Standing *E.coli* Concerns In The Area
- Residents Desire for Improvements including Sanitary Service
- CC - Awarded DEQ Clean Water State Revolving loan to Address *E.coli* and Provide Service to Residents
- Sanitary Sewer Project Initiated 2009 (3 Phases)

NCRA Un-Served Areas Identified



NCRA Sanitary Project – Construction Phases



Tie-in with Surfacewater Program Begins with Watershed Action Plans

» Purpose of WAP: Develop Basin Specific Plans to improve water quality and watershed health

» WAP Recommendation: Complete *E.coli* Source Tracking Study

» Identified Opportunity to Tie NCRA Project with TMDL *E.coli* Reduction Requirements

» Research Identified Travis County,Texas Study and EPA Equation to Estimate *E.coli* Load Reductions

Similar E.*coli* Load Reduction Strategies in US

Table 3: Reference Studies

Stream	Referenced Documents
Gilleland Creek	Gilleland Creek TMDL (TCEQ, 2006); Gilleland Creek On-Site Sewage Workgroup Report (2009)
Buffalo and Whiteoak Bayous	Buffalo Bayou TMDL (TCEQ, 2009); Draft Technical Guidance Document (University of Houston and CDM, 2008); the Houston Bacteria Implementation Group (H-GAC, 2010).
Canadian River	Final Bacteria TMDL for the Canadian River Area (OkDEQ, 2008)
Lower Mississippi River Basin	Revised Lower Mississippi River Basin TMDL (MPAC, 2006); Regional Fecal Coliform Implementation Plan for the Lower Mississippi River Basin (MPAC, 2007)

Fecal Coliform Load Estimate

EPA 2001 Protocol for Developing Pathogen TMDLs

$$L_{FC} = n_{SS} \times C_{OSSF} \times Q_{household} \times n_{indiv} \times CF$$

L_{FC} = Fecal Coliform load (counts/day)
n_{SS} = Number of systems replaced
C_{OSSF} = Fecal Coliform Concentration (MPN/mL)
$Q_{household}$ = WWTP flow per household (gal/person/day)
n_{indiv} = Number of individuals in the household
CF = Unit Conversion Factor

E.coli Load Estimate Equation

$$L_{EC} = L_{FCm} \times \%EC \times IAF$$

L_{EC} = E.*coli* Load (counts/day)
%EC = % of *E.coli* concentration
IAF = Impact Area Factor; % to account for varying levels of bacteria loading based on location to Johnson Creek

E.*coli* Load Reduction Variable Estimates

$$L_{FC} = n_{SS} \times C_{OSSF} \times Q_{household} \times n_{indiv} \times CF$$

Table 4: *E.Coli* Load Calculation Variables

Variable	Value	Units	Source
n_{ss}	Variable	households	WES estimated hook ups/year in NCRA
C_{OSSF}	10,000	MPN/mL	EPA 2001
$Q_{household}$	70	Gallons/person day	Metcalf and Eddy 1991
n_{indiv}	2.5	Person/household	2000 U.S. census
CF	3785.2	ml/gallon	
IAF	Variable	%	Estimated based on E.Coli Survival Rate & Groundwater Velocity
%EC	80	%	EPA 2001

NCRA Hydrogeology - Findings

» USGS Depth to Groundwater: 0 to 70 feet

» Average Depth of On-Site Systems: 20 feet

» Approximately 40 in/year of Precipitation

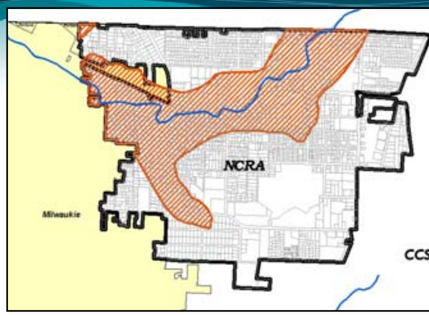
» Approximately 22 in/year Mean Recharge (USGS 2008)

» Septic Systems Contribute approximately 17% of Recharge in NCRA (USGS 2008)

» Average Daily Residential Flow: 225 Gal/Household

» **Approximately 214,000 GPD of Contaminated Recharge to the Water Table Occurs Thru Cesspools in NCRA**

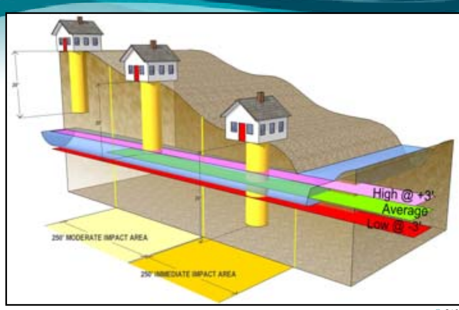
NCRA Hydrogeology: Area with Cesspools w/in 10 ft of Water Table



E.*coli* Load Reduction Impact Areas

- Highest Impact: Those that result from a direct connection between the cesspool/septic system and the creek or groundwater; and
- Moderate Impact: Those that result from either seasonal connection between the cesspool/septic system or those that occur after the partially treated effluent travels through the vadose zone (unsaturated zone) to reach the groundwater.

Impact Areas



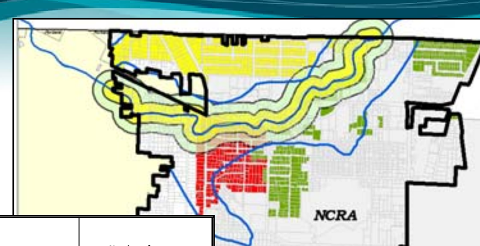
Impact Area Distance Estimates

- Groundwater seepage velocity was calculated as 9.4 ft/day (Sellwood Pump Test).
- Microbial survival of E.*coli* in pure ground is approximately 27 days (EPA July 2008)
- Distance of Highest Impact Zone(ft)
  - = Travel Time (days) * Groundwater Velocity (ft/day)
    - = 9.4 (ft/day)*(27days) = 250 feet

Impact Area Distance Estimates

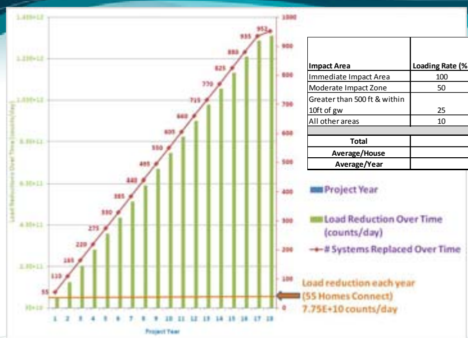
E. Coli Impact Area Loading Rates		
Impact Area	**Distance From Johnson Creek (ft)**	**Loading Rate (%)**
Immediate Impact Area	250	100
Moderate Impact Zone	500	50
Greater than 500 ft & within 10ft of gw	> 500	25
All other areas	> 500	10

Number On-Site Septic Systems within Impact Areas



Impact Area	Number of systems
Immediate Impact Area	97
Moderate Impact Zone	108
Greater than 500 ft & within 10ft of gw	182
All other areas	565
Total	**952**

Potential E.*coli* Load Reduction Estimate



Impact Area	Loading Rate (%)	Number of systems	E.Coli Reduction (counts/day)
Immediate Impact Area	100	97	5.14E+11
Moderate Impact Zone	50	108	2.86E+11
Greater than 500 ft & within 10ft of gw	25	182	2.41E+11
All other areas	10	565	2.99E+11
Total		**952**	**1.34E+12**
Average/House		**1**	**1.41E+09**
Average/Year		**55**	**7.75E+10**

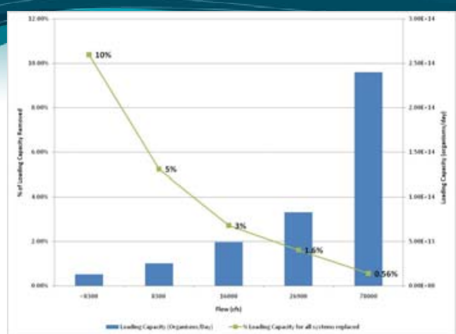
Willamette TMDL - Implications

- Overall *E.coli* Load Reduction of 78%
- *E.coli* Load Capacity for Willamette and Johnson Creek

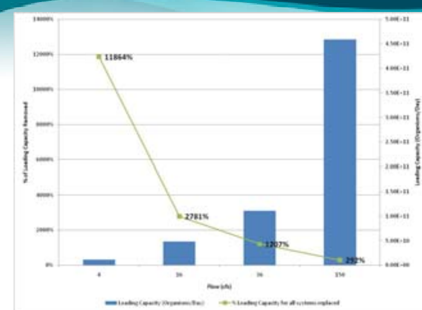
Table 1. Flow Based Loading Capacity to meet 126 cfu/100 ml *E.Coli* criteria

Willamette River at RM 18 Preliminary Loading Capacity		Johnson Creek at Luther Rd. (Site #7)	
Flow (cfs)	Loading Capacity (Organisms/Day)	Flow (cfs)	Loading Capacity (Organisms/Day)
78000	2.40×10^{14}	150	4.59×10^{11}
26900	8.29×10^{13}	36	1.11×10^{11}
16000	4.93×10^{13}	16	4.82×10^{10}
8300	2.56×10^{13}	4	1.13×10^{10}
<8300	1.29×10^{13}		

E.*coli* Load Reduction Relative to Loading Capacity – Willamette River @ RM 18



E.*coli* Load Reduction Relative to Loading Capacity – Johnson Creek at Luther Road



Activities To Facilitate Reduction Strategy

- Existing Incentive Programs
- Identify Funding for Additional Incentive Programs
- Public Education & Outreach
- Partnerships with Other Agencies (DEQ and Milwaukie)

Extending Sanitary Service is One Element in an Overall TMDL Implementation Strategy

Table 2: Willamette TMDL Implementation Plan Strategies to address E.Coli

Source	Strategy
1.Stormwater runoff	a. Develop Watershed Action Plans (WAPs)
	b. Stormwater regulations
	c. Industrial/ Commercial Stormwater Program
	d. Water quality monitoring
2.Failing septic systems	a. Septic system management
	b. Public involvement and education
	c. Septic System Replacement
3.Pet waste	a. Pet waste management and Public involvement and education
4.Dead animals	a. Dead animal management
5.Illegal dumping of solid waste	a. Illegal dumping management and public education and involvement
6.Illicit discharges and spills	a. Spill response and IDDE

Summary & Conclusions

- Potential to Significantly Reduce *E.coli* Load in Johnson Creek and the Willamette River
- Include this Approach in Overall TMDL Implementation Plan
- Continue to Provide and Identify Opportunities for Incentive Programs
- Identify opportunities to integrate WES sanitary and surfacewater program activities to meet regulatory requirements.

Water Environment Services Beyond clean water.

Questions?

Water Environment Services Beyond clean water.