Today’s Outline

- Item 1 – Review Alternative Management Measures
  - Objective: Identify appropriate management measures
  - General description of alternatives
  - LUNCH
- Item 2 – Framework for Alternatives Analysis
  - Evaluation Criteria
  - Ranking system
  - Done
- Item 3 - Site-specific example evaluating alternatives
  - Use evaluation criteria
  - Use a ranking system
  - Take steps to identify management measures
  - Example: Rolling Hills Shores and Oak Trail Shores
- Next steps

DONE
Watershed Protection Plan Focus Areas

Site-specific Evaluation of Management Measures
SITES

- Rolling Hills Shores
- Oak Trail Shores
- Long Creek
- Sky Harbor
- Port Ridglea East
- Indian Harbor
- Nassau Bay II

DISCUSSION TODAY

ADDITIONAL DISCUSSION

Site-specific Evaluation of Management Measures:

Rolling Hills Shores
Rolling Hills Shores

Most likely Potential Sources = Septic, Cattle, Dogs

On-site Sewage Facilities (OSSF)
Replacement

Considerations:

- Soil Suitability
  - Depth to Bed Rock
  - Minimum Depth to Restrictive Layer

- Applicable treatment methods
  30 TAC §285.91 Table 13
  - Septic or Aerobic Pretreatment
  - Spray Distribution, Drip Emitters, Leaching Chambers, limited conventional systems
On-site Sewage Facilities (OSSF) Replacement

Calculations:

- Estimate required area for disposal
  (30 TAC §285)
  - Design Discharge 240 gpd
  - Conventional Drainfield on Sand (0.38 gpd/ft²) to Sandy Clay (0.20 gpd/ft²) [Q/R]
    - 631 ft² to 1200 ft²
  - Spray Irrigation on Clay (Application rate 0.064 gpd/ft²) [1.6Q/R]
    - 3750 ft²
  - Drip Emitter (Irrigation) (0.2 gpd/ft²) [Q/R]
    - 1200 ft²
  - Leaching Chamber (0.2 gpd/ft²) [Q/R]
    - 1200 ft², some reduction allowed for water saving devices

Rolling Hills Shores Subdivision
On-site Sewage Facilities (Septic)

Considerations:

- Avg. lot size on cove < 6,000 ft²
- Soil Suitability
  - Depth to Bed Rock
  - Minimum Depth to Restrictive Layer
  - Soil Type
- Applicable treatment methods
  30 TAC §285.91 Table 13
Rolling Hills Shores Subdivision
On-site Wastewater Treatment Systems (Septic)

- Failing systems need to be replaced to meet current standards
  - Along cove and lake
    - Not feasible for residences in floodplain
  - Holding Tanks are only allowed where other disposal methods are not feasible
    - Annualized Cost Index = 0.32
  - Remaining lots within the subdivision, on top of hill
    - conventional systems may be appropriate for some sites
    - ET bed or Spray Application
  - Percent reduction = 46%
  - 25 year life cycle

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<th>System</th>
<th>Capital</th>
<th>O&amp;M</th>
<th>Annualized Cost Index</th>
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<td>Avg O&amp;M</td>
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<tr>
<td>Spray Dist. w/ Septic or Aerobic</td>
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Rolling Hills Shores Subdivision
Local Centralized Wastewater Treatment – Floodplain Only

Low Pressure System + Package WWTP Plant

- 103 residences in floodplain
  (103 grinder pump units)
- Avg. lot size: 0.1 acres
- Volume treated 0.031MGD
- WWTP to discharge into lake
- 25 year life cycle
- Potential load reduction = 62%
- EAC Index = 0.31
Rolling Hills Shores Subdivision
Local Centralized Wastewater Treatment – Whole, LP

Low Pressure System + Local Package WWTP Plant

- Lot sizes: 0.03 to 5.6 acres
- 299 grinder pumps (connections)
  - Along Cove:
    - 103 floodplain residences
  - Uphill of Cove: 196 lots
- Volume Treated 0.09 MGD
- WWTP discharge to lake
- 25 year life cycle
- Potential load reduction = 62%
- EAC Index = 0.3

Rolling Hills Shores Subdivision
Local Centralized Wastewater Treatment – Whole, Mixed

Mixed Collection System + Local WWTP Package Plant

- Low Pressure collection
  - 288 lots (grinder pumps)
    - 185 Uphill lots
    - 103 Floodplain residences
- Gravity collection
  - 11 lots
- 299 connections
- Volume Treated 0.09 MGD
- WWTP discharge into Lake
- 25 year life cycle
- Potential load reduction = 62%
- EAC Index = 0.32
Rolling Hills Shores Subdivision
Cove Dynamics: Dredge/Fill

1 - Fill Cove

- 4’ fill depth: 223,574 cy
- Fill & compaction
- Haul fill to site
- 299 lots/residences in subdivision
- 100 year life cycle
- Potential concentration reduction
  - Displaces load to land surface, still available for runoff flush to canal downstream
- EAC Index = 0.3

Rolling Hills Shores Subdivision
Cove Dynamics: Dredge/Fill

2 - Partial Fill

- 4’ fill depth: 187,800 cy
- Fill & compaction
- Haul fill to site
- 299 lots/residences in subdivision
- 75 year life cycle
- Change in Concentration = 0%
  - Increased concentration from direct (septic) discharge b/c reduced volume of water results
    - Load source must be reduced for reduced concentration in this alternative
  - Decreased concentration from flushing of NPS loads
- EAC Index = 0.25
Rolling Hills Shores Subdivision
Cove Dynamics: Dredge/Fill

3 – Dredge

- 3' depth, 20’ width, 1190 ft length
- Remove 2,650 cy
- Haul fill from site
- Purchase 1 acre spoil site
- 299 lots/residences in subdivision
- 5 year life cycle
- Percent concentration reduction = 4%
  - Greater reduction if direct discharge source reduced
- EAC Index = 1.0

Rolling Hills Shores Subdivision
Cove Dynamics: Dredge/Fill

4- Dredge & Partial Fill

Dredge
- 3’ depth, 20’ wide channel
- Remove 2,650 cy
- Haul fill from site
- Purchase 1 acre spoil site

Partial Fill
- 4’ fill depth
- Fill 187,800 cy
- Fill & Compaction
- Haul to site

299 lots/residences in subdivision
10 year life cycle
Net Concentration Change = 0%
EAC Index = 0.73
Rolling Hills Shores Subdivision
Cove Dynamics: Dredge/Fill

Partial Fill, Dredge and Additional Outlet

Dredge
- 3’ depth, 20’ wide channel
- Remove 2,650 cy
- Haul from site
- Purchase 1 acre spoil site

Partial Fill
- 4’ fill depth
- Fill 187,800 cy
- Haul to site

Additional Outlet
- Excavation 1,111 cy
- Culvert
- Road Removal and Repair
- Land Acquisition

299 lots/residences in subdivision
10 year life cycle
Percent concentration reduction = 86%
EAC Index = 0.76

Rolling Hills Shores Subdivision
Property Buy Out in Floodplain

- Purchase 213 lots within the floodplain
- 100 year life cycle
- Concentration Reduction = 62%
- EAC Index = 0.15
Rolling Hills Shores Subdivision
Vegetative Filter Strips

- Average Life Span 10 years
- 50 ft long x 120 ft wide
- Place north of subdivision across drainage path
- Cost
  - Capital cost minimal construction/grading, seeding
  - O&M cost mowing and general cleanup
  - 10 year life cycle
  - 299 lots/residences in subdivision
  - Annualized cost index = 0.02
- 5.1% Pollutant Removal
  - 67% Trapping Efficiency for Sediment
  - ~50% of bacteria from trapped sediment removed
  - ~40% of watershed runoff treated

Rolling Hills Shores & Oak Trail Shores
Regional (Centralized) Wastewater Treatment-Aggregation

- 2451 lots served
- 5.2 mi interceptor
  - Layout represents broad location potential for infrastructure
- Assumed 2 lift stations
- Volume treated 0.74 MGD
- 25 year life cycle
- IN-PROGRESS – City Of Granbury to provide info on proposed plant and collector location
Rolling Hills Shores to Oak Trail Shores
Regional (Centralized) Wastewater Treatment-Aggregation

- 5,961 lots served
- 5.2 mi interceptor
  - Layout represents broad location potential for infrastructure
- Assumed 4 lift stations
- Volume treated 1.79 MGD
- 25 year life cycle
- Potential load reduction
  - RHS = 62%
  - OTS = 54%
- EAC Index = 0.19

Example of Ranking System for Alternatives Evaluation

### Stakeholder Input

#### Quantitative

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<th>Factor Weight</th>
<th>Factor</th>
<th>Rating Scale</th>
<th>Score</th>
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<td>Watershed % Reduction</td>
<td>0%</td>
<td>1-20%</td>
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<tr>
<td>1</td>
<td>Time to Implement</td>
<td>&gt;15 years</td>
<td>10-15 years</td>
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<td>1</td>
<td>Annual Cost Index</td>
<td>0.65–1.0</td>
<td>0.35-0.64</td>
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#### Qualitative

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<tr>
<th>Feasibility (Constraints/Considerations)</th>
<th>Not Feasible Alternative</th>
<th>Severe Constraints</th>
<th>Significant Constraints</th>
<th>Some Constraints</th>
<th>Few Constraints</th>
<th>Negligible Constraints</th>
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<tr>
<td>Funding</td>
<td>None available</td>
<td>Limited Funding</td>
<td>Partial Funding</td>
<td>Some Funding</td>
<td>Significant Funding Available</td>
<td>Full Funding</td>
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Total Score: 9
### Rolling Hills Shores Subdivision Alternatives Ranking

<table>
<thead>
<tr>
<th>BMP Alternative</th>
<th>Watershed % Reduction</th>
<th>Time to Implement</th>
<th>Equivalent Annual Cost index</th>
<th>Score</th>
<th>Feasibility (Considerations)</th>
<th>Funding</th>
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<tbody>
<tr>
<td>Septic System Replacement along Cove</td>
<td>48%</td>
<td>3-4 yr</td>
<td>8</td>
<td>0.22</td>
<td>6</td>
<td>Future repairs, floodplain, limited to 10 holding tanks</td>
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<tr>
<td>Septic System Replacement Until</td>
<td>48%</td>
<td>3-4 yr</td>
<td>8</td>
<td>0.22</td>
<td>6</td>
<td>Future repairs</td>
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<tr>
<td>Local Centralized Wastewater Treatment - Independent</td>
<td>43%</td>
<td>4-5 yr</td>
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<td>0.19</td>
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<td>Regional Wastewater Treatment</td>
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<td>Property Buy-Out</td>
<td>62%</td>
<td>4-1-2 yr</td>
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<td>Public Opinion, Removal of Tanks</td>
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<td>Cove Dynamics:</td>
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<td>Fill</td>
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<td>0.25</td>
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<td>Partial Fill &amp; Dredge</td>
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<td>0.73</td>
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<td>Dredge, Partial Fill, Add Outlet</td>
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<td>0.76</td>
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**Site-specific development of Alternatives:**

**Oak Trail Shores**
Most likely Potential Sources = Septic, Dogs

Oak Trail Shores Subdivision
OWTS (Septic)

- 589 permits
- Avg. Lot
  - Section 1 ~14,000 ft²
  - Section 2 ~10,000 ft²
  - Section 3 ~ 10,000 ft²
- Replace Malfunctioning Systems

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<th>Section</th>
<th>Type of System</th>
<th>Equivalent Annual Cost Index</th>
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<td>conventional septic/leachfield</td>
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<tr>
<td>2</td>
<td>septic tanks with spray distribution or leach field</td>
<td>0.33</td>
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<tr>
<td>3</td>
<td>conventional septic/leachfield in NW septic tanks with spray distribution or leach field, aerobic tanks with drip emitters</td>
<td>0.23</td>
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- 25 year life cycle
- % Reduction = 41%
Oak Trail Shores Subdivision
Centralized local wastewater treatment

Low Pressure System + Local WWTP Package Plant

- 2045 residential lots
  (2045 grinder pump units)
- Average Lot Size 0.2 acres
- 1 lift station
- Volume treated 0.614 MGD
- WWTP discharge into lake
- 25 year life cycle
- Potential load reduction = 54%
- EAC Index = 0.25

Oak Trail Shores Subdivision
Centralized local wastewater treatment

Mixed System + Local WWTP Package Plant

- Low Pressure
  - 875 lots
- Gravity
  - 1170 lots
- 1 lift station
- Volume treated 0.614 MGD
- WWTP discharge into lake
- 25 year life cycle
- Potential load reduction = 54%
- EAC Index = 0.16
Oak Trail Shores Subdivision
Cove Dynamics

1-Fill Cove

- 3-5’ fill depth: 20,100 cy
- Fill & compaction
- Haul soil to site
- 2045 lots in subdivision
- 100 year life cycle
- Potential concentration reduction = %
- EAC Index = 0.01

Oak Trail Shores Subdivision
Cove Dynamics

2- Partial Fill of Cove

- 3-5’ fill depth: 7,780 cy
- Haul to Site
- Fill & Compaction
- 2045 lots in subdivision
- 75 year life cycle
- Percent concentration reduction = 0%
- EAC Index = 0.01
3- Dredge

- Dredge 3’ depth, 20’ width: 6,260 cy
- Haul up to 10 miles
- Purchase 1 acre spoil site
- 2045 lots in subdivision
- 5 year life cycle
- Potential concentration reduction = 30%
- EAC Index = 0.99

4 - Dredge and Additional Outlets

**Dredge**

- 3’ depth, 20’ width: 6,260 cy
- Haul
- Purchase 1 acre spoil site

**Outlets**

- Excavate 3155 cy
- Remove and Repair Roadway
- Culverts
- Land Acquisition and structure location

2045 lots in subdivision
10 year life cycle
Potential concentration reduction = 65%
EAC Index = 0.35
Oak Trail Shores Subdivision
Offsite Drainage Bypass

- Drainage ditch along east side of Greenbrook St routes runoff away from canal
- V-shaped channel: 2’ depth, 12.5’ top width, 3,933’ length
- Captures more frequent events (up to the 5-yr rainfall event)
- Excavation, drainage pipes under driveways, culvert pipes under Pecan Valley and Valley Ridge, revegetation
- 2045 lots in subdivision
- 50 year life cycle
- Potential concentration reduction = 51%
- EAC Index = 0.03

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Oak Trail Shores Subdivision
Alternatives Ranking

<table>
<thead>
<tr>
<th>BMP Alternative</th>
<th>Watershed % Reduction</th>
<th>Time to Implement</th>
<th>Equivalent Annual Cost Index</th>
<th>Score</th>
<th>Feasibility (Constraints/Considerations)</th>
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DRAFT - 2009-06-23
Alternatives Evaluation

Load Reduction Comparison

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<th>Pilot Program</th>
<th>Local Centralized Wastewater Treatment - Independent</th>
<th>Local Centralized Wastewater Treatment - Aggregate</th>
<th>Regional Wastewater Treatment</th>
<th>Core Drainage Dredge, Fill</th>
<th>Core Circulation Systems (Fountains, etc.)</th>
<th>Cell Treatment</th>
<th>End-Property Buy Out</th>
<th>Filter Strips for Livestock</th>
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# Time Comparison

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<th>Septic Maintenance Pump-out</th>
<th>Local Centralized Wastewater Treatment - Admission</th>
<th>Local Centralized Wastewater Treatment - Aggregation</th>
<th>Regional Wastewater Treatment</th>
<th>Core Dynamics Dredge, Fill</th>
<th>Drainage Re-route</th>
<th>Cove Circulation Systems (fountains, etc)</th>
<th>Catchment Basins</th>
<th>Property Buy-out</th>
<th>Filter Strips for Livestock</th>
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<td>Rolling Hills Shores</td>
<td>1 yr</td>
<td>4-5 yrs</td>
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<td>Long Creek</td>
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<td>4-5 yrs</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Nassau Bay II</td>
<td>1 yr</td>
<td>4-5 yrs</td>
<td>5 yrs</td>
<td>5-10 yrs</td>
<td>1 yr</td>
<td>3-5 yrs</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Waters Edge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5-10 yrs</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Indian Harbor</td>
<td>1 yr</td>
<td>4-5 yrs</td>
<td>5 yrs</td>
<td>5-10 yrs</td>
<td>1 yr</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Port Ridgea East</td>
<td>1 yr - 2 yrs</td>
<td>4-5 yrs</td>
<td>5 yrs</td>
<td>5-10 yrs</td>
<td>1 yr</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Blue Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5-10 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake-Wide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5-10 yrs</td>
<td></td>
<td></td>
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</tbody>
</table>

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# Cost Comparison

<table>
<thead>
<tr>
<th>Location</th>
<th>Conceptual Design Equivalent Annual Cost Index Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rolling Hills Shores (Uphill/Cove)</td>
<td>0.22, 0.32, 0.30, 0.19, 0.25 - 1.0, 0.15, 0.02</td>
</tr>
<tr>
<td>Long Creek</td>
<td>0.26, 0.28</td>
</tr>
<tr>
<td>Oak Trail Shores Section 1</td>
<td>0.17, 0.16, 0.19, 0.00-0.03, 0.03</td>
</tr>
<tr>
<td>Oak Trail Shores Section 2</td>
<td>0.33, 0.16, 0.19, 0.00-0.03, 0.03</td>
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<tr>
<td>Oak Trail Shores Section 3</td>
<td>0.23, 0.16, 0.19, 0.00-0.03, 0.03</td>
</tr>
<tr>
<td>Sky Harbor</td>
<td>0.26, 0.16, 0.11, 0.01, 0.10</td>
</tr>
<tr>
<td>Nassau Bay II</td>
<td>0.26, 0.28, 0.11, 0.01, 0.10</td>
</tr>
<tr>
<td>Waters Edge</td>
<td>0.24, 0.10</td>
</tr>
<tr>
<td>Port Ridgea East</td>
<td>0.45, 0.28, 0.14</td>
</tr>
<tr>
<td>Blue Water</td>
<td></td>
</tr>
<tr>
<td>Lake-Wide</td>
<td></td>
</tr>
</tbody>
</table>
Constraints

- Rolling Hills Shores
  - Topography, soils, floodplain
- Oak Trail Shores
  - Number of waterfront residences, compared to overall subdivision
- Sky Harbor
  - Topography, soils
  - Proximity of existing sewer service
- Port Ridglea
  - Existing lot size

Potential Funding Sources

- State-administered funding - Texas Water Development Board
  - CWSRF – Clean Water State Revolving Fund
  - EDAP – Economically Distressed Areas Program
- Federally-administered funding, Rural Development
  - EPA
  - USDA
- Self-financing
  - Bonds
  - Loans
### Alternatives Ranking
#### Rolling Hills Shores Subdivision

<table>
<thead>
<tr>
<th>BWP Alternative</th>
<th>Watershed % Reduction</th>
<th>Time to Implement</th>
<th>Equivalent Annual Cost Index</th>
<th>Score</th>
<th>Feasibility (Constraints/ Considerations)</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septic System Replacement Along Cove</td>
<td>48%</td>
<td>5-10 yrs</td>
<td>5</td>
<td>0.33</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Septic System Replacement Light</td>
<td>48%</td>
<td>5-10 yrs</td>
<td>5</td>
<td>0.33</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Local Centralized Wastewater Treatment - Independent</td>
<td>0%</td>
<td>4-5 yrs</td>
<td>3</td>
<td>0.30</td>
<td>2</td>
<td>Public Opinion, Removal of Tanks</td>
</tr>
<tr>
<td>Local Centralized Wastewater Treatment - Aggregates</td>
<td>82%</td>
<td>4-5 yrs</td>
<td>2</td>
<td>0.19</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Regional Wastewater Treatment</td>
<td>82%</td>
<td>4-10 yrs</td>
<td>1</td>
<td></td>
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<tr>
<td>Property Buy-Out</td>
<td>82%</td>
<td>4-10 yrs</td>
<td>4</td>
<td>0.15</td>
<td>4</td>
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</tr>
<tr>
<td>Cove Dynamics: Fill</td>
<td>0%</td>
<td>0-1 yr</td>
<td>2</td>
<td>0.30</td>
<td>2</td>
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</tr>
<tr>
<td>Partial Fill</td>
<td>0%</td>
<td>1-2 yrs</td>
<td>2</td>
<td>0.25</td>
<td>3</td>
<td>Does not address sources,</td>
</tr>
<tr>
<td>Dig Out</td>
<td>4%</td>
<td>7-10 yrs</td>
<td>4</td>
<td>1.00</td>
<td>0</td>
<td>Property Rights</td>
</tr>
<tr>
<td>Partial Fill &amp; Dig Out</td>
<td>0%</td>
<td>7-10 yrs</td>
<td>3</td>
<td>0.73</td>
<td>0</td>
<td>Property Rights</td>
</tr>
<tr>
<td>Dig Out, Partial Fill, Add Outlet</td>
<td>8%</td>
<td>5-10 yrs</td>
<td>2</td>
<td>0.79</td>
<td>0</td>
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<tr>
<td>Vegetative Filter Strips</td>
<td>5%</td>
<td>1-1 yr</td>
<td>5</td>
<td>0.02</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Next steps
Next Steps

- This is the hard part!
- Stakeholders:
  - Evaluate and rank alternative management measures for each area
  - Identify constraints
- Potential subcommittee groups?
- Reconvene to discuss and make recommendations

Questions or Comments?

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  - David Harkins
  - Kendra Riebschleager
  - Ashley Hanson
  - Chris Stewart