MEMORANDUM
Comfort Lake-Forest Lake Watershed District

To:       Board of Managers                     Date: 3/3/2020
From:     Mike Kinney                          Subject: Bone Lake Community Gravel Bed

Background/Discussion
At the upcoming board meeting, Tom Furey will be discussing the possibility of installing a community gravel bed in the Bone Lake area. Gravel beds enhance tree and shrub root growth by forcing the plant to work harder to obtain water. Consisting of bare root stock planted in an irrigated pile of gravel, gravel bed systems encourage an increase in fibrous root systems, allowing for an increased uptake of water and nutrients after planting. The more robust roots additionally serve to increase resistance to wind and water erosion, resulting in healthier trees and sturdier shorelines compared to traditional restoration plantings.

Bone Lake currently has the need for shoreline restorations following the Summer ’19 tornado, and trees taken from this proposed gravel bed would be well-suited for this purpose. Tom Furey proposes that a gravel bed of approximately 20’ by 20’ be constructed as it would be sufficient for planting ~180 saplings. The Bone Lake Apiary may be open to hosting this project. This installation would also require a watering system, preferably automated or semi-automated. Due to the high-infiltration design of the gravel bed, it will require daily watering to encourage root growth and ensure healthy saplings.

Funding for the gravel bed would be secured as a joint venture between the Bone Lake Association and the CLFLWD. Tree purchases could be funded by the organizations or by homeowners interested in participating in the program, and the planting effort would be a joint venture between some BLA / CLFLWD staff and volunteers / homeowners.

Recommended Action
Staff recommends that the District explore options to install a community gravel bed to improve shoreline restoration efforts in the Bone Lake area.

Proposed Motion: Manager __________________ moves to pursue a community gravel bed joint venture with the Bone Lake Association for the purposes of shoreline restoration on Bone Lake. Seconded by Manager __________________.

Attached: Gravel Bed Fact Sheet
Gravel Bed Fact Sheet

A gravel bed is an irrigated bed of gravel created to safely hold bare root stock for up to 6 months. Doing this dramatically increases fibrous root volume, which decreases transplant shock and increases long-term survivability of the plants while increasing resistance to erosion.

The figure below, from the University of Minnesota, demonstrates the effects 14 weeks of gravel bed growth has on plant root robustness. Large, dynamic root systems like those on the right of the figure would have natural benefits to plant health, while the increased root surface area would both hold the plant in place during high winds and retain soil during erosion events.

Figure 1: Comparison of root growth on Balsam Poplar and Red Maple trees before and after 14 weeks in the gravel bed.
Site Requirements:

Accessible – Irrigation is an essential component of a gravel bed due to the high rate of infiltration necessary to encourage root growth. When positioning a gravel bed, ensure that it has continuous and easy access to water.

Drainage requirements – Due to the high volume of water used, gravel bed locations should not be placed in low lying areas or areas where there is routinely standing water. Root growth will be inhibited by excess water.

Light and Wind – Light exposure is not a critical component for tree growth, but wind- and sun-exposed sites will require additional watering.

Gravel Types - A gravel depth of at least 15” is needed to ensure proper root growth. The University of Minnesota recommends 3/8” washed river gravel with up to 10% sand mix, although other media can be used including 3/4” washed gravel with 20% sand and a 90-10 Peastone – Sand mix.

Irrigation system - A gravel bed requires high amounts of irrigation to encourage root growth and prevent the bed from drying out. Due to the high volume and frequency required, an automated system such as a home-grade irrigation timer or soaker hoses are recommended to minimize required maintenance input. UMN recommends irrigation timers set to provide roughly 100 minutes of irrigation per day, with at least one interval during the night and one prior to sun-up.

Building Materials - Gravel beds can be built from a variety of materials, although the most cost-effective is a treated lumber bed. The table below describes the approximate amount of raw material that would go into constructing such a bed:

![Table of raw materials required for a given size of gravel bed.](image)
Project Scale – When constructing a bed it’s important to understand project goals. Depending on the available site space, number of trees to be planted, and species of plant being used different gravel bed sizes may be optimal. The table below contains a modest estimation of the number of trees that could be placed into gravel beds of varying size.

<table>
<thead>
<tr>
<th>Gravel Bed Size</th>
<th>Stem Diameter</th>
<th>0.5”-1”</th>
<th>1”-1.5”</th>
<th>1.5”-2”</th>
<th>2”-2.5”</th>
<th>2.5”-3”</th>
</tr>
</thead>
<tbody>
<tr>
<td>10’x20’</td>
<td></td>
<td>56</td>
<td>36</td>
<td>25</td>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td>10’x30’</td>
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<td>113</td>
<td>72</td>
<td>50</td>
<td>32</td>
<td>22</td>
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<td>10x40’</td>
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<td>169</td>
<td>108</td>
<td>75</td>
<td>48</td>
<td>33</td>
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<tr>
<td>10x50’</td>
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<td>226</td>
<td>144</td>
<td>100</td>
<td>64</td>
<td>44</td>
</tr>
<tr>
<td>10x60’</td>
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<td>282</td>
<td>181</td>
<td>125</td>
<td>80</td>
<td>56</td>
</tr>
<tr>
<td>Stem to Stem Spacing</td>
<td></td>
<td>16”</td>
<td>20”</td>
<td>24”</td>
<td>30”</td>
<td>36”</td>
</tr>
</tbody>
</table>

Figure 3: # of trees of a given stem diameter that can fit into a given size of gravel bed, with recommended spacing.

Figure 4: Examples of Completed Gravel Bed Projects.