23 October 2012

From: Dr. Jay Bell
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Re: Soil Morphological Investigation for Wilder Property: Proposed Frogtown Farm and Gardens Site

To whom it may concern:

I completed an investigation of soils on the Wilder Property on July 26th, 2012 using a series of approximately 15 backhoe pits excavated to a depth of 5 feet. The main purpose of the investigation was to determine the suitability of the soils on site for agricultural / horticultural production congruent with the planned uses of the property by the Frogtown community. My investigation revealed that a majority of the site was composed of fill material, including building rubble at depth, however the top 6-12 inches was composed of topsoil (dark, higher organic matter, loamy texture) material suitable for the growth of plants. In my opinion the soils should be able to support plant growth and the marginal increase that might occur through widespread topsoiling would not justify the expense.

This conclusion comes with two caveats. First, the surface soils are of sufficient depth, texture and organic matter content to serve as an adequate plant growth medium. Additionally, the soils are not overly compacted in any of the soil profiles that were observed. However, there are locations of old road beds where the soils do appear to be significantly compacted that should be avoided. It is assumed that the soils on this site would be tilled to a depth of 6-12 inches as is common practice. While a majority of the surface soils appear to be free of significant debris, some is still present and could pose a hazard to tillage operations as well as a small area that appears to be a concrete pad in the western part of the property. The site should be cleared of all surface debris prior to the first tillage operation and areas of existing asphalt clearly identified and avoided. Initial tillage will likely encounter debris such as bricks, conduit, plastic pipe and other materials. Equipment larger than typical garden tractors and implements should be used for the first several tillage operations and debris unearthed during the tillage operation should be removed from the site. Eventually the remaining debris in the surface soils should be removed in this manner and subsequent tillage could be accomplished with lighter equipment. Second, the topsoil in the south eastern corner in the vicinity of test pit 5 has been partially removed such that the topsoil is approximately 3 inches thick and plant growth is noticeably affected. There are two options for this area. First, an additional amount of topsoil from offsite could be added to bring to total depth up to at least 6 inches. Second, materials suitable to increase soil organic matter and fertility such as compost or manure could to incorporated to a depth of six inches

and cover crops planted for several years to improve soil productivity of this area. In general the topsoiling option will be the more expensive option.

The site investigation focused on the morphological and physical characteristics of the site and comprehensive evaluation of the fertility status of the soils were not performed. This investigation did confirm that the morphological and physical characteristics are suitable for urban agriculture and the next step would be a more in depth evaluation of the soil nutrient status. Most urban soils have a poor nutrient status and should be tested for nitrogen, phosphorus, potassium and pH. Initially, the soil should also be tested for a range of micronutrients to insure there are no deficiencies that need to be addressed when developing a soil management plan. While the soil physical characteristics are difficult and expensive to change, soil chemical properties can be adjusted fairly easily with a variety of soil amendments. In general, amendments such as manures and composts are highly advised and should be done in consultation with a soil scientist to insure the amendments are of high quality and are applied and incorporated in a proper fashion and in appropriate quantities. The planting of a cover crop including a legume such as clover or alfalfa for the first growing season is also highly recommended. The cover crop should be plowed into the soil to improve the organic matter and nutrient status of the soil prior to planting crops for the first time.

I have included a more extended summary and a detailed map of the site is currently being prepared.

Soil Physical and Morphological Evaluation

Wilder Property: Proposed Frogtown Farm and Gardens

Background:

The native soils on the site were mapped as Chetek sandy loams. Chetek soils are formed from glacial outwash and, as such, are composed of stratified sands and gravels. Chetek soils are somewhat excessively drained and are susceptible to droughty conditions due to poor water holding capacity. These soils are considered marginal for agricultural uses due to their high sand and gravel content. Due to the highly-disturbed nature of this site, the only location where the original soil was found was in the northwestern corner of the property in the vicinity of TP5 and J2. It appears that soil had been removed from this portion of the property for borrow material. So while the soils in this area appear undisturbed, it is likely that several feet of the original soil profile has been removed such that all that remains is C-horizon material from at least foot below the original surface. The remainder of the site is covered with at least 5 feet of highly-variable fill material of variable texture containing a diverse mixture of construction debris (bricks, concrete, conduit, wood, plastics, etc). The total depth of the fill material could not be determined since the soil pits were only dug to a depth of 5 feet.

Surface Soils:

The majority of plant roots for annual species typically grown in urban gardens are in the upper 12 inches. Therefore, it is the characteristics of this part of the soil profile that is of most concern when evaluating the soil for urban agriculture. A majority of the site was topsoiled with soil material that was probably different from the native soil that occurred on this site. The exact source of the topsoil material would be difficult to determine. The surface soil textures varied from loams to sandy loams, generally finer textured that would be expected from the native Chetek soils. In general, the surface soils were free of significant construction debris and would be expected to have water-holding capacities equal to better than the native soil. The depth of topsoil material ranged from 6-12 inches over most of the site. The exception is in the northwestern corner in the vicinity of TP5 and J2 where the topsoil depth was typically less than 3 inches.

Subsurface Soils:

The soils below 12 inches are exceptionally variable. The soil profiles observed ranged from having very little construction debris to a depth of 5 feet to a majority of the subsoil being comprised of building debris material. In several locations we severed what appeared to be electrical conduit, plastic irrigation pipe and wires. Chunks of asphalt, bricks, woody debris and other construction materials were

commonly found 2-3 feet from the surface. The majority of the soil profiles observed had sufficient soil-sized material in the subsurface soils to be able to support plant roots.

In general, the subsurface soil material is poorly suited to support the level of plant growth needed to support a viable urban farm. However, the debris was buried beneath suitable topsoil material for a majority of the soil profiles observed.

Soils in Vicinity of TP5 and J2

A large depression in evident in this area that appears to be where soil material was removed from the site. The vegetation is notably more sparse and of different species composition than the vegetation for the remainder of the site. As previously mentioned the subsoil in this area is the original sandy and gravelly outwash that would have been the parent material for the Chetek soils. The outwash material was overlain by a thin layer (approximately 3 inches) of sandy loam topsoil. This area has the thinnest topsoil depth on the entire site and, as such, would most likely not be as productive. There are two options that could be explored. First, an additional 6 inches of topsoil could be added to the surface to increase topsoil depth to a thickness more similar to the rest of the site. This would involve considerable expense for the acquisition, transportation and spreading of the topsoil. Second, soil amendments with high organic matter content such as manure or compost could be added and incorporated to a depth of 6 inches. This could increase the water-holding capacity and fertility of the surface soils and improve their productivity at less expense than hauling in additional topsoil. Additions of manure or compost would have to occur over several years and should be monitored by a soil scientist.

Soil Suitability for Urban Agriculture

Productive soils must have suitable physical characteristics as related to root penetration and water holding capacity and chemical characteristics as it relates to the fertility of the soil. Both of these will affect the ability to the soil to support macro and micro flora and fauna, which is also essential to successful urban agriculture.

Physical Characteristics:

With the exception of the northwest corner, the surface soils are of sufficient depth, texture and organic matter content to serve as an adequate plant growth medium. The soils are not overly compacted in any of the soil profiles that were observed. However, there are locations of old road beds where the soils do appear to be significantly compacted that should be avoided. It is assumed that the soils on this site would be tilled to a depth of 6-12 inches as is common practice. While a majority of the surface soils appear to be free of significant debris, some is still present and could pose a hazard to tillage operations. The site should be cleared of all surface debris prior to the first tillage operation and areas of existing asphalt clearly identified and avoided. Initial tillage will likely encounter debris such as bricks, conduit, plastic pipe and other materials. Equipment larger than typical garden tractors and

implements should be used for the first several tillage operations and debris unearthed during the tillage operation should be removed from the site. Eventually the remaining debris in the surface soils should be removed in this manner and subsequent tillage could be accomplished with lighter equipment.

Chemical Characteristics

The site investigation focused on the morphological and physical characteristics of the site and comprehensive evaluation of the fertility status of the soils were not performed. This investigation did confirm that the morphological and physical characteristics are suitable for urban agriculture and the next step would be a more in depth evaluation of the soil nutrient status. Most urban soils have a poor nutrient status and should be tested for nitrogen, phosphorus, potassium and pH. Initially, the soil should also be tested for a range of micronutrients to insure there are no deficiencies that need to be addressed when developing a soil management plan. While the soil physical characteristics are difficult and expensive to change, soil chemical properties can be adjusted fairly easily with a variety of soil amendments. In general, amendments such as manures and composts are highly advised and should be done in consultation with a soil scientist to insure the amendments are of high quality and are applied and incorporated in a proper fashion and in appropriate quantities. The planting of a cover crop including a legume such as clover or alfalfa for the first growing season is also highly recommended. The cover crop should be plowed into the soil to improve the organic matter and nutrient status of the soil prior to planting crops for the first time.

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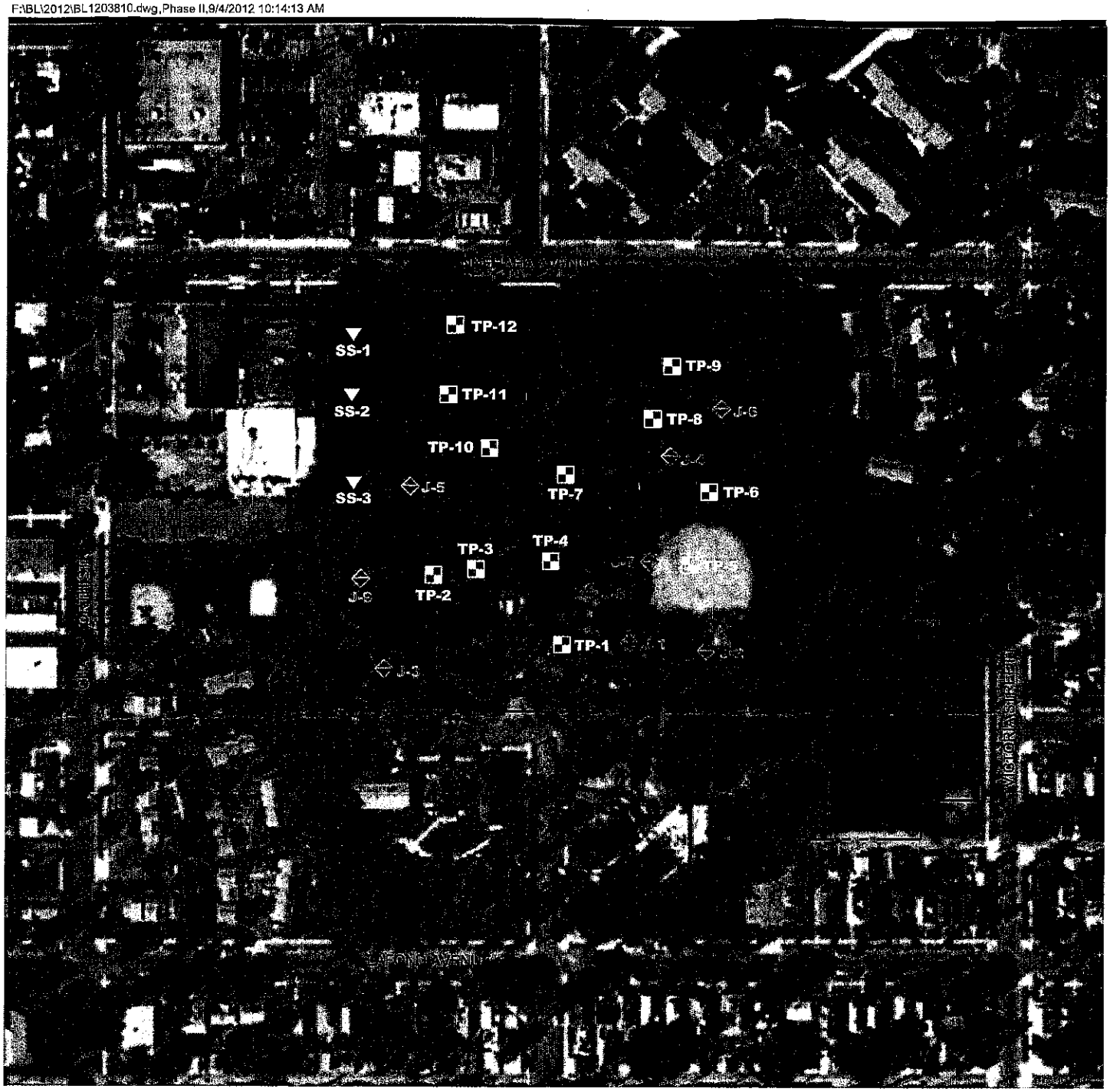

TEST PIT LOCATION

TEST PIT LOCATION (U OF M)

SOIL SAMPLE LOCATION

100' 0 200'

SCALE: 1"= 200'

Sheet: of

Fig:

Project No:	BL1203810A
Drawing No:	BL1203810
Scale:	1"= 200'
Drawn By:	JAG
Date Drawn:	7/25/12
Checked By:	MMH
Last Modified:	9/4/12

TEST PIT AND SOIL SAMPLE LOCATION SKETCH
PHASE II ENVIRONMENTAL SITE ASSESSMENT
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ST. PAUL, MINNESOTA

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