Final Report

Small Watershed Assessment and Action Plan (SWAAP)

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Executive Summary

The Small Watershed Assessment and Action Plan Project (SWAAP) report assesses, current on-the-ground conditions and detailed geospatial data assessments that provides recommended watershed protection and restoration projects. This information can be used by local stakeholders to improve existing water quality problems. To realize improvements in water quality, programmatic project recommendations must be transitioned from the planning phase, to an implemented project.

This summary identifies the efforts to transition watershed based programmatic and/or site-specific action plan recommended projects identified in the Bull Creek-Bull's Brook Watershed-Based Plan (2008) and the Buffalo Creek Watershed-Based Plan (2016) to implementation. The SWAAP presents implementable recommendations with conceptual project design, supported with project definition, probable cost and purported water quality improvement benefits for stakeholders to implement or secure future funding for project implementation. Experience confirms that if municipalities, residents, and other watershed stakeholders are left to their own devices to conduct this additional work, few of the ideas and concepts presented in a watershed-based plan will be turned into reality and the potential of the watershed-based planning process to reduce the impacts of nonpoint source pollution will not be fully realized.

Two locations with the Des Plaines River Watershed (HUC 8: 07120004) were assessed as a basis of this report. The locations assessed in detail within this SWAAP report, include areas in and around Loch Lomond (AUID:IL_RGU) in Mundelein, IL and Buffalo Creek (AUID: IL_GST) in Long Grove, IL.

The Loch Lomond SWAAP assessment, targets a study area of 469 acres, within a drainage area of 2.02 square miles for Bull Creek (AUID: IL_GV04). The SWAAP is within the Bull Creek-Des Plaines River HUC 10: 0712000403, and Loch Lomond lake is the largest waterbody in the study area (AUID: IL_RGU). The SWAAP area of Loch Lomond has previously been identified with site-specific project recommendations within the Bull Creek- Bull's Brook Watershed-Based Plan (2008) and will have additional site-specific project recommendations identified within the Des Plaines River Watershed-Based Plan (2018) as part of SMC subwatershed management unit (SMU BC019).

The Buffalo Creek SWAAP assessment, targets a study area of 161 acres, within a drainage area of 9.70 square miles. There are 28.5 stream miles upstream of the Buffalo Creek SWAAP, and it is located within the Willow Creek-Des Plaines River HUC 10: 0712000405. Buffalo Creek is the main stream corridor in the study area (AUID: IL_GST). The SWAAP area of Buffalo Creek site has previously been identified with site-specific project recommendations within the Buffalo Creek Watershed-Based Plan (2016) will have additional site-specific project recommendations identified within the Des Plaines River Watershed-Based Plan (2018) as part of SMC SMU BF025.

The determination to assesses Loch Lomond and Buffalo Creek as recommended Small Watershed Assessment and Action Plan Project study areas transpired from early watershed analyses that sought locations that were within small watersheds less than 10 sq. mi. and currently have established stakeholder groups capable of implementing SWAAP project recommendations. The

SWAAP locations of Loch Lomond and Buffalo Creek have well documented water quality issues (i.e. Bull Creek- Bull's Brook Watershed-Based Plan (2008), Buffalo Creek Watershed-Based Plan (2016), Des Plaines/ Higgens Creek TMDL (2013), Lake County Lake Reports) and passionate and established stakeholder groups that have pursued smaller water quality improvement projects (i.e. native plant installation, rain garden BMP installation, shoreline stabilization) and ongoing educational programmatic outreach to the community (phosphorus reduction/banning, lake water quality educations, lakeshed management plans, project lead for watershed plan adoption).

Recommendations for water quality improvement projects is a multi-step process of office data assessments and then authenticated with field verification. The process begins with desktop geospatial analyses based on the best available data. The field reconnaissance verifies whether the field condition validates the desktop analysis. Validated data ensures accuracy of projects recommendations and data, supplementing stakeholders with the resources to implement projects. The SWAAP assessment includes program and projects to improve the health of the watershed and provide stakeholders with the resources to solicit project and funding partners to continue the protection and restoration of the Des Plaines River Watershed.

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1. Introduction

1.1 Background

The development of a watershed-based plan (WBP) is a key step in efforts to protect and restore rivers and streams from the impacts of nonpoint source pollution. WBPs provide an analysis of existing watershed conditions and water quality problems and outline site improvement and restoration opportunities for addressing those problems, with the goal being the long-term protection and restoration of receiving waters so they can meet state water quality standards.

To realize improvements in water quality, WBP project recommendations must be transitioned from the planning phase, to implemented projects. Project implementation is neither simple nor straightforward, as, at the end of the watershed-based planning process stakeholders are typically left with a variety of project options to promote watershed protection and restoration. Many stakeholders see WBP recommendations as unachievable with little guidance on how to successfully transition the project recommendations into reality.

The Small Watershed Assessment and Action Plan Project (SWAAP) process seeks to reduce the perception that WBP projects are unachievable, by providing recommended project details, decisions, and objectives for stakeholder project implementation programs. For a project to enter implementation stage, stakeholders must be able to transition the ideas and concepts presented in a WBP into a defined action. WBP recommendations can vary on the level of technical input needed to transition a WBP recommendations to an implemented project. Defined actions can help stakeholders decide if projects can be accomplished by volunteers or contracted services. SWAAP recommendations provide a detailed assessment of the conditions in the study area at a more “local” scale to further engage stakeholder groups. The detailed assessments presented in this SWAAP are implementable recommendations.

Resources exist for stakeholders to assess their watersheds, such as the Unified Subwatershed and Site Reconnaissance (USSR) Manual developed by the Center for Watershed Protection (2004). The manual provides direction on determining actions to improve water quality but determining project specific recommendation may not be readily noticeable by inexperienced investigators. This understanding can rarely be attained without experience, including detailed on-the-ground assessment work, investigational tools or resources for drainage analysis, project design capability, and project implementation background that extends beyond the scope of work included in the typical watershed-based planning process. Experience confirms that if municipalities, residents, and other watershed stakeholders are left to their own devices to conduct this additional work, few of the ideas and concepts presented in a WBP will be turned into reality and the potential of the watershed-based planning process to reduce the impacts of nonpoint source pollution will not be fully realized.

1.2 Purpose

The purpose of the Small Watershed Assessment and Action Planning process is to assess, in detail, current on-the-ground conditions as they relate to overall local catchment drainage patterns and the current conditions influence on water quality. The assessments detail,

potential watershed protection and restoration practices that can be used to address existing water quality problems (e.g., surface water impairments) and Total Maximum Daily Load (TMDL) load allocations.

The SWAAP process further expounds upon programmatic actions from the WBP with detailed information that includes site specific projects with a conceptual design and a probable cost estimate. Since this process yields more detailed information than is feasible within the watershed-based planning process, this process can include specific detail on actions that provide significant contributions to water quality problems and/or provide significant opportunities for project implementation with a phased priority of necessary projects implementation.

The primary goal is to provide local stakeholders with a more detailed guide of the tasks needing to be completed and a budgetary target to implement watershed protection and restoration projects. These steps will increase the likelihood for real improvements in water quality.

1.3 Relationship to Watershed-Based Plan

A Small Watershed Assessment and Action Plan provides additional information on existing watershed conditions and potential watershed protection and restoration projects, which will help: (1) address existing goals, objectives, and recommendations outlined in the watershed-based plan based on site specific field verified solutions; (2) further engage municipalities, homeowners, and other watershed stakeholders in the implementation of many of the ideas and concepts presented in the watershed-based plan with succinct project directives; (3) provide watershed stakeholders with critical data and information required to secure further technical assistance and obtain funding to support the implementation of watershed protection and restoration programs and projects; and, (4) further advance local efforts to protect and restore local lakes, streams, and wetlands and address the goals of the Clean Water Act.

1.4 Elements of the Small Watershed Assessment and Action Planning Process

The Small Watershed Assessment and Action Planning process includes: a review of conditions within the selected study area, based on the contents of the associated watershed-based plan and other relevant information (e.g., GIS data), including detailed, on-the-ground assessment work in order to present a detailed characterization of the study area. The detailed assessment presents stakeholders valuable resources and information on their defined small watershed. The SWAAP assessment bolsters stakeholder awareness of water quality impacts and next steps to achieve improvement goals for progressing water quality improvements. Preliminary concept plans for stream and stream corridor restoration practices, lake and lake shoreline restoration practices, and upland protection and restoration practices are presented in following, with detailed guidance on the implementation of watershed protection and restoration projects and strategies that can help meet the watershed management goals established in the WBP.

Small Watershed Assessment and Action Planning actions include the following:

- Define the study area (define and refine boundaries of the study area)

- Review conditions within the study area based on the contents of the existing watershed-based plan and other relevant information (e.g., Lake Co. Lakes Management Unit Lake Reports, GIS data)
- Geospatial desktop assessment
- Define field assessment strategy
- Conduct field assessment work
- Develop inventory of stream and stream corridor restoration opportunities
- Develop inventory of lake and lake shoreline opportunities
- Develop inventory of upland area restoration opportunities
- Engage stakeholders
- Prepare an action plan based on the results of the desktop and field assessments

2. Small Watershed Assessment Loch Lomond Study Area

2.1 Summary of Loch Lomond Study Area Desktop Assessment & Results

The information provided within this section, will characterize the existing conditions within the Loch Lomond study area (SWAAP-LL). The characterization of current and future water quality impacts as connected to physiographic and/or anthropogenic factors will be assessed to aid in developing future water quality improvement projects. The project recommendations aim to reduce or mitigate stormwater runoff rates, volumes, and pollutant loads and/or improve the condition of receiving waters within the SWAAP-LL.

In this section, existing watershed-based plans and other relevant information, including geographic information system (GIS) data will be described on its function and use in determining project recommendations. The defined data analysis will be utilized in conjunction with field observations to identify specific project recommendations for specific locations with the small watershed study areas.

Small Watershed Study Area Delineation

To determine how water enters the receiving waters within the SWAAP-LL, the local drainage pathways must be identified. Understanding the impacts of small watersheds, is a key first step in determining how a SWAAP-LL will benefit overall water quality within the Des Plaines River Watershed. The SWAAP-LL is located within the Bull Creek-Des Plaines River HUC 12: 071200040302. Lake Loch Lomond is the largest waterbody in the study area (Assessment Unit ID: IL_RGU), (Figure 1).

SWAAP-LL boundaries were delineated via the Arc Hydro GIS modeling tools for Esri ArcMap software to define smaller drainage areas within the larger Des Plaines River watershed. Arc Hydro is a set of models and tools that operate within ArcMap to support geospatial and temporal data analyses specifically to delineate and characterize watersheds in raster and vector formats, define and analyze hydro geometric networks, manage time series data, and configure and export data to numerical models[1].

The Arc Hydro GIS tools analyzed areas in groupings of approximately 500-acres. Storm sewer network[2] data was incorporated into the Arc Hydro model to further refine the small watershed boundaries and more accurately reflect how and where stormwater runoff is impacting the SWAAP-LL area. Refining the small watershed drainage area based on all available data more accurately represents the physiographic and/or anthropogenic factors impact the BMPs selected for water quality improvement projects. The SWAAP-LL areas are based on more detailed analyses of the existing topography then what is used to delineate a subwatershed management unit (SMU) in the Des Plaines River Watershed-Based Plan.

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[1] Arc Hydro Website, http://resources.arcgis.com/en/communities/hydro/01vn0000000s000000.htm.

[2] Data provided by: Lake County Dept. of Transportation (culvert data); GIS Consortium (stormsewer network data); The Village of Mundelein (stormsewer network data); The Village of Long Grove (stormsewer network data).

The SWAAP-LL study area is 469 acres (Figure 2), within a drainage area of 1289.90 acres (2.02 square miles), which is located within SMC SMU BC019[3].

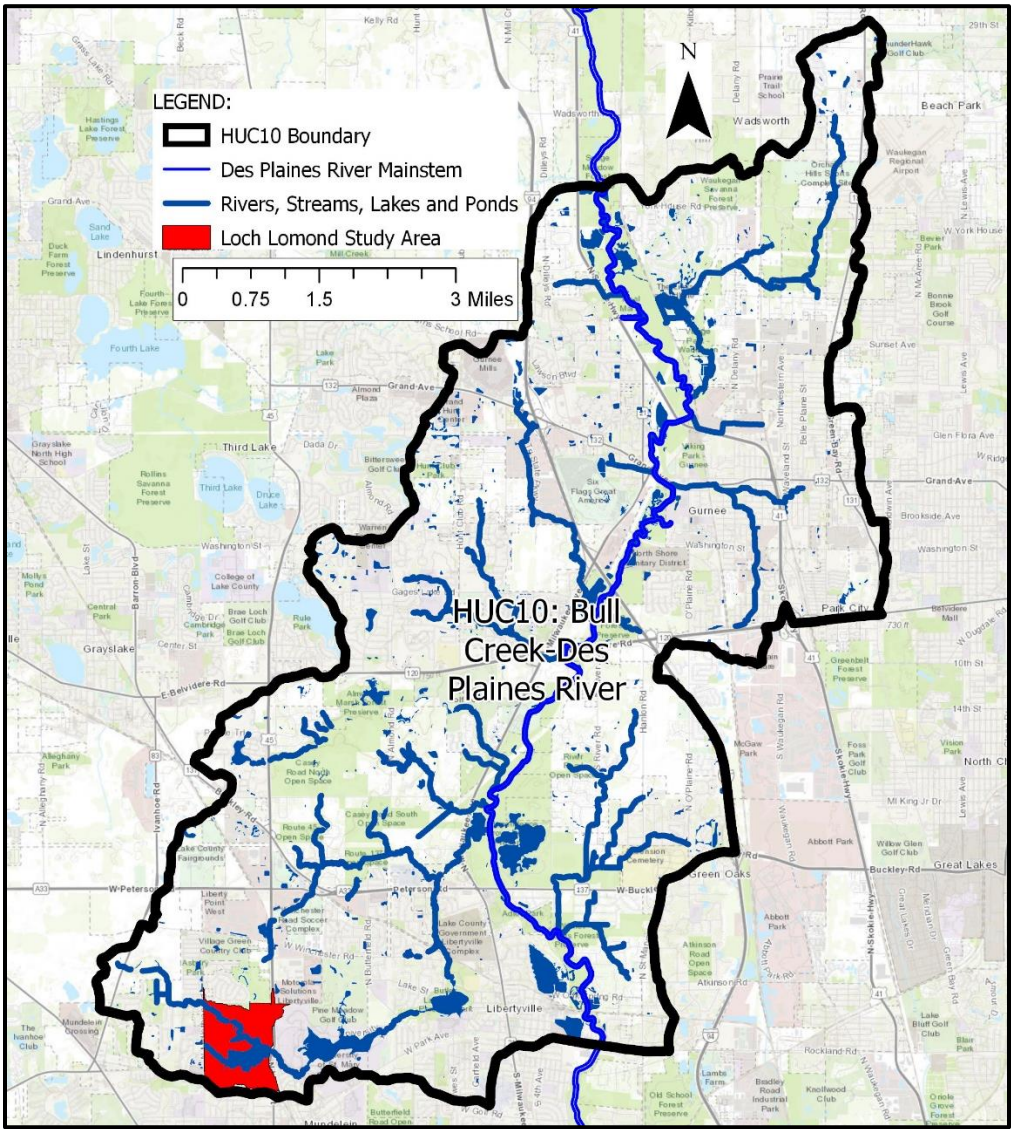


Figure 1:Loch Lomond SWAAP-LL HUC 10 Reference

Small Watershed Drainage Delineation and Hydrology

Delineating the natural surface drainage and engineered subsurface drainage networks within the small watersheds, allows for a better comprehension of how and where water enters a lake/pond or linear waterbody. Understanding the movement of water, including how much land is contributing water runoff, where it flows, and the available storage areas for runoff is essential to determine project opportunities for water quality improvement.

[3] Lake County Stormwater Commission. Des Plaines River Watershed-Based Plan, 2018.

Natural drainage pathways have been impacted by damming, redirection, channelization, culvert headwalls, and urbanization. Loch Lomond was a natural depression prior to the late 1950s. The natural depression was dammed in 1955 but did not become a lake until the 1960s, as the surrounding area converted to urbanized land functions. Future drainage concerns into Loch Lomond (AUID: IL_RGU) include continued conversion of agricultural lands into various urban land uses and a proposed multi-lane highway (IL Route 53 road extension) approximately 1,400 linear (ln.) feet (ft.) West of the SWAAP-LL Eastern boundary (Figure 2).

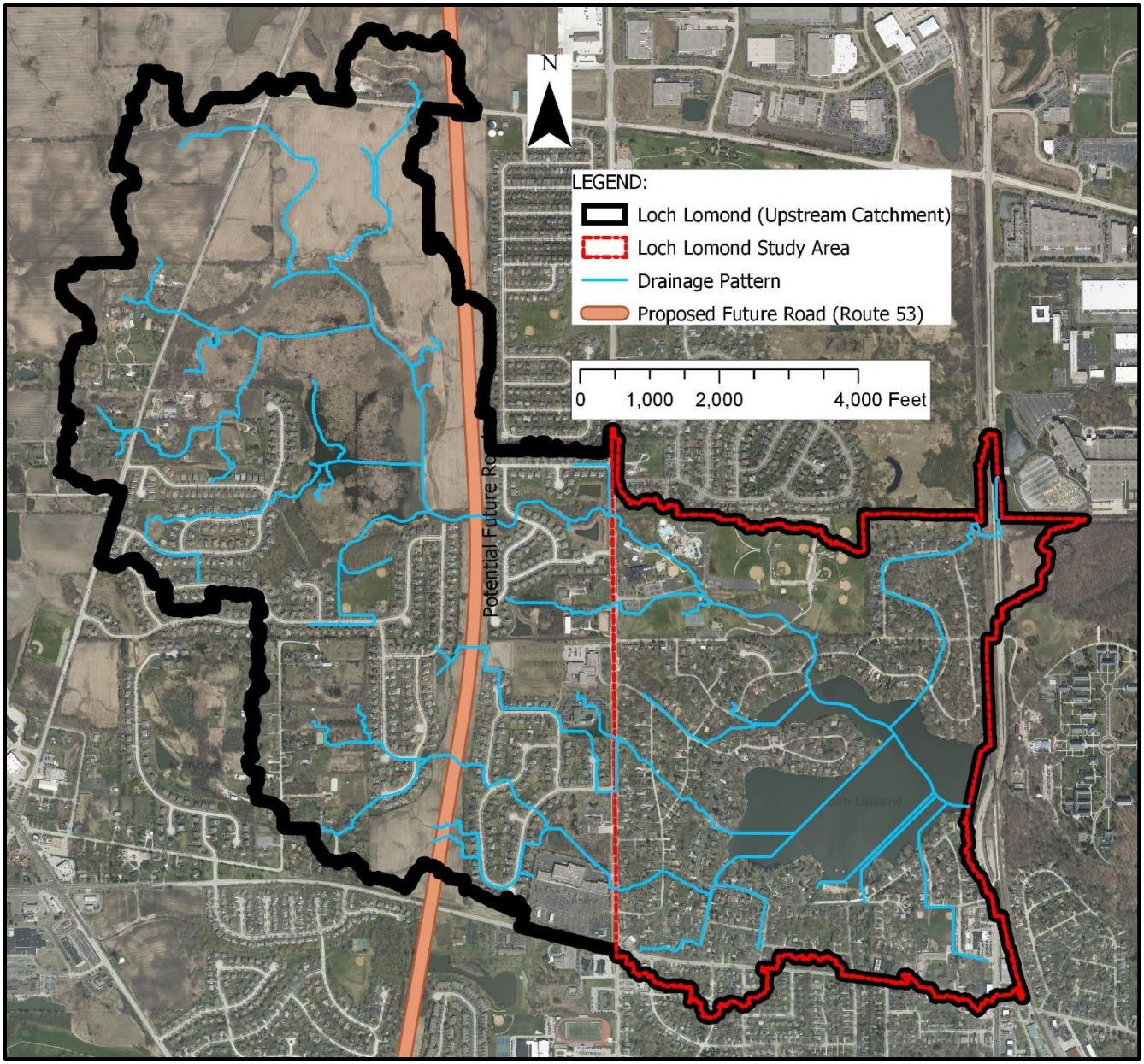
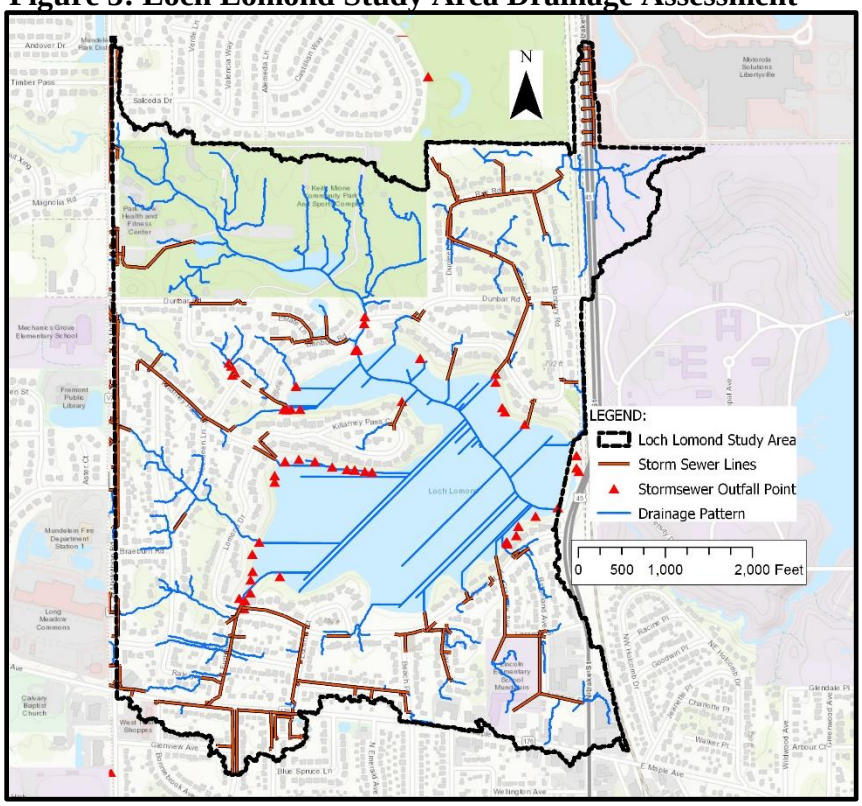


Figure 2: Loch Lomond Drainage Area Assessment

Figure 3: Loch Lomond Study Area Drainage Assessment



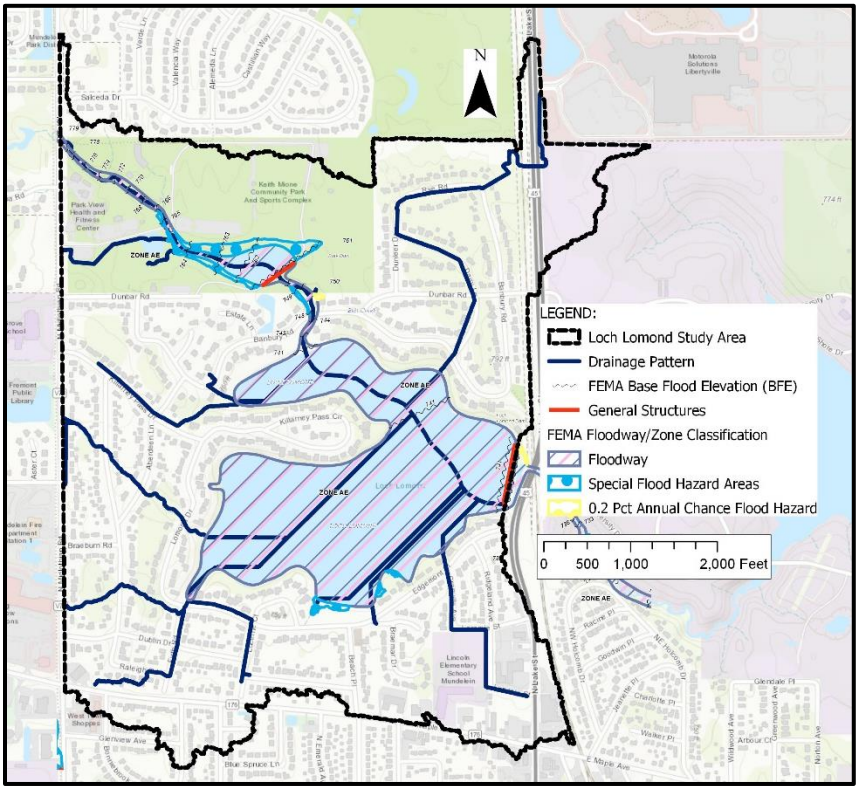
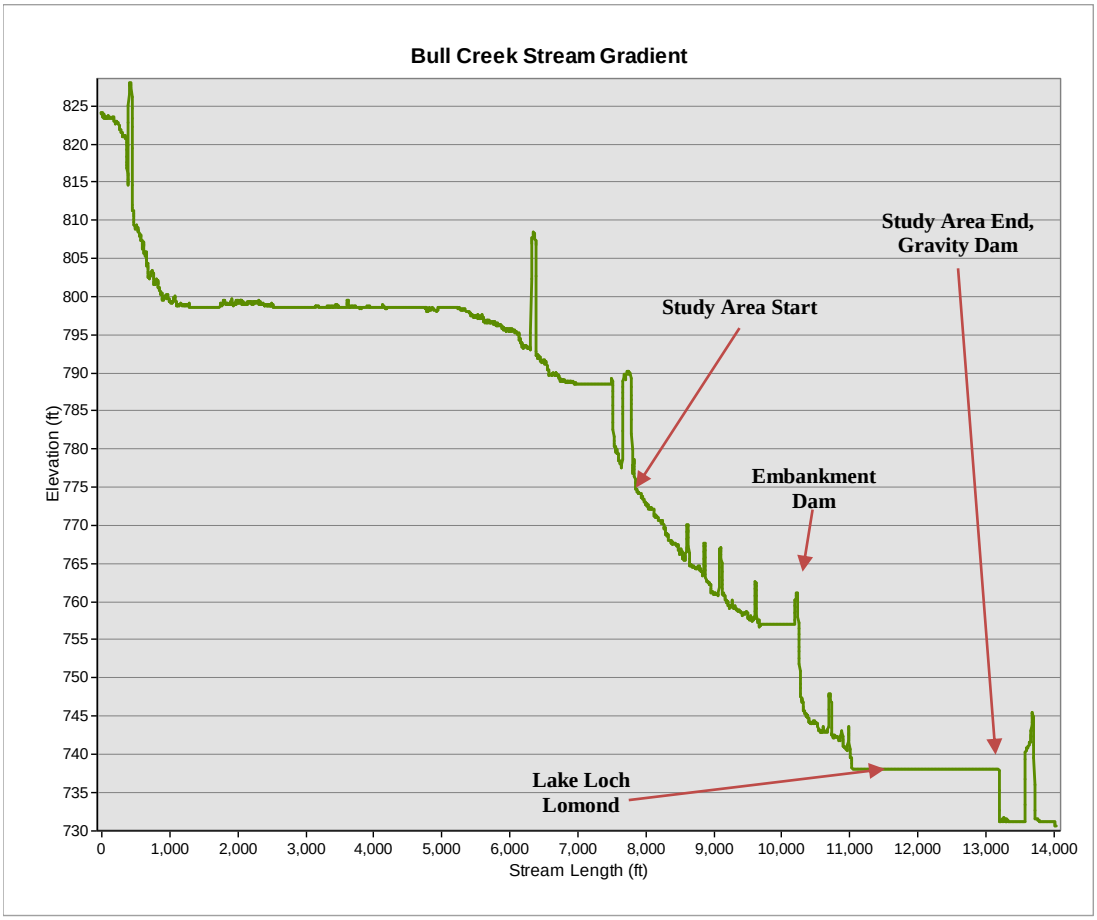


Figure 4: Loch Lomond Flood Hazard Zone Assessment

Figure 5: Bull Creek Gradient and Loch Lomond Study Area Drainage Area



The gradient of Bull Creek from West to East through Loch Lomond indicates that the area does not flood based on FEMA data (Figure 4), therefore there is a low probability of flooding to impact buildings and/or structures. Drainage enters the lake readily through multiple drainage pathways, but primarily through Bull Creek. The observed spikes in the stream gradient are related to road/bridge decks not removed in the development of the Lake County digital terrain model (DTM) dataset, with the exception on two dams identified in Figure 5. Dam structures indicate pooling on the upstream side of the structure as indicated by the location of the floodway and special flood hazard areas (1.0% Flood Zone or 100-yr Floodplain) in the Loch Lomond flood hazard zone assessment (Figure 4).

Open Space Land Assessments and Property Ownership Delineation

Evaluating and assessing the size and proximity of open undeveloped or partially development urbanized landscapes is critical to determine potential BMP locations. Significant land holdings are in private ownership (Figure 6) and have undergone urbanization at varying degrees of land impact. The available open space in the SWAAP-LL includes Homeowner Association Open Space (Loch Lomond, Hickory Hills Estate and Hampton Reserve), The Chicago Archdiocese, and the Mundelein Park District (Figure 7).

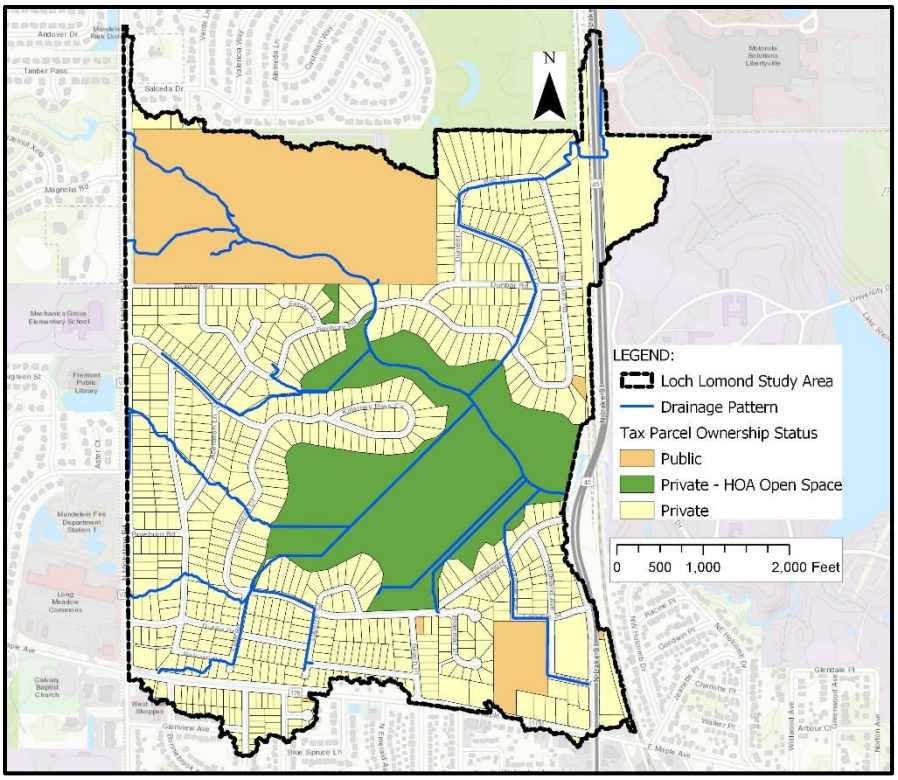


Figure 6: Loch Lomond Property Ownership Assessment

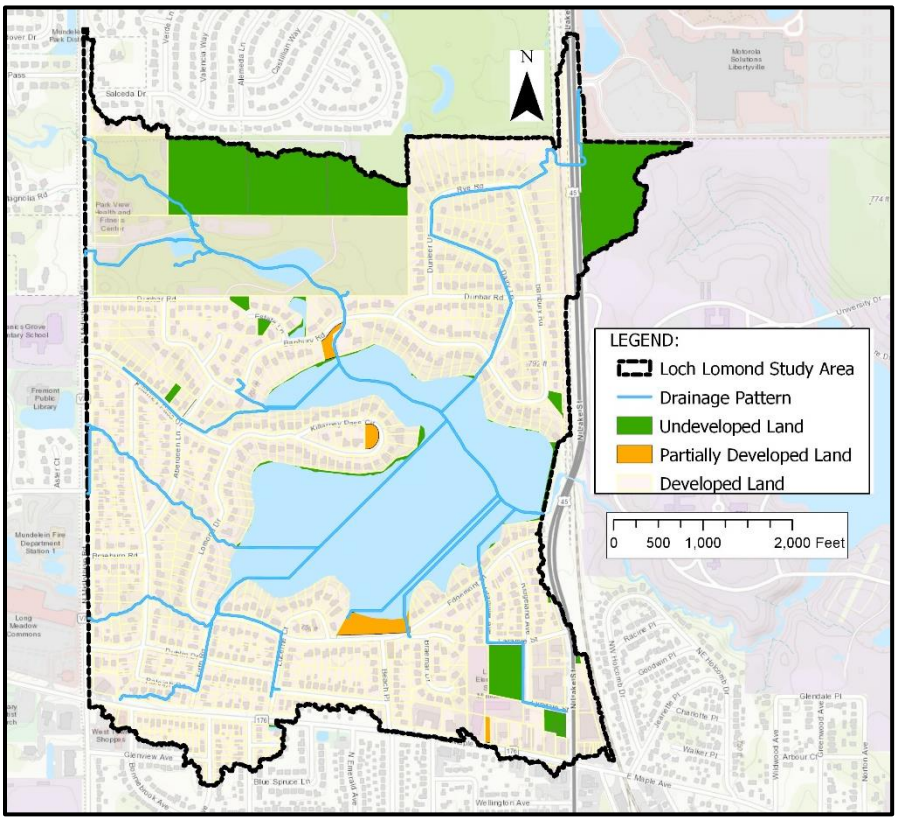


Figure 7: Loch Lomond Open Space Assessment

Topographical Assessment

A topographical assessment of the existing topography supports our field reconnaissance in identifying areas with possibly eroding streambanks or shorelines based on the severity of the slope steepness near ponds, lakes or linear waterbodies. The slope analysis is completed within the Esri ArcMap software, utilizing a LiDAR derived digital terrain model (DTM)[4]. LIDAR, which stands for Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth[5] and a DTM is a data interpretation of the distance data derived from the remote sensing. Areas that have been determined to be exhibiting potential erosion based on a GIS analysis were reviewed in the field, and recommendations for stabilization have been included in the conceptual drawings.

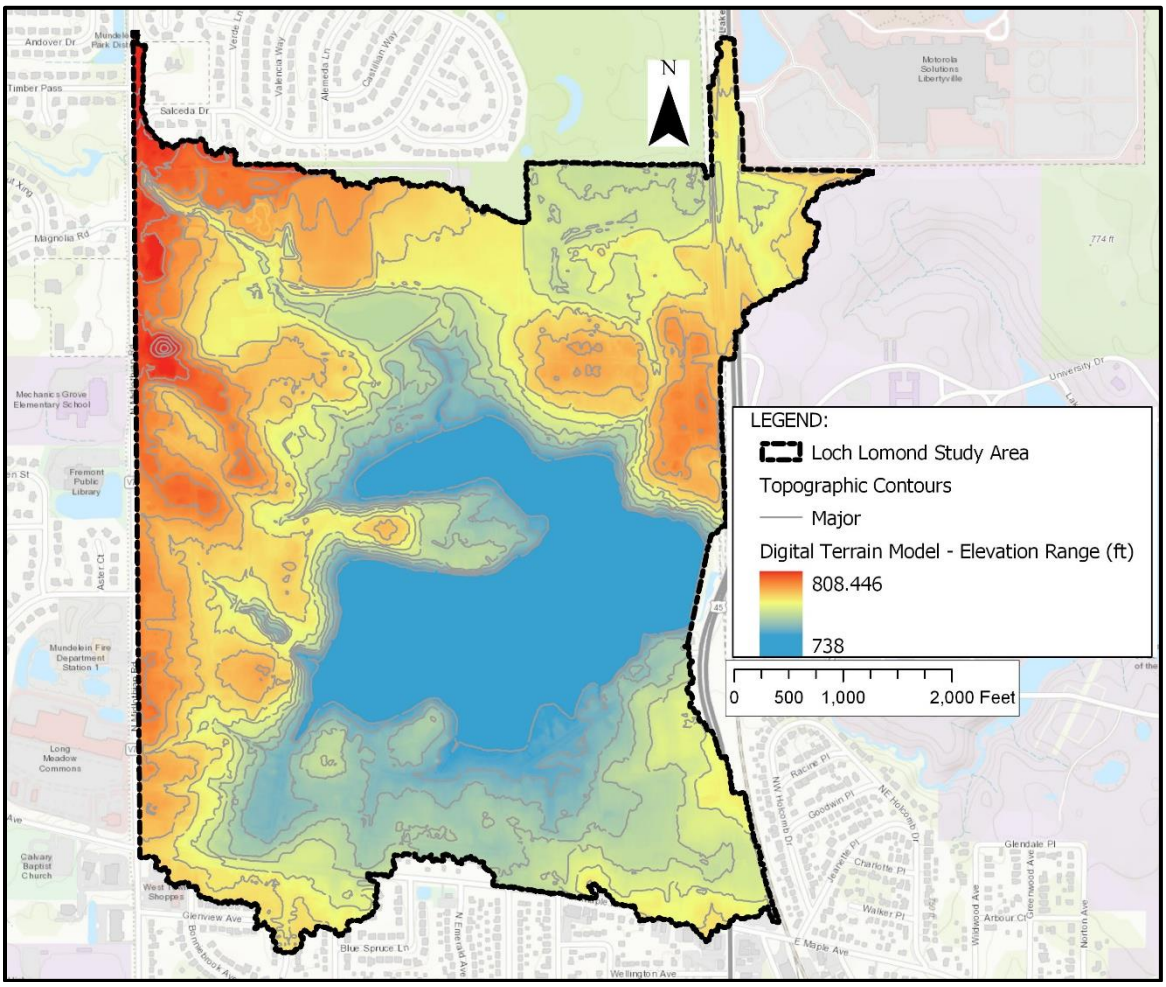


Figure 8: Loch Lomond Topographical Assessment

[4] Lake County GIS. DTM Data, 2007. (https://s3.amazonaws.com/lakecountygis-public/topography.html).
[5] National Oceanic and Atmospheric Administration. LiDAR Description & Function. (https://oceanservice.noaa.gov/facts/lidar.html).

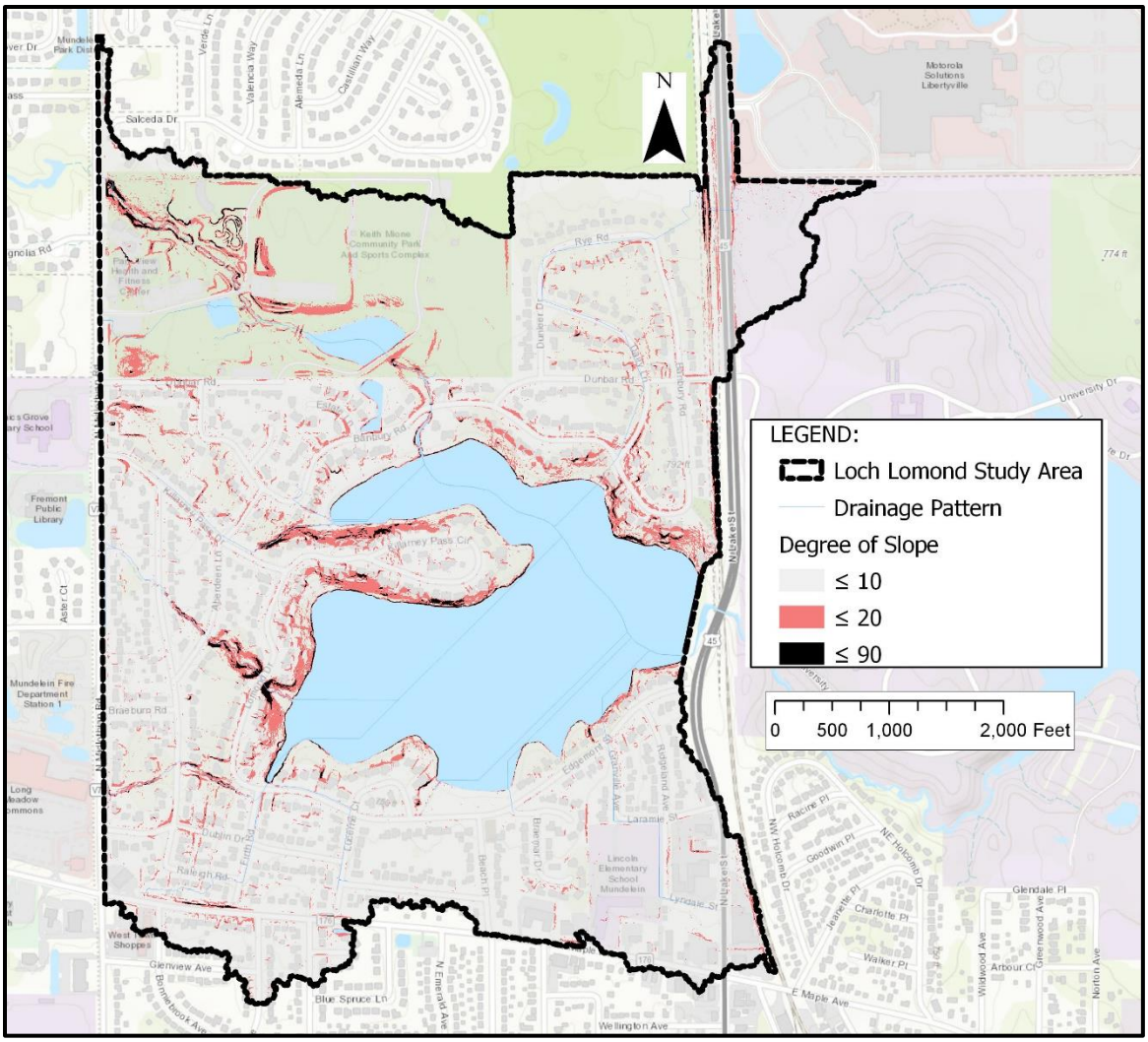


Figure 9: Loch Lomond Steep Slope Assessment

Using the results of the desktop GIS assessments, key areas were identified within the SWAAP-LL to facilitate field assessment work. The opportunities will be presented as preliminary concept designs projects for future development, funding, and implementation. This initial desktop assessment work is critical in forming a comprehensive understanding of the selected sites prior to conducting a more detailed on-the-ground assessment of watershed conditions and potential watershed protection and restoration opportunities.

The GIS analyses identified areas of concern within the SWAAP-LL, particularly along streambanks and shorelines which is an anticipated result of urbanization impacts of natural waterways. Lake County Health Department Lake Assessments have consistently noted that Loch Lomond's water quality is poor with low water clarity, high total suspended solids (TSS) concentrations, chloride concentrations and total phosphorous (TP) concentrations, and few established aquatic plants[6].

[6] Lake County Health Department, Lakes Management Unit. Loch Lomond Summary Report - Lake County, IL, 2015. (https://www.lakecountyil.gov/DocumentCenter/Home/View/14163).

2.2 Summary of Loch Lomond Study Area Field Assessments & Results

Field assessment data collection determines the validity and accuracy of GIS desktop assessments. Field results benefit the calibration of the models for watershed protection and restoration opportunities. Esri software offers multiple tools for accomplishing desktop and field assessments and field inventorying. GIS derived desktop analyses data was imported into ArcGIS online for real-time data access while in the field and accessible via a tablet connected to the cellular network. Field verification of open space, drainage pathways, riparian habitat and slope inventory data, were observed and noted for comparison to desktop data. Observations noted that may impact BMP siting includes: street modernization from rural ditch drainage to curb and gutter drainage systems (Loch Lomond), previously implemented slope stabilization practices by homeowners, storm sewer network functionality, condition, and ownership.

2.2.1 Stream & Stream Corridor Assessment

Introduction

The Lake County Stormwater Management Commission (SMC) conducted an on-the-ground assessment of stream characteristics to evaluate conditions within the corridor of the stream network within the SWAAP-LL. Though not specifically assessed, the stream assessment also made note of observed aquatic and riparian life. The stream assessment inventoried approximately 4,500 ln. ft. of stream channel within the SWAPP-LL in September 2017 (Figure 10). Supplemental stream assessment data was also used from previous SMC stream inventories conducted in Bull Creek in 2015.

Methods

Inventory methodology included walking the entire reach, measuring channel dimensions, noting streambank and riparian conditions, and documenting hydraulic structures and discharge points using a standardized database. A digital camera with an integrated Global Positioning System (GPS), was used to take geolocated photographs during the stream assessment. The major stream characteristics evaluated included:

- Channel conditions (physical dimensions, degree of bank erosion, degree of channel erosion, sediment accumulation, debris load, pool/riffle development)
- Hydraulic structures (bridges, culverts, dams and weirs)
- Discharge points (pipes, drain tiles, stormsewers, tributary streams and swales)
- Riparian corridor (floodplain and streambank land use and cover)
- Aquatic habitat (substrate composition and in-stream cover)

Although some quantitative data was collected such as channel width, discharge point sizes and hydraulic structure measurements, the condition of the creek was largely assessed using a qualitative method that involved visually inspecting and rating each stream reach as low, moderate, or high for the characteristic being evaluated. A more detailed description of the stream assessment can be observed here: http://arcg.is/1Ne1lgm.

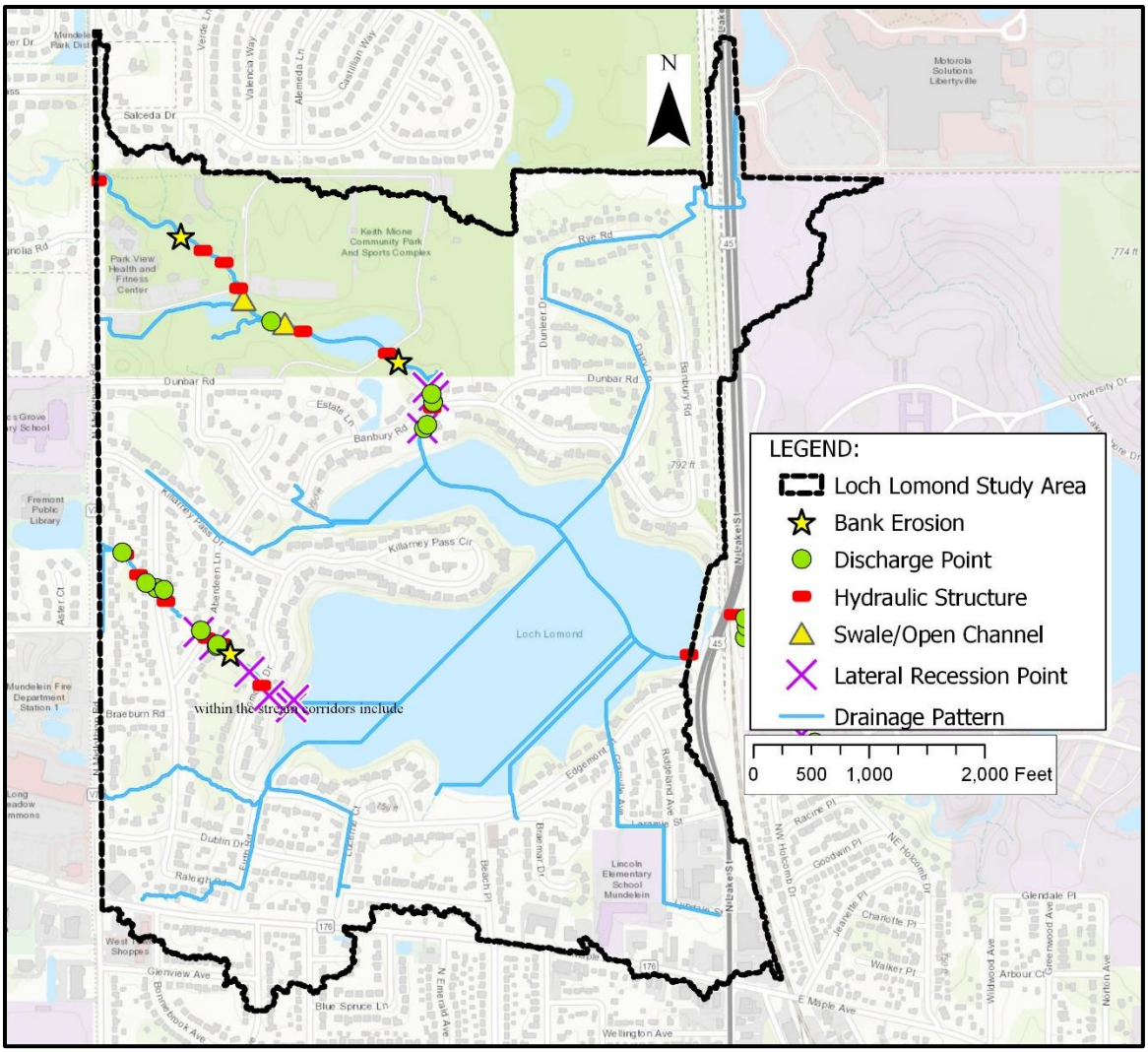


Figure 10: Loch Lomond Stream Assessment

Results and Discussion

The stream assessment identified an extensive amount of vegetative species that are not native nor conducive for effective slope stabilization along the stream channels. Much of the stream channels are dominated by a dense canopy and understory of ornamental and/or non-native invasive species (Buckthorn, European Mulberry, Eastern Cottonwood, Norway, Boxelder and Silver Maple, and Multiflora Rose). The dense canopy prevents native riparian grasses and forbs from establishing in populations significant enough to prevent soil loss. Trees are losing the soil mass around their roots and falling into the stream channels, developing debris jams and redirecting the normal stream thalweg, promoting new sources of slope instability and streambank erosion. Native plant vegetation in stream corridors, have evolved to thrive, stabilize and mitigate soil loss with deep root systems. The volume and velocity of water moving through the Bull Creek channel combined with the lack of suitable vegetation has impacted streambanks.

The water quality data presented in section 2.2.2, implies that soil loss due to streambank erosion and agricultural land runoff, is continuing to contribute to the turbidity and pollutant loads within the lake. Upstream development of the SWAAP-LL is regulated by the Lake County, IL

watershed development ordinance (WDO), https://www.lakecountyil.gov/2358/Watershed-Development-Ordinance. Per the WDO, site impact must comply with construction sediment and erosion control site protections to maximize water quality. Compliance is completed by self-reporting, community and inspector reporting to ensure compliance. Soil erosion contributes phosphorus and nitrogen as the soil particles are released into the water column by erosive forces.

The section of Bull Creek located within the study area and upstream of Loch Lomond is not identified as impaired in either the 2016 303(d) or 305(b) programs[7].

Bull Creek's biological integrity[8] is rated as relatively poor to non-existent for fish and macroinvertebrate diversity and establishment. Bull Creek has been impacted by culvert headwalls, damming, redirection, channelization, and urbanization, and no upstream hydraulic connectivity exists for aquatic species to move upstream within the Bull Creek stream corridor.

BMPs will benefit the long-term stability within the stream corridors. BMP recommendations will include thinning the vegetative canopy, runoff reduction surfaces, stone armoring on stream channel slopes where appropriate, in stream stone riffles, stone stabilization of upstream tributaries, and incorporation of naturalized detention basins for offsite runoff into the natural drainage pathways.

2.2.2 Lake Shoreline Assessment

Introduction

The Lake County Stormwater Management Commission (SMC) conducted an on-the-ground assessment of lake and pond characteristics. Though not specifically assessed, the lake/pond assessment also made note of observed aquatic and aquatic life. The shoreline assessment inventoried approximately 2,000 of the 12,000 ln. ft. of shoreline for Loch Lomond in September 2017 (Figure 11). Supplemental shoreline data was also used from Loch Lomond Lake Report prepared by the Lake County Health Department in 2015[9].

Methods

Inventory methodology included walking the shoreline where accessible, noting shoreline conditions, and documenting hydraulic structures and discharge points if there are probable impacts to water quality. The major shoreline characteristics evaluated included:

- Conditions (degree of bank erosion, sediment accumulation, debris load)
- Hydraulic structures (bridges, culverts, dams and weirs)
- Discharge points (pipes, drain tiles, and stormsewers)
- Corridor (floodplain, land use and cover)
- Aquatic habitat (substrate composition and lake cover)

[7] Illinois Environmental Protection Agency. Illinois Integrated Water Quality Report and Section 303(d) List - Volume I: Surface Water, 2016. (http://www.epa.illinois.gov/topics/water-quality/watershed-management/tmdls/303d-list/index).

[8] Des Plaines River Watershed Workgroup (DRWW), Water Quality Data, 2016.

[9] Lake County Health Department, Lakes Management Unit. Loch Lomond Summary Report - Lake County, IL, 2015. (https://www.lakecountyil.gov/DocumentCenter/Home/View/14163).

The shoreline assessment was largely assessed using a qualitative method that involved visually inspecting and identifying whether the shoreline was impacting water quality.

2.2.2.1 Lakes Water Quality

Lake Reports

The 2015 Loch Lomond Summary Report reported that total phosphorus in Loch Lomond averaged 0.196 mg/L. This represents a 33.5% decrease from the 2005 concentration of 0.295 mg/L, this is still higher than the Illinois Environmental Protection Agency impairment rate of 0.050 mg/L. Sources of phosphorus include inputs from the watershed, local sources (i.e., lawn fertilizers and agricultural runoff) and internal loading from sediment caused by wind and wave action and carp. Nitrogen is the other nutrient critical for algal growth. The average Total Kjeldahl nitrogen (TKN) concentration for Loch Lomond was 1.54 mg/L, which was higher than the county median of 1.20 mg/L. A total nitrogen to total phosphorus (TN:TP) ratio of 8:1 indicates that nitrogen was the nutrient limiting aquatic plant and algae growth in Loch Lomond. By using phosphorous as an indicator, the trophic state index (TSIp) ranked Loch Lomond as hypereutrophic with a TSIp value of 80.2. This means that the lake has high nutrients which can result in excess plant and algae growth. The 2015 average total suspended solids (TSS) concentration for Loch Lomond was 11.0 mg/L, which was higher than the county median of 8.2 mg/L and a 16.7% decrease from the 2005 average of 13.1 mg/L. Water clarity was measured by Secchi depth, with the lowest reading in August (1.60 ft.) and the deepest was in May (6.90 ft). The average Secchi depth for the season was 2.94 ft, which was near the county median (2.96 ft). The average conductivity of Loch Lomond was 0.7736 mS/cm which is higher than the county median (0.7920 mS/cm). This was a 7.8% increase from the 2005 average (1.3298 mS/cm). The average chloride concentration for Loch Lomond in 2015 was 134 mg/L which was slightly lower than the county median of 139 mg/L. Although Loch Lomond is at the top of the watershed, it has lower water quality than the lakes it flows into. This is in part due to the lack of aquatic plants to stabilize sediments and take up excess nutrients and continually internal loading of phosphorus from disturbed lakebed sediment. Loch Lomond experiences minimal stratification because it is relatively shallow (avg. water depth 5 ft and a maximum depth of 8 ft). The inability to stratify increases suspension of nutrients in the water column and water surface, instead of trapping nutrients in the lower profile of the lake.

HOA Water Sampling

The Loch Lomond HOA is in the process of developing and implementing a lake management plan for Loch Lomond. As part of their management plan they collected water chemistry data (2016-2017) from four (4) inlet sampling points entering lake Loch Lomond. Total phosphorus entering Loch Lomond averaged 0.098 mg/L, higher than the Illinois Environmental Protection Agency (IEPA) impairment rate of 0.050 mg/L. The main tributary to Loch Lomond, Bull Creek contributes 0.164 mg/L of phosphorus. Sources of phosphorus include inputs from the watershed, local sources (i.e., lawn fertilizers and agricultural runoff) and loading from the sediment of streambank erosion. The average total suspended solids (TSS) concentration entering Loch Lomond was 11.42 mg/L. The average chloride concentration entering Loch Lomond was 136.88 mg/L.

IEPA 2016 Integrated Water Quality Report

Loch Lomond (AUID: IL_RGU) has been identified as impaired for Fecal Coliform, Phosphorus (Total), and Total Suspended Solids (TSS) in the 303(d) Program[10].

Loch Lomond (AUID: IL_RGU) has been identified for the following impairments, potential pollutant sources, and designated use classification in the 305(b) Program[11].

- Potential Pollutant Causes: Fecal Coliform, Total Suspended Solids (TSS), Phosphorus (Total).
- Potential Pollutant Sources: Source Unknown, Littoral/shore Area Modifications, Other Recreational Pollution Sources, Streambank Modifications/destabilization, Agriculture, Rural (Residential Areas), Urban Runoff/Storm Sewers, Waterfowl.
- Designated Uses: Fully Supporting Aquatic Life, Not Assessed Fish Consumption, Not Supporting Primary Contact, Not Assessed Secondary Contact, Not Supporting Aesthetic Quality.

2.2.2.2 Lake Shoreline Assessments

A full shoreline erosion assessment was completed for Loch Lomond in 2015. One hundred percent of the shoreline was developed with the major shoreline types being riprap, seawall, and lawn. The shoreline was divided into 11 reaches, and evaluated for none, slight, moderate and severe erosion based on exposed soil and tree/plant roots, failing infrastructure, undercut banks, and other signs of erosion. Based on the 2015 data[12], 23.4% of Loch Lomond's shoreline has some erosion, with 1.2% of the shoreline classified as moderate erosion and 2.6% of the shoreline classified as severely eroded, Figure 11.

Lakes Reports and Lake Shoreline Assessments Discussion

The inlet sampling data and in-lake water quality sampling data indicate that phosphorus reduction and sediment reduction are needed to improve water quality. Due to the shallow nature of lake Loch Lomond, mitigating pollutants prior to discharging into the lake will benefit the overall health of the lake. As with any impounded system, dredging will be a short-term water quality improvement. Dredging select areas of the lakes will increase water depth and may improve water quality and inversion, but it is a costly service and does not mitigate continued input of pollutant into the lake. The Loch Lomond HOA's current aquatic maintenance practices for water quality issues, includes a pesticide program of herbicides and algicides (control primarily of algae and invasive vegetation), which only serves as a temporary solution to improve water quality issues.

BMPs that target permanent and long-term reductions in sediment and nutrient movement into Loch Lomond will benefit the water quality within Loch Lomond the most. Stabilizing stream

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[10] Illinois Environmental Protection Agency. Illinois Integrated Water Quality Report and Section 303(d) List Volume I: Surface Water, 2016. (http://www.epa.illinois.gov/topics/water-quality/watershed-management/tmdls/303d-list/index).

[11] Illinois Environmental Protection Agency. Illinois Integrated Water Quality Report and Section 303(d) List - Volume I: Surface Water, 2016. (http://www.epa.illinois.gov/topics/water-quality/watershed-management/tmdls/303d-list/index).

[12] Lake County Health Department, Lakes Management Unit. Loch Lomond Summary Report - Lake County, IL, 2015. (https://www.lakecountyil.gov/DocumentCenter/Home/View/14163).

channels entering Loch Lomond would be the most effective BMP as well as stabilizing areas with moderate to severe shoreline erosion. The shallow nature of the lake and internal loading of nutrients will continue to be a problem as native emergent and submergent vegetation remain non-existent. Planting buffer strips and emergent vegetation to stabilize the water's edge may be feasible pending the existence of a transitional shoreline profile below the waterline conducive to plant establishment.

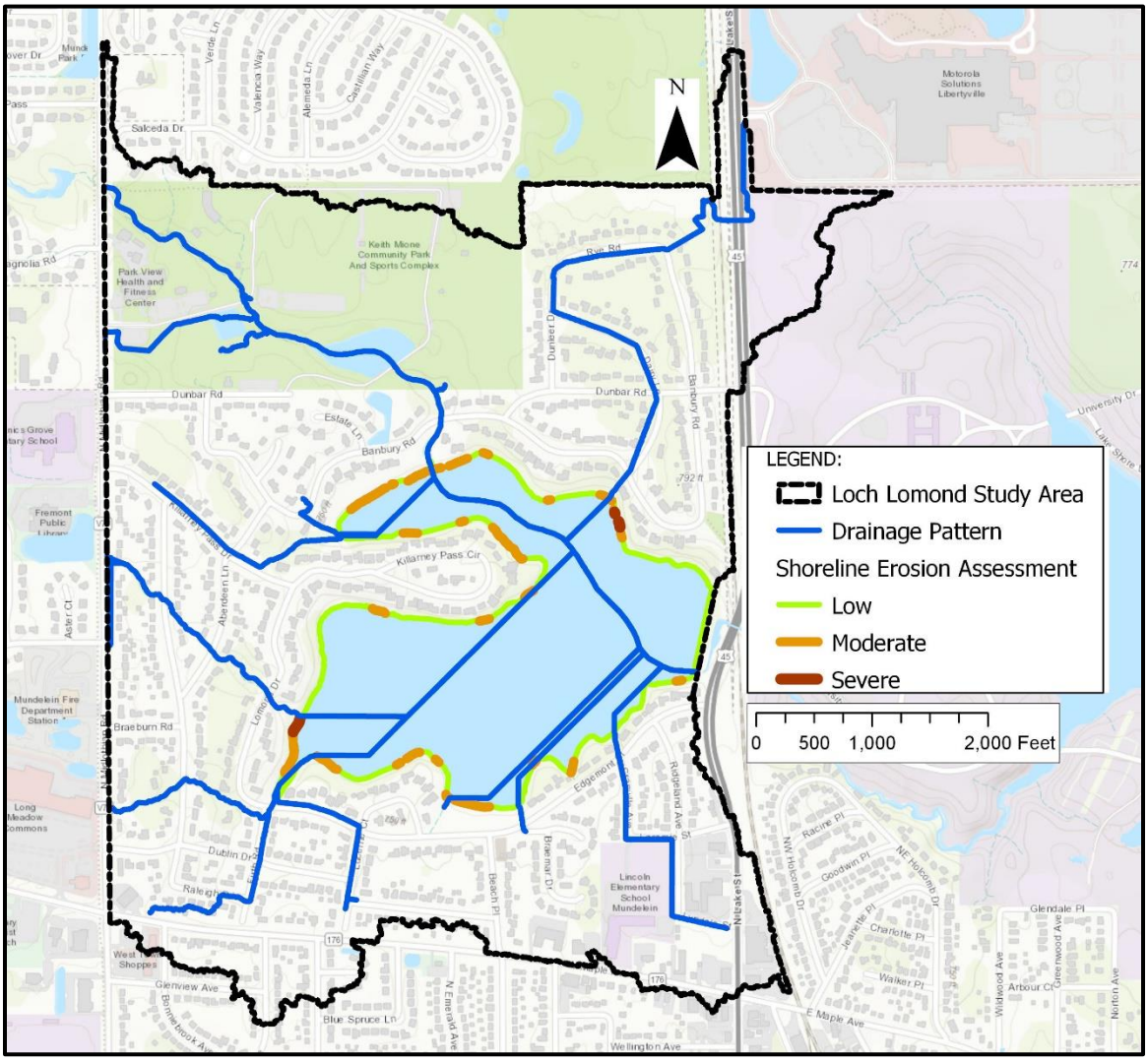


Figure 11: Loch Lomond Shoreline Assessment

Floating treatment wetlands (FTWs) serve as an alternative BMP to shoreline stabilization, vegetated FTWs mimic the function of naturalized shorelines with nutrient and sediment uptake. FTWs support aquatic vegetation on an anchored self-buoyant system, the root system of the native plants grow into the water oxygenating the water, absorbing nutrients and binding suspended sediment. The root systems also provide protection, habitat and food sources to aquatic species. FTWs are also proposed as isolated islands within the lake; they were presented as near-term implementable projects to stakeholders. The majority of the lake shoreline is located on private property, easement/site access will need to be negotiated, whereas the lake itself is the

property of the Loch Lomond HOA and thereby a near-term implementable project. Research has indicated significant reduction of in lake pollutants is achievable (TSS, TN, P) from FTWs[13]. An additional benefit of FTWs specific to native plant establishment and longevity is that the buoyancy of the FTW system abates the effects of water level variability, urban hydrology in a small watershed increases the probability of plant failure due to variability in water levels.

2.2.3 Upland Assessments

Upland assessments were conducted by a windshield survey of the adjoining community within the SWAAP-LL, in addition to aerial imagery interpretation and Google street view assessment of areas outside the SWAAP-LL.

Upland areas were assessed based on observation techniques presented in the Unified Subwatershed and Site Reconnaissance (USSR) Manual developed by CWP (2004) to identify potential pollution sources influencing water quality and to evaluate restoration project opportunities. The manual provides detailed guidance regarding survey techniques to help watershed groups, municipal staff, and consultants unfamiliar with identifying stormwater pollution sources. The manual also offers guidance to assess subwatershed restoration potential for source controls, pervious area management, and improved municipal maintenance such as education, retrofits, street sweeping, inlet cleaning, and open space management.

The potential actions that were considered during the assessment to address observed sources of stormwater pollution were:

- Improved management of common areas
- Storm drain stenciling/marking program
- Tree planting
- Improved landscaping/native landscaping
- Stormwater management practice maintenance
- Stormwater retrofit opportunity

2.2.3.1 Neighborhood Source Assessment (NSA)

NSAs describe pollution source areas, stewardship behaviors, and restoration opportunities within individual neighborhoods. Each neighborhood has unique characteristics which determine the ability to implement restoration projects, source controls, and stewardship practices.

Methods

Potential stormwater pollutant sources are observed within the adjoining communities as pollutants can be introduced from yards and lawns, rooftops and downspouts, driveways and sidewalks, and common areas. Specific watershed protection and restoration practices can be recommended based on the results of the neighborhood assessment. Assessments can identify programs and projects that allows municipalities, homeowners, and other watershed stakeholders to identify resource allocation toward achieving the goals of the watershed-based plan.

[13] T. R. Headley and C.C. Tanner. Floating Treatment Wetlands: An Innovative Option for Stormwater Quality Applications, 2008. 11th International Conference on Wetland Systems for Water Pollution Control.

Results and Discussion

The community is predominately residential consisting of 45% of the SWAAP-LL (Table 1) with an average lot size of 4.73 acres.

Table 1: Loch Lomond Study Area Land Use Data

Loch Lomond Land Use Assessment[14]		
Land Use	Acres	Percent of SWAAP-LL
Commercial/Retail	5.42	1.15
Disturbed Land	0.20	0.04
Forest/Grassland/Beach	9.69	2.05
Government/Institutional	7.77	1.65
Industrial	0.32	0.07
Office/Research	0.55	0.12
Public/Private Open Space	76.34	16.18
Rail	5.93	1.26
Residential-Multi Family	1.36	0.29
Residential-Single Family	212.27	45.00
Transportation	68.55	14.53
Utility/Waste Facility	0.23	0.05
Water	77.73	16.48
Wetlands	8.01	1.14
Total	469	100

Improved management of common areas

Street sweeping helps remove trash, sediment and other organic matter such as leaves and grass clippings from the curb and gutter system and prevents them from entering the storm drains and nearby streams. Street sweeping also reduces sediment and other pollutant loads such as oil and metals to the stream system. Excessive organic matter, sediment, and trash can clog streams and the storm drain system resulting in costly maintenance and stream health impairment. Also, the decay of an unbalanced amount of organic matter in a stream depletes the supply of dissolved oxygen, depriving other aquatic life including fish of their oxygen demand. As the SWAAP-LL area moves to curb and gutter systems, a street sweeping initiative must be implemented to ease the effects of a curb and gutter storm drain system on receiving streams and Loch Lomond. The assessed areas had minimal trash, but the presence of sediment, and/or organic matter (leaves and grass clippings) was identified.

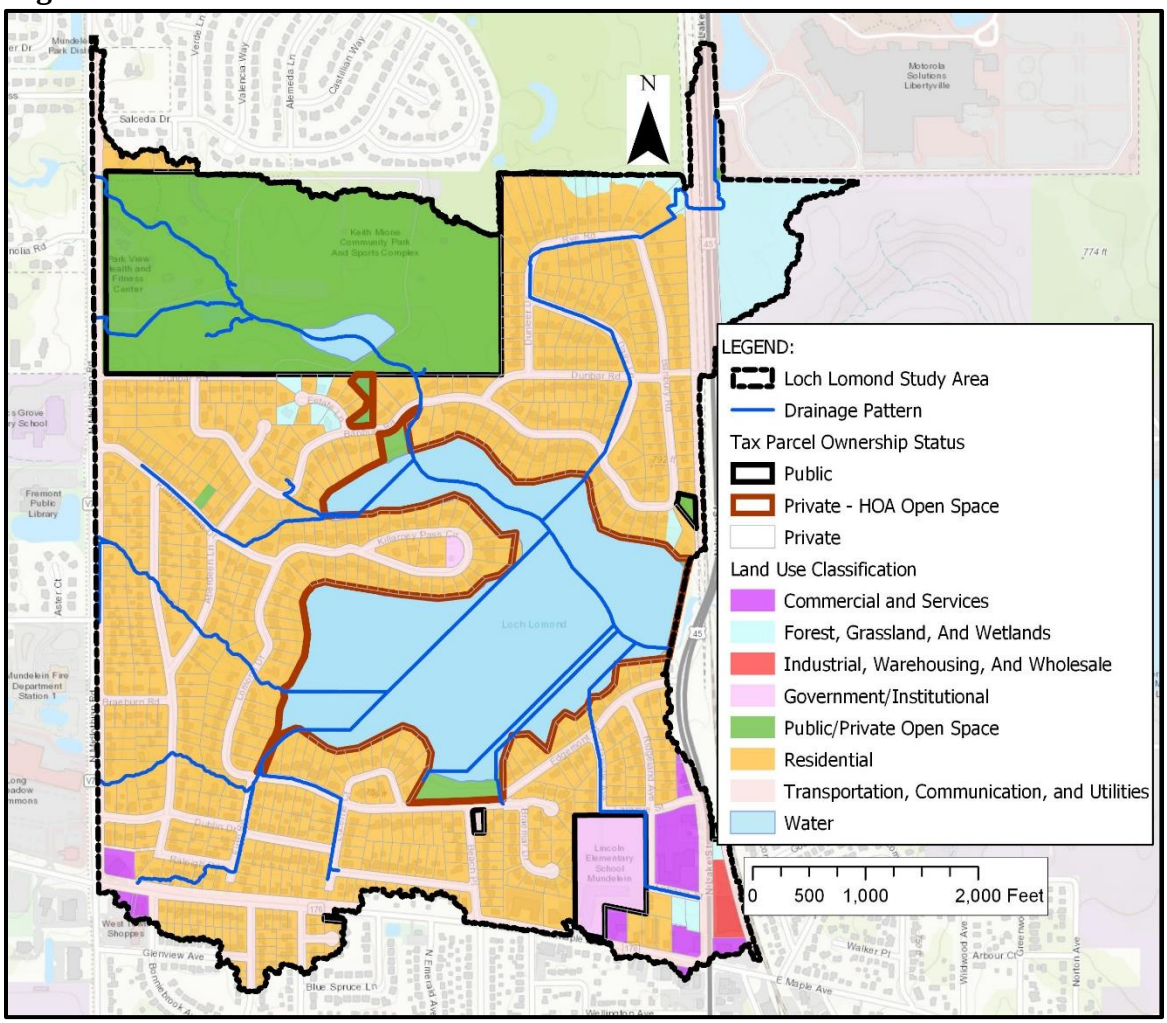
Storm Drain Marking

Most of the road infrastructure in the SWAAP-LL consist of a mix of natural ditch drainage (90%) and modern curb and gutter systems (10%) with storm drain inlets that convey stormwater runoff quickly and directly to the stream system and ultimately to Loch Lomond. At the time of field reconnaissance, the Village of Mundelein was in the process of converting portions of the natural ditch drainage system to curb and gutter systems and filling in the ditch depressions. Since there is little or no infiltration of stormwater in a curb and gutter system, the future potential for more pollutants to be carried to the lake is feasible. The new installed storm drains do not have markings or indicators that the inlets eventually drain to Loch Lomond. New

[14] Lake County GIS. Land Use GIS Data, 2010.

and existing inlets should be identified with markings or indicators to educate residents that any trash, lawn clippings (potential for nutrient pollution), or other debris accumulating along the curbs and gutters will be washed away during a storm event and end up in Loch Lomond.

Figure 12: Loch Lomond Land Use Assessment

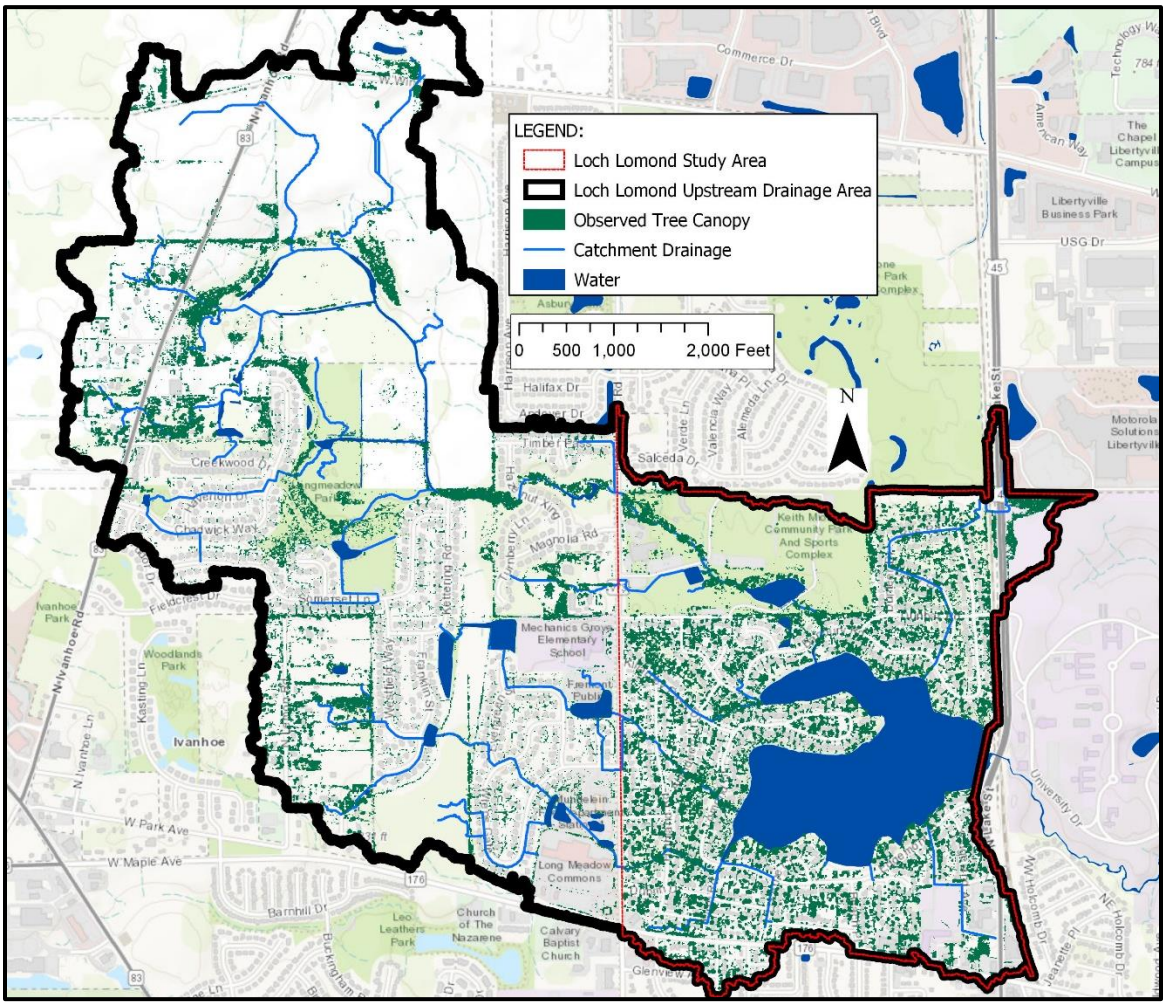


Street and Shade Trees

Street and shade trees are an aesthetic asset to the community, but also provide air and water quality improvements since they intercept precipitation with their leaves and absorb precipitation and nutrients through their root systems. This infiltration of precipitation through leaves or the root systems reduces runoff and provides some treatment before stormwater runoff reaches the stream or waterbody system. Street trees are recommended for neighborhoods with a minimum of 6 feet of green space between the sidewalk and curb and less than 20% of these areas had trees planted (Figure 13). Approximately 100 trees are needed in the SWAAP-LL, based on a spacing of one tree per 30 feet. A spacing of 30 feet presumes a mature tree canopy and the dripline as the extent of tree root system. The tree canopy establishment within the upstream drainage area of Loch Lomond outside of the SWAAP-LL is relatively poor. The canopy establishment is limited due to the age of the tree population (18-22 years old, development impact within the years 1996-1999). Mature trees are an effective stormwater BMP

tool, the uptake of stormwater for a mature tree (ex. 36-inch Bur oak will intercept 6,365 gallons of stormwater runoff per year) is more significant than a newly planted 3" caliper tree (ex. 3-inch Bur oak will intercept 95 gallons of stormwater runoff per year)[15]. The association of canopy coverage tends to correlate with tree maturity and size. The inclusion of the tree canopy coverage upstream of the SWAAP-LL, highlights the need for preservation/installation of trees to intercept stormwater.

Figure 13: Loch Lomond Tree Canopy Assessment



Improved landscaping/native landscaping

The vegetative inventory assessment in the SWAAP-LL concluded that little native vegetation exists outside of the vegetated stream buffers. The Loch Lomond HOA has implemented rain gardens planted with native grasses and forbs. The stream buffers have mature trees that are mix of native and non-native species, with an understory of invasive species. The residential landscape vegetation is predominately turf with non-native ornamental plant species existing as shrubs and flowers. Trees within the SWAAP-LL are a mix of native and non-native

[15] National Tree Benefit Calculator, (http://www.treebenefits.com/calculator/).

species. As mentioned in the lake assessment the lake has no substantial shoreline or emergent plant habitat established in the lake.

Long term improvements will include thinning the canopy of the stream corridors and removing and replacing invasive and aggressive plant species to improve soil stability. Converting turf depressions and/or detention basins with native plant species can improve water quality. Determining the types of fertilizer or turf maintenance in practice on each parcel was not completed as part of this report, but educational support will be offered to stakeholders to educate the community on reduced chemical inputs into lawn maintenance.

2.2.3.2 Impervious Area Assessment

Introduction

Assessing the locations and extent of impervious surface area in proximity to drainage patterns will aid in identification and evaluation of potential BMP project locations for impervious pavement reduction, vegetation enhancement, or stormwater retrofitting.

Methods

Impervious cover assessments were conducted by a windshield survey of the adjoining community within the study area, in addition to aerial imagery interpretation, and GIS data analyses[16,17,18].

Project recommendations are determined by existing conditions at the sites and potential level of community support for BMP implementation. Parcel size, ownership, value of existing vegetation, neighbor proximity and adjacency considerations have been assessed to identify sites with good potential as a stormwater retrofit location.

Results and Discussion

The SWAAP-LL study area of 469 acres has approximately 75% of available land in some form of imperviousness that continues to impact water quality, stormwater runoff volume and velocity (Table 2). The primary considerations for impervious cover tend to be attributed to artificial structures such as buildings, roads, driveways, or parking lots. Impervious cover can also be attributed to open spaces and properties with compacted soils in the landscape or areas with limited vegetation establishment that do not support sufficient water infiltration. In the SWAAP-LL 45.48 acres are attributed to impervious street pavement and 1,120 building structures constitute 50.66 acres of impervious cover, which comprises a significant component of High Impervious Cover.

The impervious cover assessment in combination with the drainage analysis assessment seeks to characterize parcels with the best opportunity to be retrofitted with BMPs for improved rain and runoff infiltration where paved surfaces are present. Potential opportunities for retrofitting existing land use with BMP projects have been identified in the conceptual designs for the SWAAP-LL. Specific recommendations will include reductions in upland drainage directly to

[16] National Land Cover Database (NLCD). Percent Developed Imperviousness Database, 2011. (https://www.mrlc.gov/nlcd2011.php).
[17] Lake County GIS. Planimetric GIS data: Buildings, Edge of Pavement, and Parking Lots.
[18] Lake County SMC. Des Plaines River Watershed-Based Plan- impervious cover assessment data, 2018.

water bodies, reductions of impervious pavements, or redirection of runoff through naturalized basins or buffers before reaching receiving waters of a creek or lake. Ongoing programmatic education with communities and municipalities will continue to promote and highlight projects and opportunities for increased infiltration and absorption of runoff. Permeable pavement projects will continue to be long term education effort to ensure stakeholder support of the benefits and long-term cost benefits of permeable pavements as a substitute for impervious pavement. Currently off-road parking and parking lots are being proposed for retrofits from asphalt parking to a permeable pavement system. Recommendations will be for public properties such as school districts and park districts for parking lot retrofits but will be contingent on funding opportunities and ongoing education for support.

Figure 14: Loch Lomond Percent Impervious Cover Assessment

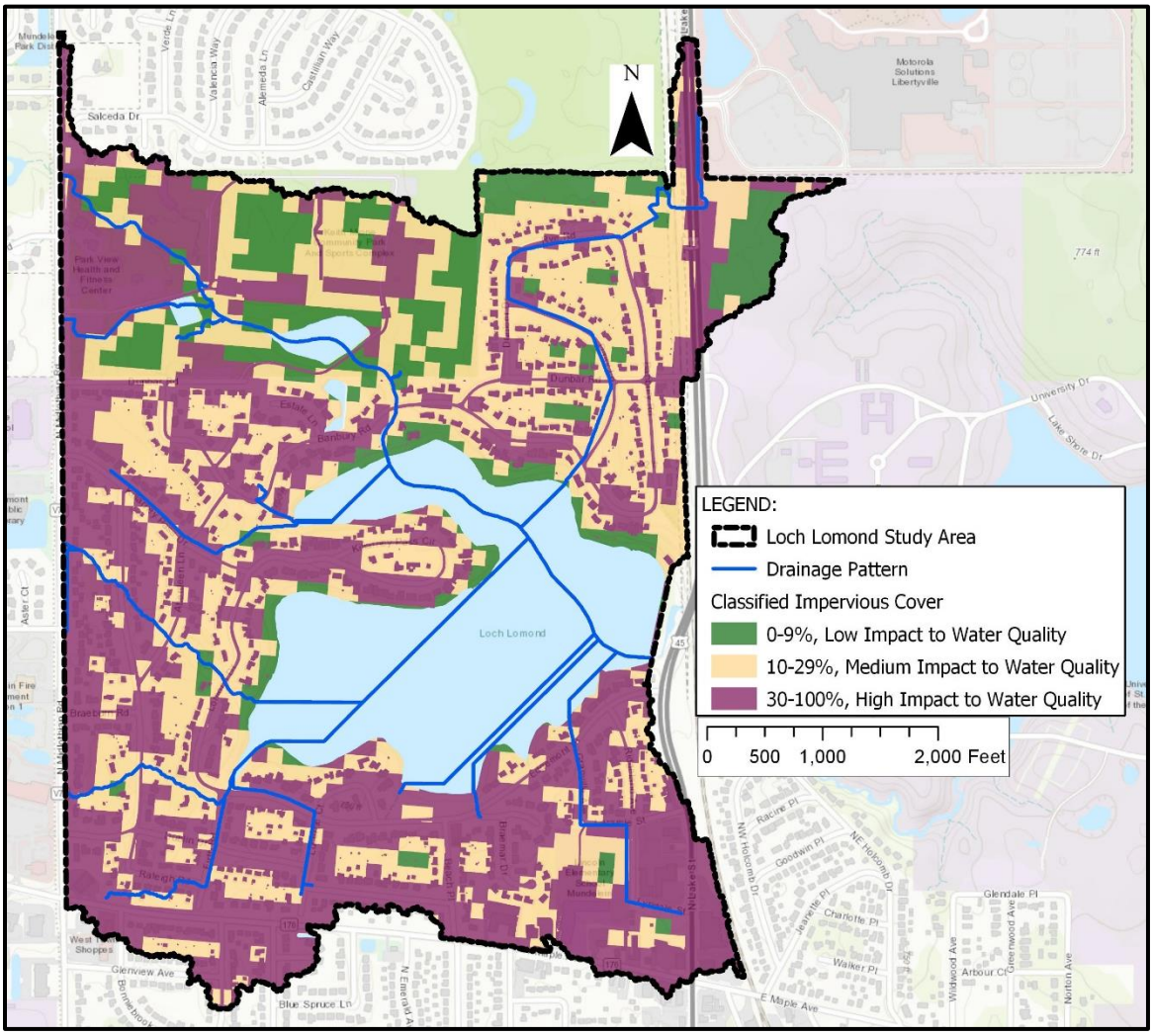


Table 2: Loch Lomond Impervious Cover Data

ITEM	ACRES	% AREA
Low Impervious Cover, 0-9%	44.59	10%
Medium Impervious Cover, 10-29%	135.65	29%
High Impervious Cover, 30-100%	208.90	45%
Water	79.87	17%
Total	469	100%

2.2.4 Stormwater Retrofit Inventory

Introduction

Stormwater retrofits are a valuable tool to improve water quality in areas where the natural soil, vegetation or drainage has been altered and/or impacted. Stormwater retrofit opportunities included treating runoff from parking lots, inlet retrofits, and conversion/inspection of existing stormwater management detention and retention facilities. Retrofit locations will seek to ensure sufficient pervious area is available to treat a portion of stormwater runoff from impervious surfaces. Retrofit opportunities promote infiltration or filtration of stormwater runoff with BMPs. BMPs such as infiltration trenches, naturalized basins, or bio-retention solutions incorporate native vegetation and filter media through which stormwater passes. This reduces the volume and velocity of water, pollutants, and water temperature of the runoff prior to groundwater recharge or entering the stream/lake system.

Methods

Stormwater retrofit opportunities are effective in areas of medium and high impervious cover. Areas of high and medium impervious cover (30-100%) are presumed to have been altered from their natural state to include some form of development. The development thereby reduces the available green space to a range of 0-70% of land cover while also impacting and potentially impeding natural drainage pathways. Field investigations were conducted by a windshield survey of the adjoining community within the study area, in addition to aerial imagery interpretation, and GIS data analysis[19,20,21]. The feasibility of implementing a stormwater retrofit project at each site was evaluated by investigating drainage patterns, drainage boundaries, impervious cover, available space, and other site constraints (e.g., conflicts with existing utilities and land uses, site access and potential impacts to natural areas). As discussed in section 2.2.3.2, impervious cover can also be attributed to open spaces and properties with compacted soils in the landscape or areas with limited vegetation establishment that do not support sufficient water infiltration. Project recommendations are determined by existing conditions at the sites and potential level of community support for BMP implementation and maintenance. Parcel size, ownership, value of existing vegetation, neighbor proximity and adjacency considerations have been assessed to identify sites with good potential as a stormwater retrofit location were also noted during the assessment.

Results and Discussion

[19] National Land Cover Database (NLCD). Percent developed imperviousness database, 2011.
[20] Lake County GIS. Planimetric GIS data: Buildings, Edge of Pavement, and Parking Lots.
[21] Lake County SMC, Des Plaines River Watershed-Based Plan- impervious cover assessment data, 2018.

Many viable stormwater retrofit opportunities existing in the SWAAP-LL, but the immediate project recommendations seek immediate benefits for water quality improvement. Key project recommendations seek to rehabilitate, enhance and/or naturalize existing stormwater management detention and retention facilities to increase infiltration, and reduce pollutant reduction loads from overland runoff. Additional project recommendations seek to convert open turf patches into mixed use vegetative landscapes for passive recreational use.

2.3 Small Watershed Assessment Summary of Loch Lomond Study Area

In sections 2.1 and 2.3, the overall results of the desktop and field assessments indicate that the natural habitat of the SWAAP-LL has been substantially impacted by land use and land function. The impact of development has contributed to increased volume and velocity of runoff via roofs, roads, and stormwater pipes based on the assessed erosion issues in the field and validated via GIS analysis. The available open space needed for runoff infiltration/filtration has been severely impacted by current land uses and has increased the sediment and pollutant load of Loch Lomond over the last six (6) decades. Water chemistry issues observed in Loch Lomond will continue to be observed until appropriate programmatic and field actions are pursued to mitigate and reduce the impacts of upstream runoff into Loch Lomond.

Water quality impacts include the following:

- Nonpoint water quality impacts from urbanization contribute to increased soil erosion, turbidity, nutrient introduction, and upland habitat loss to Loch Lomond.
- Aquatic life is inconsistent due to the lack of upstream stream continuity, channelization, elevated/perched stormsewer structures and damming.
- Streambank stability and streambank function are a foreseeable concern until appropriate stabilization practices are completed.

Programmatic and field project recommendations for stakeholders to incorporate in their community include:

- Pesticide awareness on property management.
- Fertilizer awareness on property management.
- Site specific water infiltration/reuse awareness
    - Downspout disconnect information for riparian land owners and upland land owners.
    - Rain water harvesting opportunities.
    - Retrofitting of natural depression or drainage paths with rain gardens or bio-swales.
    - Native vegetation inclusion/incorporation with landscaped areas.
    - Tree preservation/tree planting for stormwater runoff reductions.
- Stormwater runoff education
    - Storm drain stenciling/marking.
    - Street Cleaning.
    - Permeable pavement surfaces.
    - Reduced vegetative debris storing on slopes or drainage paths.
    - Proper trash disposal or use of hazardous household collection or recycling facilities for disposal.

3. Inventory of Watershed Restoration Opportunities in the Loch Lomond Study Area

3.1 Stream & Stream Corridor Restoration Opportunities in the Loch Lomond Study Area

Stream and stream corridor restoration practices have been selected to enhance the appearance, stability, and function of the stream corridors. Applicable practices range from vegetative bank stabilization and localized grade control, to comprehensive restoration projects, such as full channel redesign and re-alignment. Stream and stream corridor restoration practices are often combined with stormwater retrofits and upland restoration programs and practices to meet subwatershed restoration objectives. Based on the results of the stream assessment, recommendations will include examples of: stream restoration, streambank/shoreline stabilization, vegetative buffer enhancement, and stream cleanups.

3.1.2 Potential Stream & Stream Corridor Restoration Programs

This section of the plan will provide a summary of the program-type opportunities (i.e., non-site specific or watershed-wide opportunities) identified during the field assessment work or developed to address issues identified during the field assessment work. Individual program opportunities may be further developed through the identification of the next steps toward program implementation.

In following are identified stakeholder support and outreach program recommendations to continue ongoing awareness, education, or housekeeping activities. SMC offers an array of educational stormwater best practice resources for the Lake County Community (https://lakecountyil.gov/2261/Stormwater-Best-Practices).

- Stakeholders to offer native vegetation management reference resources.
- Stakeholders to offer invasive species identification reference resources (terrestrial, aquatic, plants, animals, insects).
- Pesticide awareness on property management.
- Fertilizer awareness on property management.
- Site specific water infiltration/reuse awareness
    - Downspout disconnect information for riparian land owners and upland land owners.
    - Rain water harvesting opportunities.
    - Top of streambank buffer enhancement, maintenance, or preservation.
    - Stream clean-up includes removing trash, tires and other debris from waterways.
- Stormwater runoff education
    - Eliminate the storage of vegetative debris on slopes or in drainage paths (i.e. grass clippings, wood piles).
    - Removal of instream vegetative debris obstructions.

- Proper trash disposal or use of hazardous household collection or recycling facilities for disposal.

3.1.3 Potential Stream & Stream Corridor Restoration Projects

This section of the plan will provide a summary of the project-type opportunities (i.e., site- or reach-specific opportunities) identified during the field assessment work or developed to address issues identified during the field assessment work. Individual projects for which preliminary concept designs were not developed may be further developed through the identification of the next steps toward project implementation.

Table 3: Loch Lomond Proposed Vegetation Management Projects

Proposed Vegetation Management										
PROJECT ID	**PROJECT DESCRIPTION**	**ACRE**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
LLVM01	Vegetation management: clearing of invasive/aggressive woody species diameter at breast height (DBH) <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.62	$20,000.00	$12,400.00	Mundelein Park District, Private Property	High	N/A	N/A	N/A	N/A
LLVM02	Vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.98	$20,000.00	$19,600.00	Mundelein Park District	High	N/A	N/A	N/A	N/A
LLVM03	Vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.90	$20,000.00	$18,000.00	Private Property	High	N/A	N/A	N/A	N/A

LLVM04	Vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.44	$20,000.00	$8,800.00	Private Property	High	N/A	N/A	N/A	N/A
LLVM05	Vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.18	$20,000.00	$3,600.00	Private Property	High	N/A	N/A	N/A	N/A
LLVM06	Vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.22	$20,000.00	$4,400.00	Private Property	High	N/A	N/A	N/A	N/A
LLVM07	Vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.45	$20,000.00	$9,000.00	Private Property	High	N/A	N/A	N/A	N/A
LLVM08	Vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.21	$20,000.00	$4,200.00	Private Property	High	N/A	N/A	N/A	N/A

Table 4: Loch Lomond Proposed Streambank Stabilization Projects

Proposed Streambank Stabilization[22]										
PROJECT ID	**PROJECT TYPE**	**LN FT**	**UNIT COST**	**TOTAL COST**	**PROJECT SUPPORT**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
LLSBS01	Stabilize the streambanks from previous stabilization activities to the retention pond of Bull Creek. Clear invasive and aggressive vegetation and plant low profile native species. Stabilization should include stone toe stabilization practices.	873.10	$50.00	$43,655.14	Multiple Private Resident Parcels	High	2.98	1.15	5.97	2.20
LLSBS02	Stabilize the streambanks of Bull Creek from retention pond into Loch Lomond. Clear invasive and aggressive vegetation. Stabilization should include stone toe stabilization practices.	1,028.15	$70.00	$71,970.63	Multiple Private Resident Parcels and Mundelein Park District.	High	18.22	1.36	7.03	2.59
LLSBS03	Stabilize the streambanks of tributary to Loch Lomond lake. Clear invasive and aggressive vegetation and plant low profile native species. Stabilization should include stone toe stabilization practices.	697.84	$50.00	$34,892.24	Multiple Private Resident Parcels	Medium	9.05	0.92	4.77	1.76

[22] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

LLSBS04	Stabilize the streambanks of tributary to Loch Lomond lake. Clear invasive and aggressive vegetation and plant low profile native species. Stabilization should include stone toe stabilization practices.	626.02	$60.00	$37,561.34	Multiple Private Resident Parcels	Medium	6.54	0.83	4.28	1.58
LLSBS05	Stabilize the streambanks of tributary to Loch Lomond lake. Clear invasive and aggressive vegetation and plant low profile native species. Stabilization should include stone toe stabilization practices. A 40-ln ft (both banks) section of the stream needs a retaining wall replacement.	850.33	$150.00	$127,549.70	Multiple Private Resident Parcels	High	7.03	1.12	5.81	2.14
LLSBS06	Stabilize the streambanks of tributary to Loch Lomond lake. Clear invasive and aggressive vegetation and plant low profile native species. Stabilization should include stone toe stabilization practices.	1,026.65	$50.00	$51,332.71	Multiple Private Resident Parcels	Medium	6.78	1.35	7.02	2.58

Table 5: Loch Lomond Proposed In-Stream Stabilization Projects

Proposed In-Stream Stabilization										
PROJECT ID	**PROJECT DESCRIPTION**	**SQ FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**

LLSS01	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	149.08	$33.00	$4,919.64	Mundelein Park District	Medium	N/A	N/A	N/A	N/A
LLSS02	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	275.09	$33.00	$9,077.97	Mundelein Park District	Medium	N/A	N/A	N/A	N/A
LLSS03	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	363.85	$33.00	$12,007.05	Mundelein Park District	High	N/A	N/A	N/A	N/A
LLSS04	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	69.12	$33.00	$2,280.96	Private Residence	Low	N/A	N/A	N/A	N/A
LLSS05	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	147.03	$33.00	$4,851.99	Private Residence	High	N/A	N/A	N/A	N/A

General Notes:

1. The Probable Cost Estimates do not include field surveys, permitting costs and engineering services if needed.
2. Cost will vary pending the phasing and scope of work implemented. Probable additional cost dependent on project owner, consultant, contracting team: Permitting/Engineering +30%, Mobilization +10%, Maintenance/Restoration +5%.
3. Pending the project/s and prior to finalizing a scope of work a professional field survey may be needed.
4. Pending the scope of project/s being implemented, soliciting a permit from the municipality, county, state and/or federal government of jurisdiction may be needed.
5. The probable cost does not include costs for bidding services, mobilization, or temporary construction access costs if needed.
6. The probable cost does make an estimated cost based on the presumed material and labor to implement a project.
7. Pending the funding sources and the requirements of the funding sources, permanent drainage and/or conservation easements may be needed if they do not currently exist to implement public funds on private land holdings. Costs for implementing easements are not addressed in the probable cost.

3.2 Lake & Lake Shoreline Restoration Opportunities in Loch Lomond Study Area

This section of the plan will provide an overview of lake and lake shoreline restoration practices and programs recommended for lake and lake shoreline restoration opportunities identified during the field assessment work or developed to address issues identified during the field assessment work. It will include conceptual designs, complete with planning level cost-estimates and preliminary pollutant load reduction estimates for the potential restoration opportunities.

3.2.1 Potential Lake & Lake Shoreline Restoration Programs

This section of the plan will provide a summary of the project-type opportunities (i.e., site-specific opportunities) identified during the field assessment work developed, to address issues identified during the field assessment work. Individual program opportunities may be further developed through the identification of the next steps toward program implementation.

In following are identified stakeholder support and outreach program recommendations to continue ongoing awareness, education, or housekeeping activities. SMC offers an array of educational stormwater best practice resources for the Lake County Community (https://lakecountyil.gov/2261/Stormwater-Best-Practices).

- Stakeholders to offer native vegetation management reference resources.
- Stakeholders to offer invasive species identification reference resources (terrestrial, aquatic, plants, animals, insects).
- Pesticide awareness on property management.
- Fertilizer awareness on property management.
- Site specific water infiltration/reuse awareness
    - Rain water harvesting opportunities.
    - Shoreline buffer enhancement, maintenance, or preservation.
    - Cleaning of boats or other aquatic recreation items to minimize the transfer of invasive species.
- Stormwater runoff education
    - Eliminate the long-term or temporary storage of vegetative debris in streets, catch basins, or in drainage paths.
    - Proper trash disposal or use of SWALCO hazardous household collection or recycling facilities for disposal.

3.2.2 Potential Lake & Lake Shoreline Restoration Projects

This section of the plan will provide a summary of the project-type opportunities (i.e., site- or reach-specific opportunities) – identified during the field assessment work or developed to address issues identified during the field assessment work. Individual projects for which preliminary concept designs were not developed may be further developed through the identification of the next steps toward project implementation.

Table 6: Loch Lomond Proposed In-Lake Habitat Enhancement Projects

Proposed In-Lake Habitat Enhancement[23]										
PROJECT ID	**PROJECT DESCRIPTION**	**SQ FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (lb./year)**
LLFTW01	Installation of a floating treatment wetland.	1,149.33	$20.00	$22,986.60	Loch Lomond HOA, Shoreline placement in open water of Loch Lomond Lake.	High	50.52	6.43	9.19	360.82
LLFTW02	Installation of a floating treatment wetland.	988.71	$25.00	$24,717.75	Private Residence and Loch Lomond HOA, Shoreline placement in open water of Loch Lomond Lake.	High	43.47	5.53	7.91	310.49
LLFTW03	Installation of a floating treatment wetland.	656.79	$20.00	$13,135.80	Private Residence and Loch Lomond HOA, Shoreline placement in open water of Loch Lomond Lake.	High	50.52	6.43	9.19	360.82
LLFTW04	Installation of a floating treatment wetland.	1,673.26	$20.00	$33,465.20	Loch Lomond HOA, Shoreline placement in open water of Loch Lomond Lake.	High	43.47	5.53	7.91	310.49
LLFTW05	Installation of a floating treatment wetland.	23,660.94	$20.00	$473,218.80	Loch Lomond HOA, Shoreline placement in open water of Loch Lomond Lake	Medium	28.88	3.68	5.25	206.25
LLFTW07	Installation of a floating	11,333.41	$25.00	$283,335.25	Loch Lomond HOA, Island in open water of	Medium	73.56	9.36	13.39	525.46

[23] Preliminary Pollutant Load Reductions from vendor water quality monitoring research, (http://www.floatingislandinternational.com/research/research-papers/).

	treatment wetland.				Loch Lomond Lake.					
LLFTW08	Installation of a floating treatment wetland.	14,444.20	$25.00	$361,105.00	Loch Lomond HOA, Placement in open water of Loch Lomond Lake	Low	1040.24	132.39	189.29	7430.28
LLFTW09	Installation of a floating treatment wetland.	11,334.64	$25.00	$283,366.00	Loch Lomond HOA, Island in open water of Loch Lomond Lake	Medium	498.27	63.42	90.67	3559.05
LLFTW10	Installation of a floating treatment wetland.	11,334.64	$25.00	$283,366.00	Loch Lomond HOA, Island in open water of Loch Lomond Lake	Low	635.03	80.82	115.55	4535.93

General Notes:

1. The Probable Cost Estimates do not include field surveys, permitting costs and engineering services if needed.
2. Cost will vary pending the phasing and scope of work implemented. Probable additional cost dependent on project owner, consultant, contracting team: Permitting/Engineering +30%, Mobilization +10%, Maintenance/Restoration +5%.
3. Pending the project/s and prior to finalizing a scope of work a professional field survey may be needed.
4. Pending the scope of project/s being implemented, soliciting a permit from the municipality, county, state and/or federal government of jurisdiction may be needed.
5. The probable cost does not include costs for bidding services, mobilization, or temporary construction access costs if needed.
6. The probable cost does make an estimated cost based on the presumed material and labor to implement a project.
7. Pending the funding sources and the requirements of the funding sources, permanent drainage and/or conservation easements may be needed if they do not currently exist to implement public funds on private land holdings. Costs for implementing easements are not addressed in the probable cost.

3.3 Upland Area Restoration Opportunities in Loch Lomond Study Area

This section of the plan will provide an overview of upland restoration practices and will present the upland restoration opportunities identified during the field assessment work or developed to address issues identified during the field assessment work. It will include – as applicable – tables and maps, complete with planning level cost-estimates and preliminary pollutant load reduction estimates for the potential restoration opportunities.

3.3.1 Potential Upland Area Restoration Programs

This section of the plan will provide a summary of the project-type opportunities (i.e., site-specific opportunities) identified during the field assessment work or developed to address issues identified during the field assessment work. Individual program opportunities may be further developed through the identification of the next steps toward program implementation.

In following are identified stakeholder support and outreach program recommendations to continue ongoing awareness, education, or housekeeping activities. SMC offers an array of educational stormwater best practice resources for the Lake County Community (https://lakecountyil.gov/2261/Stormwater-Best-Practices).

- Stakeholders to offer native vegetation management reference resources.
- Stakeholders to offer invasive species identification reference resources (terrestrial, aquatic, plants, animals, insects).
- Pesticide awareness on property management.
- Fertilizer awareness on property management.
- Site specific water infiltration/reuse awareness
    - Rain water harvesting opportunities.
    - Shorelines of water bodies located outside of FEMA floodplains require buffer enhancement, maintenance, or preservation.
    - Naturalization of turf drainage ditches with low-profile native plant species.
    - Tree Planting installation program in right of ways and private property where suitable.
- Stormwater runoff education
    - Eliminate the storage of vegetative debris in streets, catch basins, or in drainage paths.
    - Proper trash disposal or use of SWALCO hazardous household collection or recycling facilities for disposal.
    - Proper siting of housekeeping activities (i.e. pool cleaning, car washes, equipment storage as examples).
    - Storm drain stenciling/marking program for all inlets.

3.3.2 Potential Upland Area Restoration Projects

This section of the plan will provide a summary of the project opportunities, including stormwater retrofits – identified during the field assessment work to address identified issues. Individual projects for which preliminary concept designs were not developed may be further developed through the identification of the next steps toward project implementation.

Table 7: Loch Lomond Proposed Wetland Restoration Projects

Proposed Wetland Restoration[24]										
PROJECT ID	**PROJECT DESCRIPTION**	**ACRE**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
LLWR01	Existing wetland captures parking lot runoff. Proposed increase of wetland size to capture additional stormwater runoff prior to entering Bull Creek.	0.54	$30,000.00	$16,200.00	Mundelein Park District	High	N/A	N/A	N/A	N/A
LLWR02	Existing wetland receives stormwater runoff from residential properties, local streets and Route 45. Proposed increase of wetland storage capacity by deepening portions of the wetland for increased filtration and reduction of pollutant loads from entering Loch Lomond lake.	5.47	$40,000.00	$218,800.00	Mundelein Park District and Private Residence's	Medium	N/A	N/A	N/A	N/A
LLWR03	Existing wetland receives stormwater runoff from Route 45, which has hydraulic connectivity to Loch Lomond lake via culverts and underground stormsewer lines. Proposed increase of wetland storage capacity by deepening portions of the wetland for increased filtration and reduction of pollutant loads from entering Loch Lomond lake.	2.18	$20,000.00	$43,600.00	Archdiocese of Chicago	Medium	N/A	N/A	N/A	N/A

[24] Wetland modification recommendations are intended to increase collection and first flush filtration of runoff pollutants during small rain events.

LLWR04	Existing wetland receives stormwater runoff from residential properties, local streets, and actively used agricultural lands which discharges into Bull Creek. Proposed stabilization of streambanks and outfall area with stone practices to minimize soil erosion.	0.84	$40,000.00	$33,600.00	Hampton Reserve HOA	Medium	N/A	N/A	N/A	N/A

Table 8: Loch Lomond Proposed Drainage Basin Enhancement Projects

Proposed Drainage Basin Enhancements[25]										
PROJECT ID	**PROJECT DESCRIPTION**	**LN FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
LLDB01	Create a dry detention basin to capture runoff from fields, stabilize the inlet and outlet drainage paths with stone, and replace turf slopes with native low-profile plant species.	20,534.67	$5.00	$102,673.35	Mundelein Park District	High	1.32	0.24	-	61.61
LLDB02	Dry detention basin, meander the drainage path within the basin, stabilize the drainage path with stone, and replace turf slopes with native low-profile plant species.	26,068.44	$5.00	$130,342.20	Mundelein Park District	High	1.68	0.30	-	78.21
LLDB03	Dry detention basin, stabilize the drainage path with stone and replaced turf slopes with native low-profile plant species.	10,189.40	$4.00	$40,757.60	Mundelein Park District	Low	0.66	0.12	-	30.57
LLDB04	Create a rain garden to capture runoff from road and	24,682.59	$8.00	$197,460.72	Hickory Hills Estates HOA	Medium	1.59	0.29	-	74.06

[25] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

	residential properties and replace turf slopes with native low-profile plant species.									
LLDB05	Create a right of way rain garden for road runoff, stabilize the bottom with stone and the outfall with stone, and replace turf slopes with native low-profile plant species.	4,027.46	$8.00	$32,219.68	Loch Lomond HOA	High	0.26	0.05	-	12.08
LLDB06	Create a rain garden to capture runoff from road and residential properties and replace turf slopes with native low-profile plant species.	5,040.74	$8.00	$40,325.92	Mundelein Park District	Low	0.33	0.06	-	15.12
LLDB07	Expand the drainage basin to capture runoff from parking lot, and residential properties, stabilize inlet and outlet with stone, and replace turf slopes with native low-profile plant species.	7,636.02	$7.00	$53,452.14	Mundelein School District	High	0.49	0.09	-	22.91
LLDB08	Create a rain garden basin to capture runoff from parking lot and replace turf slopes with native low-profile plant species.	2,854.36	$6.00	$17,126.16	Mundelein School District	Low	0.18	0.03	-	8.56
LLDB09	Create a pocket park and rain garden to capture runoff from road and residential properties and replace turf slopes with native low-profile plant species.	8,984.01	$9.00	$80,856.09	Loch Lomond HOA	High	0.58	0.10	-	26.96

Table 9: Loch Lomond Proposed Permeable Pavement Projects

Proposed Permeable Pavement[26]										
PROJECT ID	**PROJECT DESCRIPTION**	**SQ FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
LLPP01	Conversion of traditional pavement surfaces to a permeable pavement. Expectations are decreased stormwater runoff into Loch Lomond.	14,067.87	$10.00	$140,678.70	Village of Mundelein and Loch Lomond HOA	Medium	1.29	0.16	-	50.72
LLPP02	Conversion of traditional pavement surfaces to a permeable pavement. Expectations are decreased stormwater runoff into Loch Lomond from a smaller catchment with direct discharge into Loch Lomond.	8,864.14	$10.00	$88,641.40	Mundelein School District	High	0.81	0.10	-	31.96
LLPP03	Conversion of traditional pavement surfaces to a permeable pavement. Expectations are decreased stormwater runoff into Loch Lomond from a smaller catchment with direct discharge into Loch Lomond.	13,998.39	$10.00	$139,983.90	Mundelein School District	High	1.28	0.16	-	50.47
LLPP04	Conversion of traditional pavement surfaces to a permeable pavement. Expectations are decreased stormwater runoff into Loch Lomond from a smaller	23,750.40	$10.00	$237,504.00	Mundelein School District	High	2.17	0.27	-	85.63

[26] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

	catchment with direct discharge into Loch Lomond.									
LLPP05	Conversion of traditional pavement surfaces to a permeable pavement. Expectations are decreased stormwater runoff into Loch Lomond.	14,710.01	$10.00	$147,100.10	Mundelein Park District	Low	1.35	0.17	-	53.04
LLPP06	Conversion of traditional pavement surfaces to a permeable pavement. Expectations are decreased stormwater runoff into Loch Lomond.	35,748.56	$10.00	$357,485.60	Mundelein Park District	Medium	3.27	0.40	-	128.89
LLPP07	Conversion of traditional pavement surfaces to a permeable pavement. Expectations are decreased stormwater runoff into Loch Lomond.	4,165.28	$10.00	$41,652.80	Mundelein Park District	Low	0.38	0.05	-	15.02
LLPP08	Conversion of traditional pavement surfaces to a permeable pavement. Expectations are decreased stormwater runoff into Loch Lomond.	2,409.37	$10.00	$24,093.70	Mundelein Park District	Low	0.22	0.03	-	8.69

General Notes:

1. The Probable Cost Estimates do not include field surveys, permitting costs and engineering services if needed.
2. Cost will vary pending the phasing and scope of work implemented. Probable additional cost dependent on project owner, consultant, contracting team: Permitting/Engineering +30%, Disposal +10%, Mobilization +10%, Maintenance/Restoration +5%.
3. Pending the project/s and prior to finalizing a scope of work a professional field survey may be needed.
4. Pending the scope of project/s being implemented, soliciting a permit from the municipality, county, state and/or federal government of jurisdiction may be needed.
5. The probable cost does not include costs for bidding services, mobilization, or temporary construction access costs if needed.
6. The probable cost does make an estimated cost based on the presumed material and labor to implement a project.
7. Pending the funding sources and the requirements of the funding sources, permanent drainage and/or conservation easements may be needed if they do not currently exist to implement public funds on private land holdings. Costs for implementing easements are not addressed in the probable cost.

4. Loch Lomond Study Area Small Watershed Action Plan – Implementation Strategy

The watershed restoration opportunities and goals, recommended in this plan are based on the results of the desktop & field assessment work. The intent of this report is to empower stakeholder support in maintaining an implementation strategy for watershed restoration programs and projects in the small watershed study area. The SWAAP-LL report focused on high priority practices – where prioritization is based on evaluation and prioritization criteria goals.

Although there are a significant number of stormwater-related issues found within the SWAAP-LL area, promising opportunities exist to address these issues through a sustainable approach to stormwater management. As reflected in the summary of potential solutions and recommendations presented in Section 3.0, Inventory of Watershed Restoration Opportunities in the Loch Lomond Study Area, stormwater-related damage to structures and infrastructure can be reduced and stormwater-related maintenance problems can be fixed through the implementation of projects that achieve the community's stormwater management goals.

In addition to the technical information presented in both Section 2 and 3 and Appendix A regarding the actions and/or projects that could be used to address each of the problem areas found within the community, SMC staff has developed additional information to assist the SWAAP-LL stakeholders in budgeting for, funding, and implementing projects that will resolve the community's stormwater-related issues. This information is presented below.

Preliminary Cost Estimates

SMC staff has developed a preliminary cost estimate for each of the potential solutions and recommendations presented in Section 3. The preliminary cost estimates provide SWAAP-LL stakeholders a budget target. Stakeholders can use the detailed information to solicit and/or secure funding to implement projects that will resolve the community's stormwater-related issues. It should be noted that the preliminary cost estimates provided in Section 3 tables are based on the potential solutions and recommendations presented in the preliminary concept designs presented in Appendix A.

Such solutions, recommendations, and preliminary concept designs were developed based on a preliminary assessment of site conditions and preliminary engineering analyses performed in accordance with acceptable engineering practices. They are provided for planning purposes only. Actual construction costs may vary depending on the results of additional engineering analyses, further assessment of site conditions, timing of construction, availability of materials, construction methods, and other related factors.

Phased Implementation

SMC staff recognizes that the implementation of the potential solutions and recommendations presented in Section 3 will be limited by the amount of funding available. For that reason, the SWAAP-LL stakeholders should take a phased, multi-year approach to resolving the stormwater-related issues found within the community. Each table in section 3, ranks the

community's stormwater-related. This may be used by the SWAAP-LL stakeholders to prioritize future actions to addressing the community's stormwater-related issues (i.e., project selection, funding, and implementation).

Additionally, it should be noted that each of the detailed preliminary concept designs presented in Appendix A includes several individual elements that, when implemented as part of a single, comprehensive project, are expected to fully resolve the stormwater-related issue found within the associated problem area. SMC staff recognizes that the implementation of the individual preliminary concept designs may be limited by the amount of funding available and that, for this reason, the individual elements described in the preliminary concept designs may not be implemented as part of single, comprehensive projects. For this reason, the SWAAP-LL stakeholders may take a phased approach to implementation of the individual preliminary concept designs, selecting the individual elements that will address the community's most immediate and pressing needs for early implementation and delaying implementation of the remainder of the individual elements until additional funding has been compiled.

Potential Funding Sources

Several grants may be available to assist the SWAAP-LL stakeholders with the implementation of projects that follow this plan's guiding principle and achieve the community's comprehensive stormwater management goals. Some potential funding sources are outlined below.

- SMC Watershed Management Board Grant Program: SMC's Watershed Management Board grant program helps fund the planning, design, and implementation of stormwater management projects. Nine project prioritization criteria are considered by SMC staff in the evaluation of grant applications, with the highest priority placed on flood damage prevention/mitigation projects. However, water quality improvement, natural resource preservation and restoration, and green infrastructure projects are also considered. There is a 50% local match requirement, which can be in the form of cash, in-kind services, or both. Applications for Watershed Management Board grant funds are accepted on an annual basis, typically in early October, and approximately $67,620/year of grant funding is typically awarded to projects located in the Des Plaines River Watershed through the program. More information about SMC's Watershed Management Board grant program can be found online: https://lakecountyil.gov/3635/Watershed-Management-Board-WMB.
- Illinois EPA Section 319(h) Grant Program: The Illinois EPA makes grants available to local units of government and other organizations for projects that address nonpoint source pollution through its Section 319(h) grant program. Projects funded under the Section 319(h) grant program must address water quality issues relating directly to nonpoint source pollution. Grant funds can be used for the implementation of Illinois EPA-approved watershed-based plans, including the development of information/education programs and the implementation of best management practices. Illinois EPA receives these grant funds through Section 319(h) of the Clean Water Act and administers the program within Illinois. The maximum federal funding available is 60%, meaning that there is a minimum 40% local match requirement. Applications for Section 319(h) grant funds are accepted on an annual basis, between June 1 and August 1, and between $3,000,000/year and $4,000,000/year have been awarded to projects

around the state through the program in recent years. More information about Illinois EPA's Section 319(h) grant program can be found online: http://www.epa.illinois.gov/topics/water-quality/watershed-management/nonpoint-sources/faqs/index.

Potential Project Partners

Generally, the stormwater stormsewer infrastructure serving the SWAAP-LL area is owned and operated by the Village of Mundelein. However, some of the community's natural stormwater infrastructure is located on land owned by public and private entities and several of the problem areas identified during the field assessment work are located, at least in part, upon land owned by multiple landowners. The stormwater-related issues found within these problem areas are negatively impacting water quality, as well as adjacent land owners property. SMC staff recommends that the SWAAP-LL stakeholders develop a partnership with their respective municipality to implement projects that will resolve the community's stormwater-related issues located in the study area. The resolution of such issues will benefit all stakeholders of the SWAAP-LL study area and downstream communities.

Assistance with Final Design, Permitting, & Construction

Stakeholders pursing recommended projects should consult with SMC or their local municipality on whether a professional engineering firm is required to assist with the implementation of actions and/or projects requiring additional design, permitting, and/or land description revisions. Stakeholders should review experience and body of work when evaluating and selecting, consultants, contractors, and/or construction oversight. Stakeholder's may use the conceptual designs in Appendix A as needed to support the completion of the additional tasks (e.g., additional site investigation, final design, general and technical specification development, permit acquisition, bidding and contract document preparation, contract award, construction observation, construction management) in order to implement any portion of the recommendations projects. While the implementation of many of the solutions and recommendations presented in this plan may not require the completion of additional design or permitting tasks, SMC staff recommends that the stakeholders review its planned actions and/or projects with the relevant local municipality and/or its selected consultant to identify any additional necessary or beneficial design or permitting tasks, such as permit acquisition and bidding and contract document preparation.

5. Buffalo Creek Study Area Small Watershed Assessment

5.1 Summary of Buffalo Creek Study Area Desktop Assessment & Results

The information provided within this section, will characterize the existing conditions within the Buffalo Creek study area (SWAAP-BC). The characterization on current and future water quality impacts as connected to physiographic and/or anthropogenic factors will be assessed to aid in developing future water quality improvement projects. The project recommendations aim to reduce or mitigate stormwater runoff rates, volumes, and pollutant loads and/or improve the condition of receiving waters within the SWAAP-BC.

In this section, existing watershed-based plans and other relevant information, including geographic information system (GIS) data will be described on its function and use in determining project recommendations. The defined data analysis will be utilized in conjunction with field observations to identify specific project recommendations for specific locations with the small watershed study areas.

Small Watershed Study Area Delineation

To determine how water enters the receiving waters within the SWAAP-BC, the local drainage pathways must be identified. Understanding the impacts of small watersheds, is a key first step in determining how a SWAAP-BC will benefit overall water quality within the Des Plaines River Watershed. The SWAAP-BC is within the Willow Creek-Des Plaines River HUC 12: 071200040502 (Figure 15). Buffalo Creek is the main stream corridor in the study area (Assessment Unit ID: IL_GST), (Figure 16).

The boundaries of the SWAAP-BC were delineated using the Arc Hydro GIS modeling tools for Esri ArcMap software to define smaller drainage areas within the larger the Des Plaines River watershed. Arc Hydro is a set of data models and tools that operates within ArcGIS to support geospatial and temporal data analyses specifically to delineate and characterize watersheds in raster and vector formats, define and analyze hydro geometric networks, manage time series data, and configure and export data to numerical models[27].

The Arc Hydro GIS tools analyzed areas in groupings of approximately 500-acres. Storm sewer network[28] data was incorporated into the Arc Hydro model to further refine the small watershed boundaries and more accurately reflect how and where stormwater runoff is impacting the SWAAP-BC area. Refining the small watershed drainage area based on all available data more accurately represents the physiographic and/or anthropogenic factors impact the BMPs selected for water quality improvement projects. The SWAAP-BC areas are based on more detailed analyses of the existing topography then what is used to delineate subwatershed management unit (SMU) in the Des Plaines River Watershed-Based Plan.

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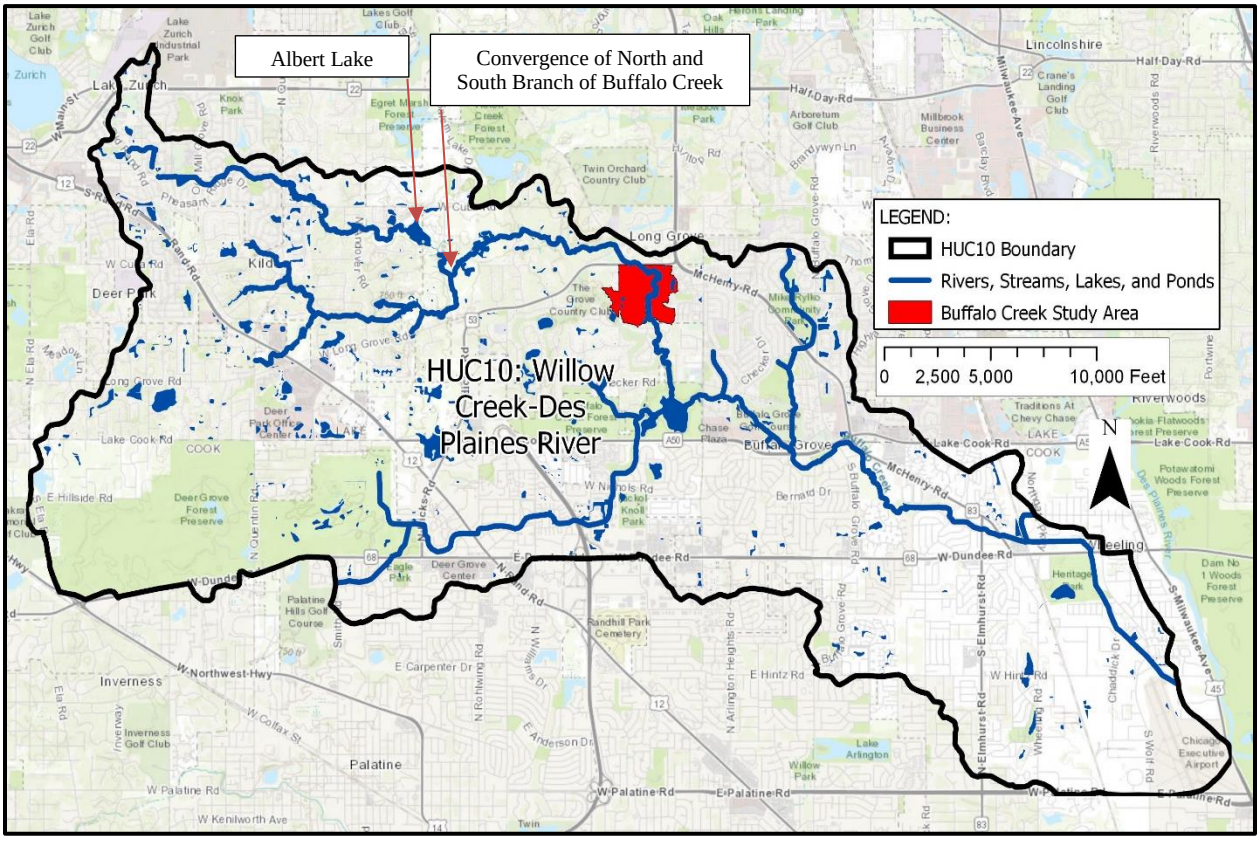
[27] Arc Hydro Website, http://resources.arcgis.com/en/communities/hydro/01vn0000000s000000.htm.

[28] Data provided by: Lake County Dept. of Transportation (culvert data); GIS Consortium (stormsewer network data); The Village of Buffalo Grove (stormsewer network data); The Village of Long Grove (stormsewer network data).

The SWAAP-BC study area is 161 acres (Figure 16, within a drainage area of 6,208 acres (9.70 square miles), which is located within SMC subwatershed management unit (SMU) BC025[29]. There are 28.5 stream miles upstream of the SWAAP-BC, Figure 15.

Figure 15: Buffalo Creek SWAAP-BC HUC 10 Reference



Small Watershed Drainage Delineation and Hydrology

Delineating the natural surface drainage and engineered subsurface drainage networks within the small watersheds, allows for a better comprehension of how and where water enters a lake/pond or linear waterbody. Understanding the movement of water, including how much land is contributing water runoff, where it flows, and the available storage areas for runoff is essential to determine mitigation opportunities for water quality impacts.

The natural drainage pathways of Buffalo Creek have been impacted by damming, redirection, channelization, and urbanization. Buffalo Creek was redirected and channelized within the study area in the early 1970s to accommodate a subdivision in the Village of Buffalo Grove. Buffalo Creek is a heavily developed and densely urbanized subwatershed[30,31], future drainage concerns into Buffalo Creek (AUID: IL_GST) include continued conversion of open space into various

[29] Lake County Stormwater Commission. Des Plaines River Watershed-Based Plan, 2018.
[30] Buffalo Creek Clean Water Partnership and Lake County Stormwater Commission. Buffalo Creek Watershed-Based Plan, 2015.
[31] Lake County Stormwater Commission. Des Plaines River Watershed-Based Plan, 2018.

urban land uses increasing in the ratio of building footprints to open space per parcel of land, with a large footprint of impervious surfaces (Figure 16 and Figure 17).

Figure 16: Buffalo Creek Drainage Area Assessment

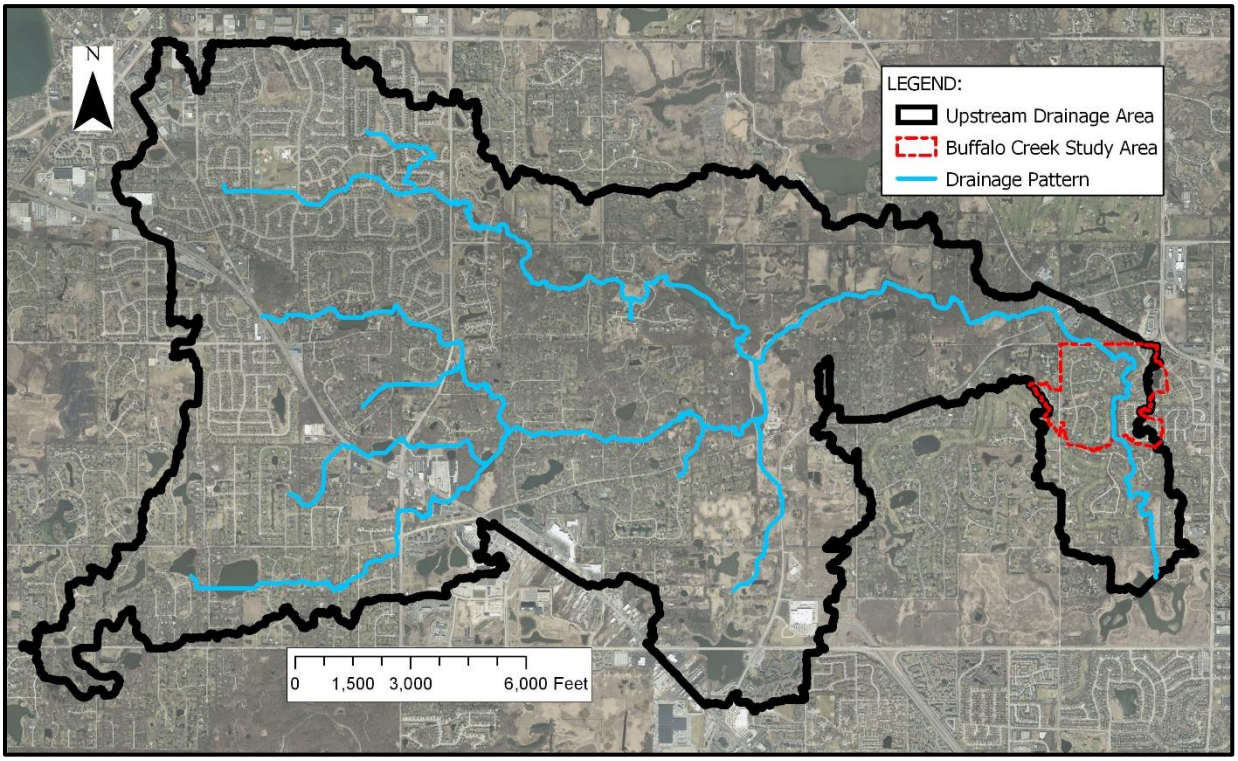


Figure 17: Buffalo Creek Study Area Drainage Assessment

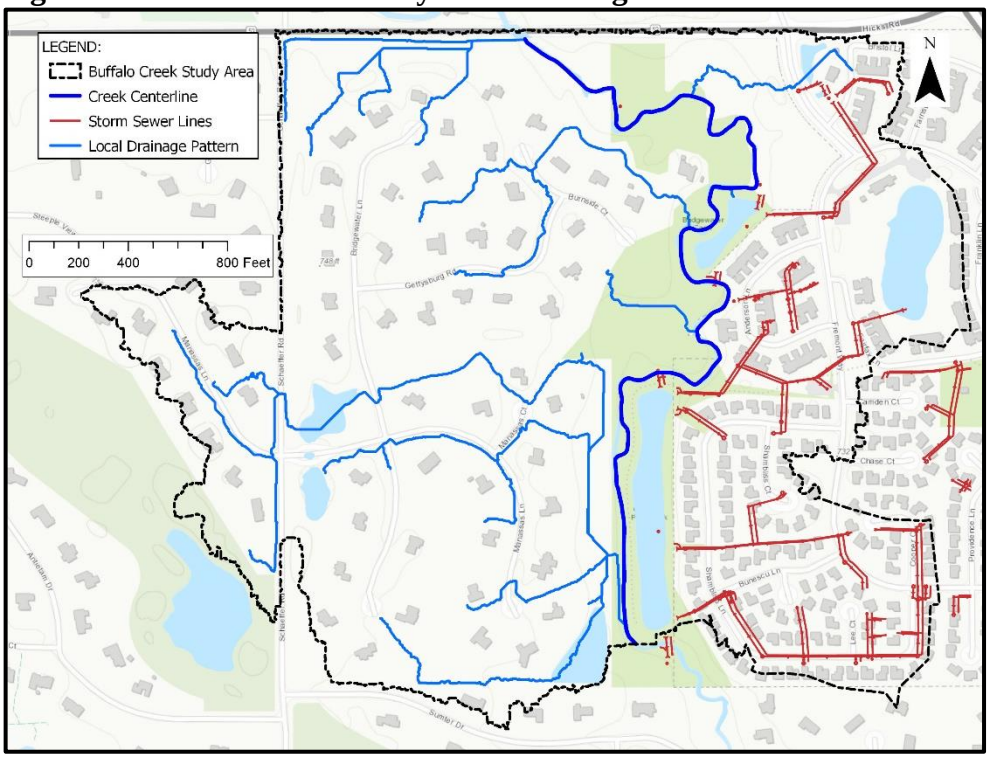
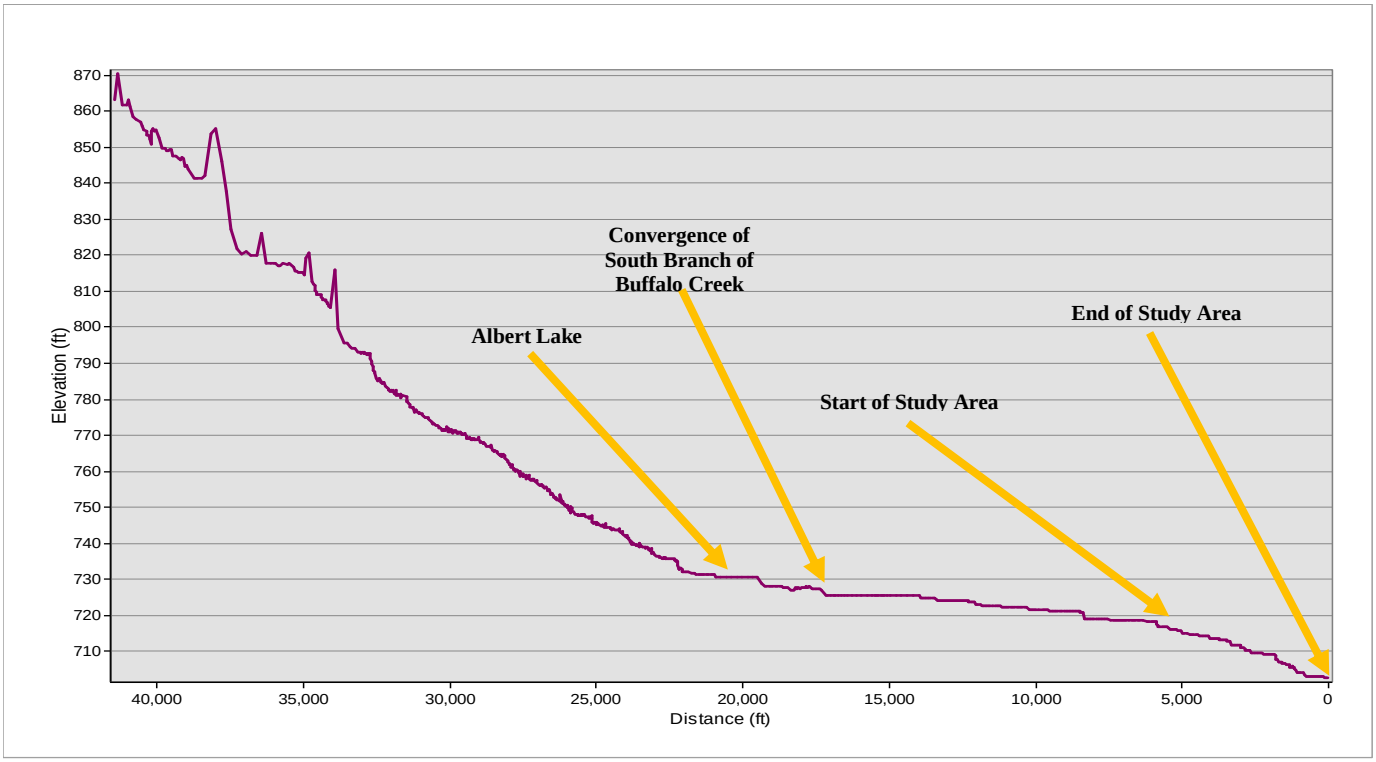


Figure 18: Buffalo Creek Gradient and Study Area Drainage Area

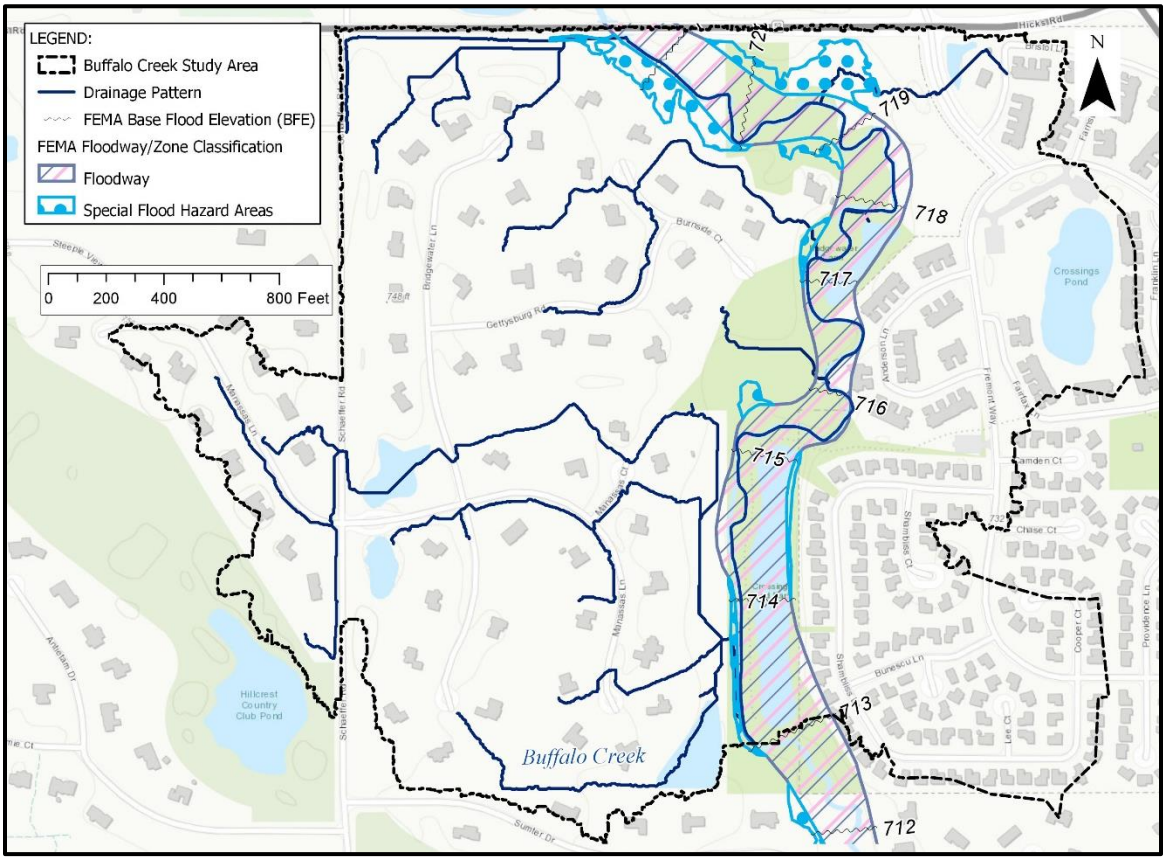


The stream gradient of Buffalo Creek from West to East indicates an elevation drop of 168' over 42,000 ln. ft. along the stream centerline for the main stem of Buffalo Creek (Figure 15 and Figure 18), a relatively flat gradient. The observed spikes in the stream gradient are related to road/bridge decks not removed in the development of the Lake County digital terrain model (DTM) dataset. Observing the stream gradient as it enters the SWAAP-BC study area helps determine how the overall drainage area of 9.70 square miles impacts the SWAAP-BC. The gradient upstream of Lake Albert is six times the observed gradient downstream of Lake Albert. Lake Albert is an observed pooling area for Buffalo Creek, which dissipates creek energy and flow. The convergence of the South Branch of Buffalo Creek 12,000 ln. ft. upstream of the study area adds additional water volume (Figure 16), which enters a pool area that dissipates some of the energy of the intersecting North and South branches of Buffalo Creek.

The flood hazard analysis of Figure 19, indicates some pooling on the northern section of the study area in the FEMA floodway and special flood hazard areas (1.0% Flood Zone or 100-yr Floodplain)[32].

[32] Federal Emergency Management Agency (FEMA). National Flood Hazard Layer (NFHL). (https://hazards.fema.gov/gis/nfhl/rest/services/public/NFHL/MapServer)

Figure 19: Buffalo Creek Flood Hazard Zone Assessment



Open Space Land Assessments and Property Ownership Delineation

Evaluating and assessing the size and proximity of open undeveloped or partially development urbanized landscapes is critical to determine potential BMP locations. Significant land holdings are in private ownership (Figure 20) and have undergone urbanization at varying degrees of land impact. The available open space in the SWAAP-BC includes the Long Grove Park District, the Buffalo Grove Park District, the Bridgewater Farms HOA and the Grove Country Club Golf Course (Grove Acquisitions LLC).

Figure 20: Buffalo Creek Property Ownership Assessment

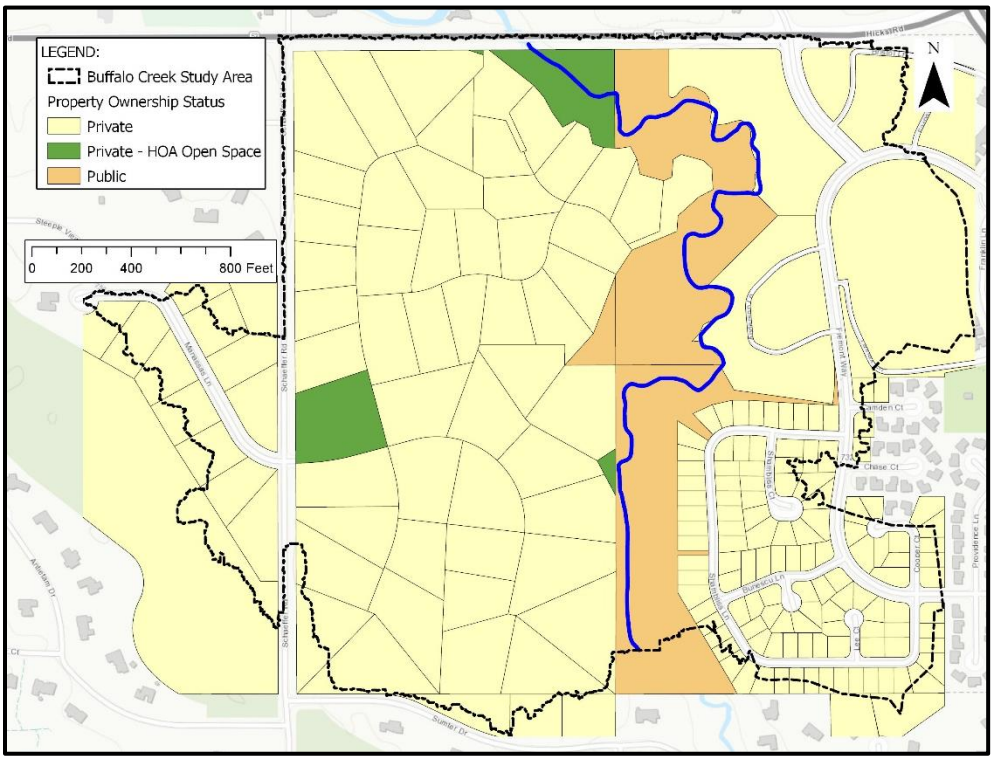
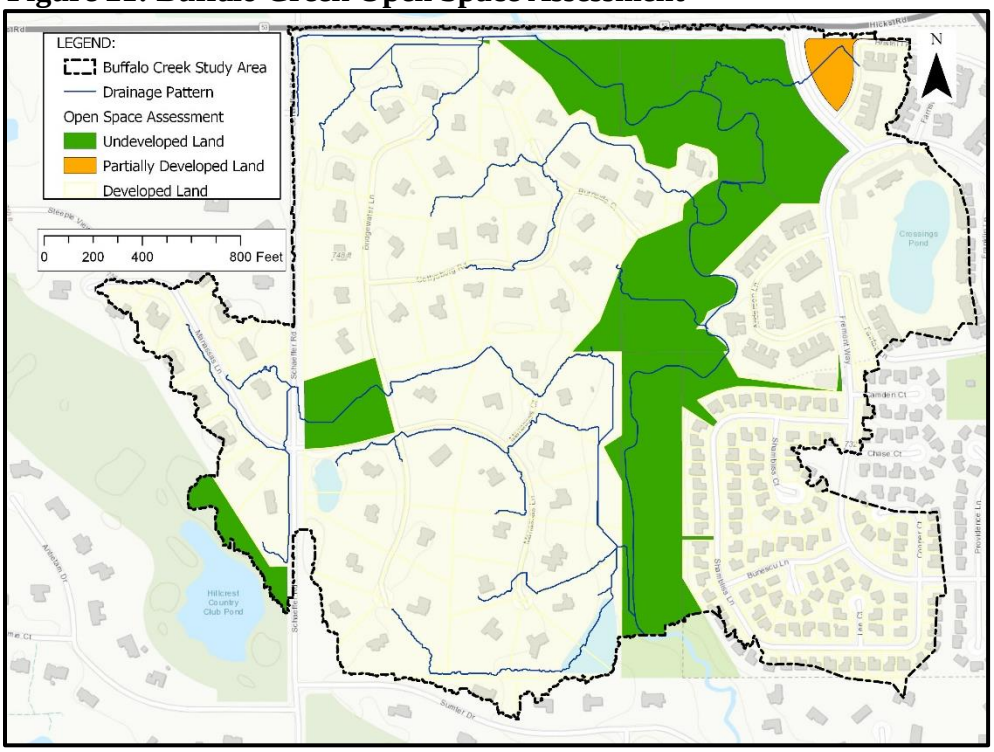


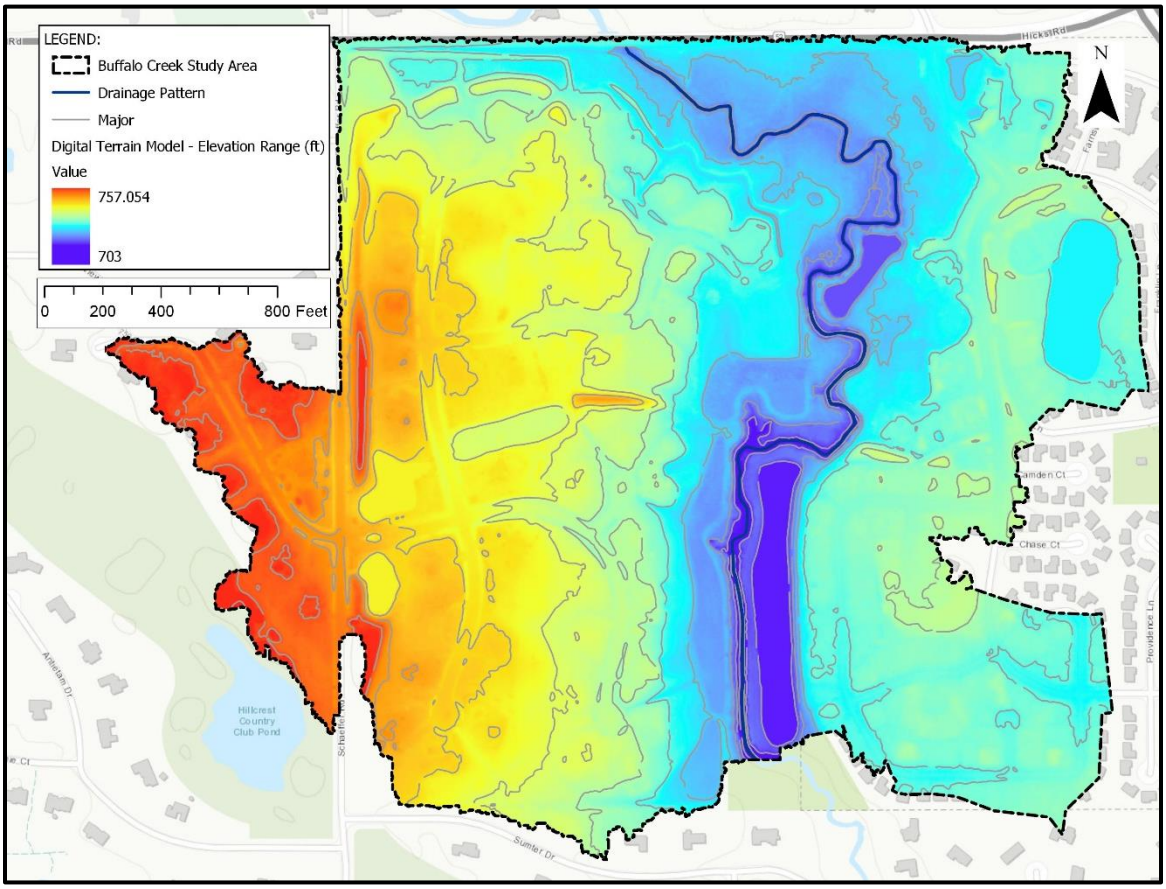
Figure 21: Buffalo Creek Open Space Assessment



Topographical Assessment

A topographical assessment of the existing topography supports our field reconnaissance in identifying areas with possibly eroding streambanks or shorelines based on the severity of the slope steepness near ponds, lakes or linear waterbodies. The slope analysis is completed within the Esri ArcMap software, utilizing a LiDAR derived digital terrain model (DTM)[33]. LIDAR, which stands for Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth[34] and a DTM is a data interpretation of the distance data derived from the remote sensing. Areas that have been determined to be exhibiting potential erosion based on a GIS analysis were reviewed in the field, and recommendations for stabilization have been included in the conceptual drawings.

Figure 22: Buffalo Creek Topographical Assessment

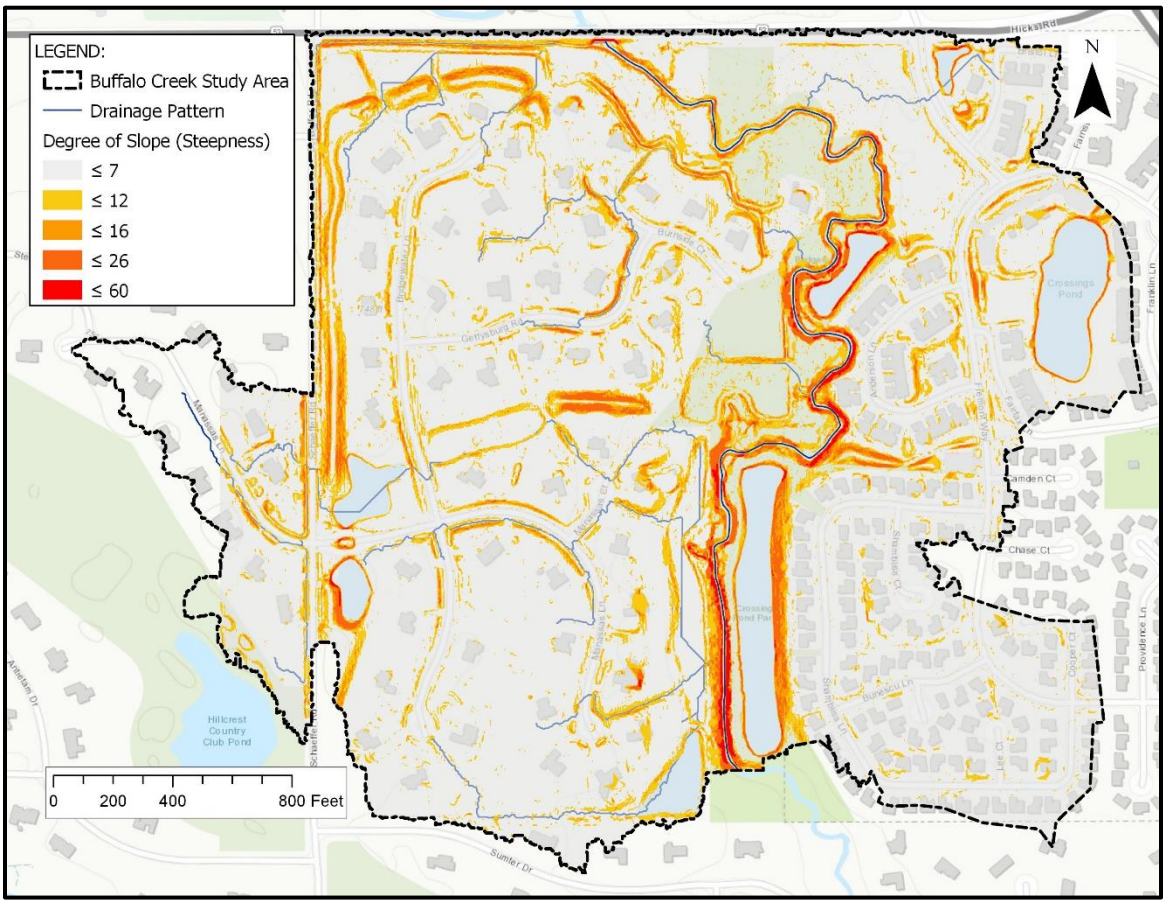


Using the results of the desktop geographic information system (GIS) assessments, key areas were identified within the SWAAP-BC to facilitate field assessment work. The opportunities will be presented as preliminary concept designs projects for future development, funding, and implementation. This initial desktop assessment work is critical in forming a comprehensive understanding of the selected sites prior to conducting a more detailed on-the-ground assessment of watershed conditions and potential watershed protection and restoration opportunities.

[33] Lake County GIS. DTM Data, 2007. (https://s3.amazonaws.com/lakecountygis-public/topography.html).
[34] LiDAR Description & Function, https://oceanservice.noaa.gov/facts/lidar.html

The GIS analysis identified areas of concern within the SWAAP-BC, particularly along streambanks, retention pond shorelines, and steep roadside drainage swales which is an anticipated result of urbanization impacts of natural waterways.

Figure 23: Buffalo Creek Steep Slope Assessment



5.2 Summary of Buffalo Creek Study Area Field Assessments & Results

Field assessment data collection determines the validity and accuracy of GIS desktop assessments. Field results benefit the calibration of the models for watershed protection and restoration opportunities. Esri software offers multiple tools for accomplishing desktop and field assessments and field inventorying. GIS derived desktop analyses data was imported into ArcGIS online for real-time data access while in the field and accessible via a tablet connected to the cellular network. Field verification of open space, drainage pathways, riparian habitat and slope inventory data, were observed and noted for comparison to desktop data. Observations noted that may impact BMP siting includes: implementation of previously implemented slope stabilization practices by homeowners, and coordination of storm sewer network (functionality, condition, and ownership).

5.2.1 Stream & Stream Corridor Assessment

Introduction

The Lake County Stormwater Management Commission (SMC) conducted an on-the-ground assessment of stream characteristics to evaluate conditions within the corridor of the SWAAP-BC stream network. Though not specifically assessed, observed aquatic and riparian life were recorded. The stream assessment inventoried 4,433 ln. ft. of stream channel within the SWAAP-BC in September 2017 (Figure 24). Supplemental stream assessment data was also used from the 2015 Buffalo Creek stream inventory.

Methods

Inventory methodology included walking the entire reach, measuring channel dimensions, noting streambank and riparian conditions, and documenting hydraulic structures and discharge points using a standardized database. A digital camera with an integrated Global Positioning System (GPS), was used to take geolocated photographs during the stream assessment. The major stream characteristics evaluated included:

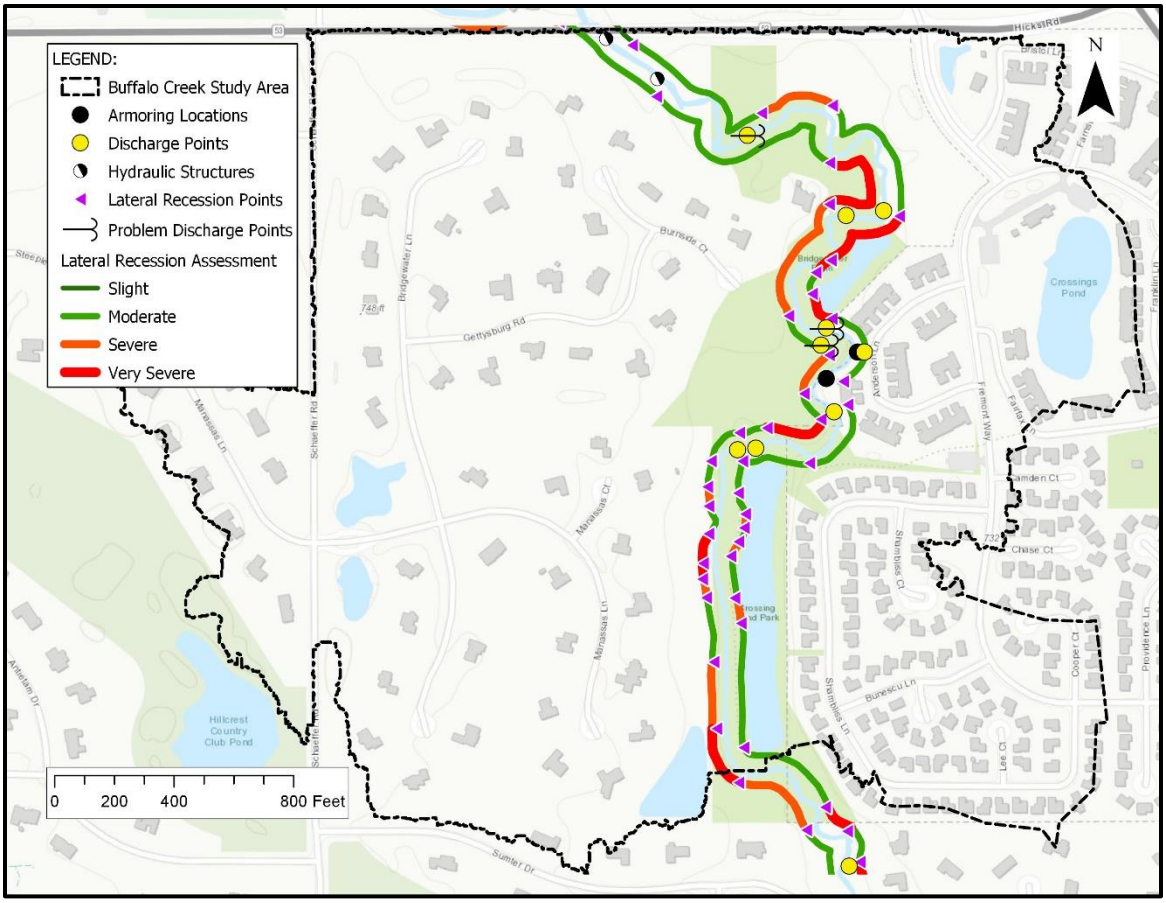
- Channel conditions (physical dimensions, degree of bank erosion, degree of channel erosion, sediment accumulation, debris load, pool/riffle development);
- Hydraulic structures (bridges, culverts, dams and weirs);
- Discharge points (pipes, drain tiles, stormsewers, tributary streams and swales);
- Riparian corridor (floodplain and streambank land use and cover); and,
- Aquatic habitat (substrate composition and in-stream cover).

Although some quantitative data was collected such as channel width, discharge point sizes and hydraulic structure measurements, the condition of the creek was largely assessed using a qualitative method that involved visually inspecting and rating each stream reach as low, moderate, or high for the characteristic being evaluated. A more detailed description of the stream assessment can be observed here: https://lakecountyil.maps.arcgis.com/home/webmap/viewer.html?webmap=c6beeb2a08d149b1a35e89eab50538cc.

Results and Discussion

The stream assessment identified an extensive amount of vegetative species that are not native nor conducive for effective slope stabilization along the stream channels. Much of the stream channels are dominated by a dense canopy and understory of ornamental and/or non-native invasive species (Buckthorn, European Mulberry, Eastern Cottonwood, Norway Maple, Boxelder and Silver Maple, and Multiflora Rose). The dense canopy prevents native riparian grasses and forbs from establishing in populations significant enough to prevent soil loss. Trees are losing the soil mass around their roots and falling into the stream channels, eventually developing debris jams or a redirection of the normal stream thalweg, promoting new sources of slope instability and streambank erosion. Native plant vegetation has evolved to thrive, stabilize and mitigate soil loss with deep root systems within these types of stream corridors. The assessed section of Buffalo Creek has 33 debris jams from trees undercut by streambank failure, with 22 of the debris jams substantially altering the creek flow and increasing slope erosion as a new thawleg develops along the newly eroded streambanks. The volume and velocity of water moving through Buffalo Creek channel combined with the lack of suitable vegetation has impacted streambanks and overland drainage paths.

Figure 24: Buffalo Creek Stream Assessment



Upstream development of the SWAAP-BC, is regulated by the Lake County, IL watershed development ordinance (WDO), https://www.lakecountyil.gov/2358/Watershed-Development-Ordinance. Per the WDO, site impact must comply with construction sediment and erosion control site protections to maximize water quality. Compliance is completed by self-reporting, community and inspector reporting to ensure compliance. Soil erosion contributes phosphorus and nitrogen as the soil particles are released into the water column by erosive forces. Ongoing land use concerns related to stormwater runoff is a problem from land development prior to the WDO establishment in 1992, where many communities installed non-existent, inadequate or undersized stormwater management systems to mitigate runoff before entering a natural drainage system. The runoff volume and velocity from areas of high impervious cover negatively affects the conditions within the stream corridor.

IEPA 2016 Integrated Water Quality Report

- Buffalo Creek (AUID: IL_GST) has been identified as impaired for TSS for the in the 303(d) Program[35].

[35] Illinois Environmental Protection Agency. Illinois Integrated Water Quality Report and Section 303(d) List Volume I: Surface Water, 2016. (http://www.epa.illinois.gov/topics/water-quality/watershed-management/tmdls/303d-list/index).

- Buffalo Creek (AUID: IL_GST)) has been identified for the following impairments, potential pollutant sources, and designated use classification in the 305(b) Program[36].
    - Potential Pollutant Causes: Chloride, Oxygen Dissolved, TSS, Fecal Coliform
    - Potential Pollutant Sources: Urban Runoff/Storm Sewers, Source Unknown
    - Designated Uses: Not Supporting Aquatic Life, Not Assessed Fish Consumption, Not Supporting Primary Contact, Not Assessed Secondary Contact, Not Assessed Aesthetic Quality

IEPA 2013 Stream Approved TMDL[37]

- Watershed: Des Plaines/ Higgens Creek
- Segment Name: Buffalo Creek
- Impairment: Ammonia, CBOD, Chloride, DO, Fecal Coliform
- Status: TMDL Approved, Approval Date: August 25, 2013

Buffalo Creek's biological integrity[38] has been determined to be relatively poor to non-existent for fish and macroinvertebrate diversity and establishment within Buffalo Creek. Buffalo Creek has been impacted by damming, redirection, channelization and urbanization. No upstream hydraulic connectivity exists for aquatic species within the Buffalo Creek stream corridor North of the Buffalo Creek reservoir (AUID: IL_SGC).

BMPs will benefit the long-term stability within the stream corridors. BMP recommendations will include thinning the vegetative canopy, stone armoring on stream channel slopes where appropriate, in stream stone riffles, stone stabilization of upstream tributaries, and incorporation of naturalized detention basins for offsite runoff into the natural drainage pathways.

5.2.2 Pond Shoreline Assessment

Introduction

The Lake County Stormwater Management Commission (SMC) conducted an on-the-ground assessment of the pond characteristics. Though not specifically assessed, the lake/pond assessment also recorded observed aquatic and aquatic life. The SWAAP-BC shoreline assessment inventoried approximately 4,338 ln. ft. of shoreline of the three retention ponds in September 2017.

Methods

Inventory methodology included walking the shoreline where accessible, noting shoreline conditions, and documenting hydraulic structures and discharge points if there are probable impacts to water quality. The major shoreline characteristics evaluated include:

- Conditions (degree of bank erosion, sediment accumulation, debris load)
- Hydraulic structures (bridges, culverts, dams and weirs)
- Discharge points (pipes, drain tiles, and stormsewers)

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[36] Illinois Environmental Protection Agency. Illinois Integrated Water Quality Report and Section 303(d) List Volume I: Surface Water, 2016. (http://www.epa.illinois.gov/topics/water-quality/watershed-management/tmdls/303d-list/index).

[37] United States Environmental Protection Agency. Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs). (https://www.epa.gov/tmdl).

[38] Des Plaines River Watershed Workgroup's (DRWW). Bioassessment Report, In development.

- Corridor (floodplain, land use and cover)
- Aquatic habitat (substrate composition and lake cover)

The shoreline assessment was largely assessed using a qualitative method that involved visually inspecting and identifying whether the shoreline was impacting water quality.

5.2.2.1 Pond Water Quality

Lake Reports

The Lake County Health Department does not monitor the water quality of the retention ponds in the study area. No active water quality monitoring program exists for these retention ponds.

5.2.2.2 Pond Shoreline Assessments

A full shoreline erosion assessment was completed for Crossings Pond 1 (2.138 acres), Crossings Park Pond (2.38 acres), and the Bridgewater Farm Park Pond (0.579 acres). One hundred percent of the shorelines are eroding with the major shoreline type being turfgrass lawn. The shoreline was evaluated for none, slight, moderate and severe erosion based on exposed soil and tree/plant roots, failing infrastructure, undercut banks, and other signs of erosion. Based on the assessment 100% of the shoreline had moderate to severe erosion. There is no aquatic shoreline vegetation present in the water.

Current practices to improve water quality, includes mechanical and pesticide programs. The pesticide program of herbicides and algicides (control primarily of algae and invasive vegetation), which only serves as a temporary solution to improve water quality issues. The mechanical program maintains aerators in each of the retention ponds. BMPs that target permanent and long-term reductions in sediment and nutrient movement into Buffalo Creek will benefit the water quality within Buffalo Creek the most. Stabilizing pond shorelines would be the most effective BMP as well as stabilizing areas with moderate to severe shoreline erosion. Sections rated as severe in erosion will require a combination of structural and vegetative improvements. All retention ponds can support an increased footprint of native plant buffers above the waterline.

5.2.3 Upland Assessments

Upland assessments were conducted by a windshield survey of the adjoining community within the SWAAP-BC, in addition to aerial imagery interpretation and Google street view assessment of the study area.

Upland areas were assessed based on observation techniques presented in the Unified Subwatershed and Site Reconnaissance (USSR) Manual developed by CWP (2004) to identify potential pollution sources influencing water quality and to evaluate restoration project opportunities. The manual provides detailed guidance regarding survey techniques to help watershed groups, municipal staff, and consultants unfamiliar with identifying stormwater pollution sources. The manual also offers guidance to assess subwatershed restoration potential for source controls, pervious area management, and improved municipal maintenance such as education, retrofits, street sweeping, inlet cleaning, and open space management.

The following is a list of the potential actions that were considered during the assessment to address observed sources of stormwater pollution.

- Improved management of common areas
- Storm drain stenciling/marking program
- Tree planting
- Improved landscaping/native landscaping
- Stormwater management practice maintenance
- Stormwater retrofit opportunity

5.2.3.1 Neighborhood Source Assessment (NSA)

NSAs describe pollution source areas, stewardship behaviors, and restoration opportunities within individual neighborhoods. Each neighborhood has unique characteristics which determine the ability to implement restoration projects, source controls, and stewardship practices.

Methods

Potential stormwater pollutant sources are observed within the adjoining communities as pollutants can be introduced from yards and lawns, rooftops and downspouts, driveways and sidewalks, and common areas. Specific watershed protection and restoration practices can be recommended based on the results of the neighborhood assessment. Assessments can identify programs and projects that allows municipalities, homeowners, and other watershed stakeholders to identify resource allocation toward achieving the goals of the watershed-based plan.

Results and Discussion

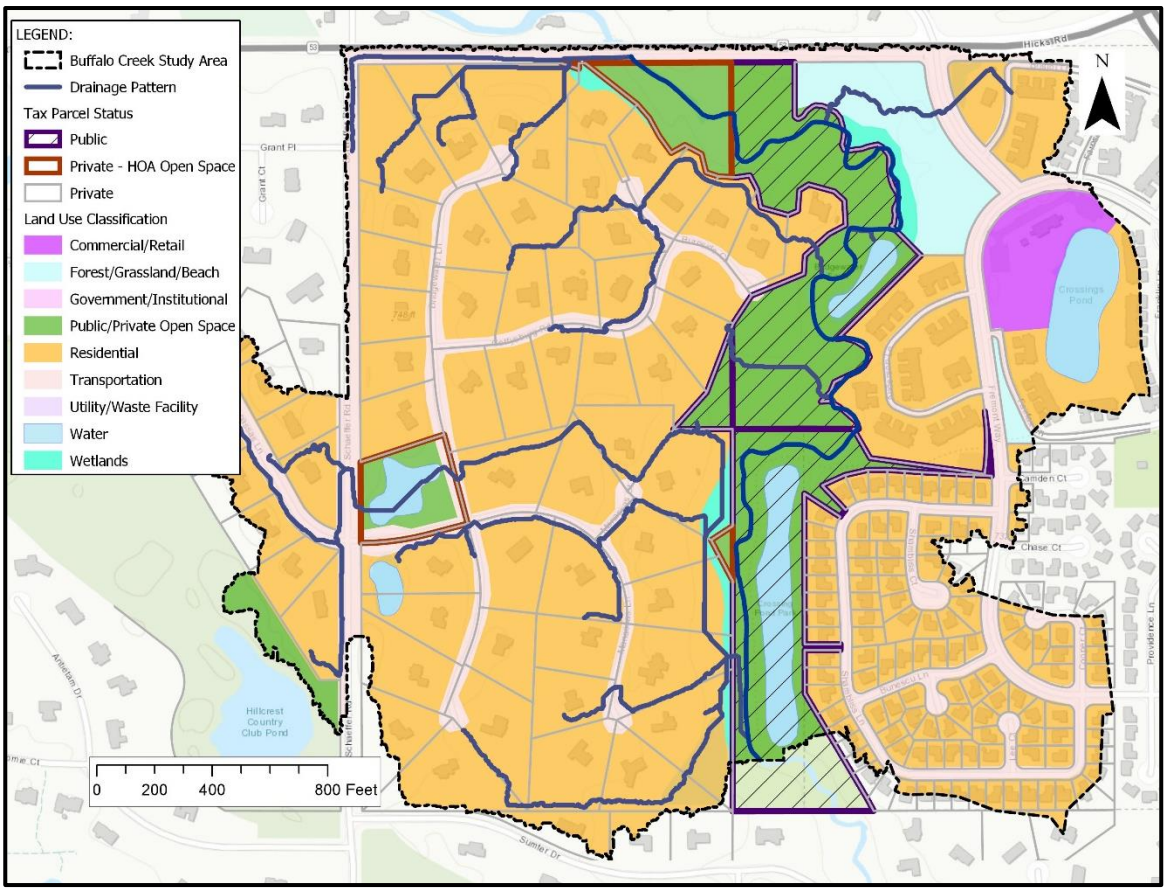
The community is predominately residential consisting of 62% of the SWAAP-BC (Table 10) with an average lot size of 5.08 acres.

Table 10: Buffalo Creek Study Area Land Use Data

Buffalo Creek Land Use Analysis[39]		
Land Use	**Acres**	**Percent of study area**
Commercial/Retail	3.09	1.92
Forest/Grassland/Beach	4.78	2.97
Public/Private Open Space	21.79	13.53
Residential-Single Family	100.23	62.24
Transportation	23.15	14.38
Water	5.96	4.10
Wetlands	2.05	2.13
Total	161.05	100

[39] Lake County GIS. Land Use GIS Data, 2010.

Figure 25: Buffalo Creek Land Use Assessment



Improved management of common areas

The Crossings Pond community (east of Buffalo Creek), is predominately a curb and gutter drainage system. The assessed areas had minimal trash, but the presence of sediment, and/or organic matter (leaves and grass clippings) were identified. Removal of this material is recommended as part of a street sweeping program. The curb and gutter drainage system can collect pollutants, nutrients and other materials from the surface of the street. Education should emphasize minimizing the introduction of grass clippings, turf fertilizer, trash, leaves, automotive liquids or other materials from the street surface to mitigate movement of these items into the retention ponds and creek. Excessive organic matter, sediment, and trash can clog streams and the storm drain system resulting in costly maintenance and stream health impairment. Also, the decay of an unbalanced amount of organic matter in a stream depletes the supply of dissolved oxygen, depriving other aquatic life including fish of their oxygen demand. Street sweeping and catch basin cleaning area essential to minimize the surface movement and collection of street pollutants into the waterways. Street sweeping helps remove trash, sediment and other organic matter such as leaves and grass clippings from the curb and gutter system and prevents them from entering the storm drains and nearby streams. Street sweeping also reduces sediment and other pollutant loads such as oil and metals to the stream system.

The Bridgewater Farm community (west of Buffalo Creek), is predominately right-of-way turf drainage swales. The assessed areas exhibited minimal trash, but the presence of organic matter

(leaves and grass clippings) was identified. Natural overland drainage systems carry less organic matter, sediment, and/or trash versus the direct discharge of runoff via a curb and gutter system as vegetation will filter runoff and/or breakdown organic matter before entering the creek. Excessive organic matter, sediment, and trash can clog streams and the storm drain system resulting in costly maintenance and stream health impairment. Overall education should promote the naturalization of the ditches with native vegetation to enhance the function of natural drainage system into Buffalo Creek.

Based on the visual assessment, most of the Bridgewater Farm landscapes consist of non-native shrubs and trees and expansive lawns of turf, and turf ditches. The condition of the turf during the assessment indicates active turf maintenance programs are in place based on key visual characteristics: fertilization (deep green hue to grass), irrigation (non-dormancy in drier months) and pesticide use (lack of undesirable turf grasses and flowers). The concern is that synthetic fertilizers and pesticides are easily transported through runoff and irrigation and may be entering the natural waterways. Additional educational outreach to stakeholders will include resources in Section 6, highlighting sustainable lawn management.

Storm Drain Marking

The road infrastructure in the SWAAP-BC consist of a mix of natural ditch drainage and modern curb and gutter systems with storm drain inlets that convey stormwater runoff quickly and directly to retention ponds and ultimately to Buffalo Creek. Existing inlets in the Crossings Pond community should be identified with markings or indicators to educate residents that any trash, lawn clippings (potential for nutrient pollution), or other debris accumulating along the curbs and gutters will be washed away during a storm event and end up in Buffalo Creek.

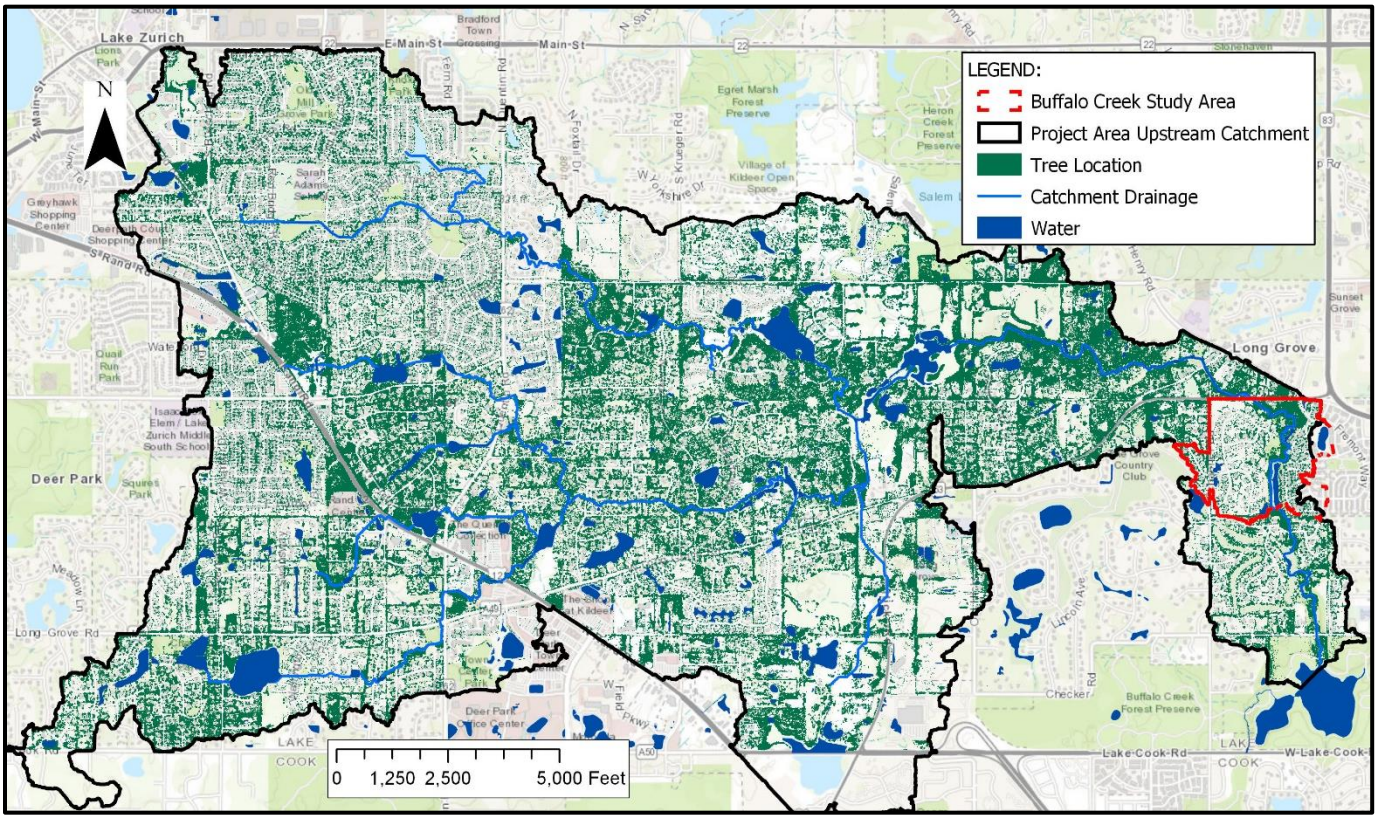
Street and Shade Trees

Street and shade trees are an aesthetic asset to the community, but also provide air and water quality improvements by intercepting precipitation with their leaves and absorbing precipitation and nutrients through their root systems. This slows runoff and can provide treatment of runoff before reaching Buffalo Creek or other waterbodies. Street trees are recommended for neighborhoods with a minimum of 6 feet of green space between the sidewalk and curb and less than 20% of these areas had trees planted (Figure 26). Approximately, 120 trees are needed in the SWAAP-BC, based on a spacing of one tree per 30 feet. A spacing of 30 feet presumes a mature tree canopy and the dripline as the extent of tree root system.

Tree canopy coverage tends to correlate with tree maturity. Figure 26 highlights the need for preservation of mature trees upstream of the SWAAP-BC. The quantity of trees within the upstream drainage area of Buffalo Creek outside of the SWAAP-BC appears sufficient; however, the canopy establishment upstream is limited due to the variable age of the tree population (1-30 years old) based on the age of the development impacts. Mature trees are an effective stormwater BMP tool, the uptake of stormwater for a mature tree (ex., 36-inch Bur oak will intercept 6,365 gallons of stormwater runoff per year) is more significant than a newly planted 3” caliper tree (ex., 3-inch Bur oak will intercept 95 gallons of stormwater runoff per year)[40].

[40] National Tree Benefit Calculator, (http://www.treebenefits.com/calculator/).

Figure 26: Buffalo Creek Tree Canopy Assessment



Improved landscaping/native landscaping

The vegetative inventory assessment in the SWAAP-BC concluded that little native vegetation exists outside of the vegetated stream buffers. The stream buffers have mature trees that are mix of native and non-native species, with an understory of invasive species. The residential landscape vegetation is predominately turf with non-native ornamental plant species existing as shrubs and flowers. Trees within the SWAAP-BC are a mix of native and non-native species. As mentioned in the pond assessment there is no shoreline or emergent plant habitat established in the ponds. Long term improvements will include thinning the canopy of the stream corridors and removing and replacing invasive and aggressive plant species to improve soil stability and converting turf depressions and/or detention basins with native plant species to improve water quality. Determining the types of fertilizer or turf maintenance in practice on each parcel was not completed as part of this report, but educational support will be offered to stakeholders to educate the community on reduced chemical inputs into lawn maintenance.

5.2.3.2 Impervious Area Assessment

Introduction

Assessing the locations and extent of impervious surface area in proximity to drainage patterns aided in identification and evaluation of potential BMP project locations for impervious pavement reduction, vegetation enhancement, or stormwater retrofitting.

Methods

Impervious cover assessments were conducted by a windshield survey of the adjoining community within the study area, in addition to aerial imagery interpretation, and GIS data analysis[41,42,43].

Project recommendations are determined by existing conditions at the sites and potential level of community support for BMP implementation. Parcel size, ownership, value of existing vegetation, neighbor proximity and adjacency considerations have been assessed to identify sites with good potential as a stormwater retrofit location were also noted during the assessment.

Results and Discussion

The SWAAP-BC study area of 161 acres has approximately 77% of available land in some form of imperviousness that impacts water quality and stormwater runoff volume and velocity. Impervious cover tends to be attributed to artificial structures such as buildings, roads, driveways, or parking lots. Impervious cover can also be attributed to open spaces and properties with compacted soils in the landscape or areas with limited vegetation establishment that do not support sufficient water infiltration. In the SWAAP-BC 11.76 acres are attributed to impervious street pavement and 211 building structures constitute 13.59 acres of impervious cover.

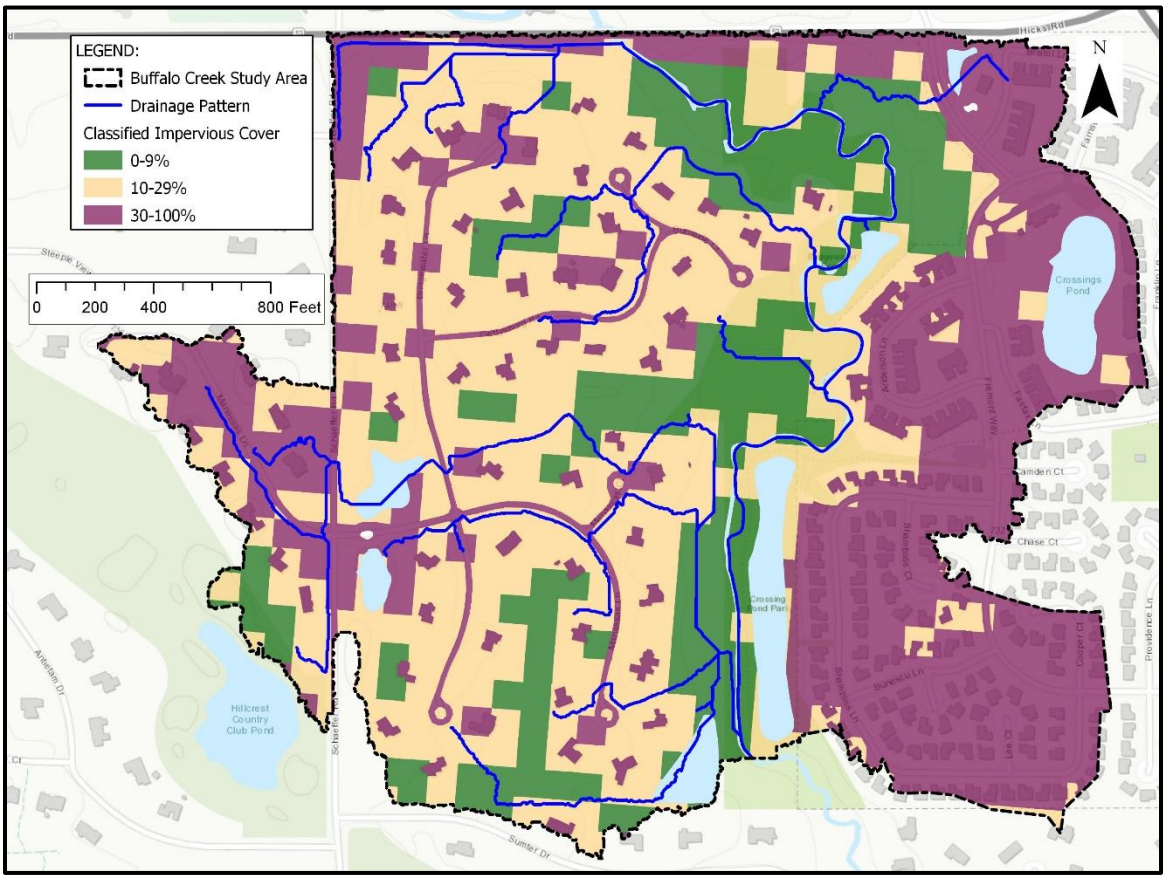
Table 11: Buffalo Creek Impervious Cover Data

ITEM	ACRES	% AREA
Low Impervious Cover, 0-9%	28.47	18%
Medium Impervious Cover, 10-29%	63.38	39%
High Impervious Cover, 30-100%	60.41	38%
Water	8.74	5%
Total	161	100%

The impervious cover assessment in combination with the drainage analysis assessment seeks to characterize parcels with the best opportunity to be retrofitted with BMPs for improved rain and runoff infiltration where paved surfaces are present. Potential opportunities for retrofitting existing land use with BMP projects have been identified in the conceptual designs for the SWAAP-BC. Specific recommendations include reductions in upland drainage directly to water bodies, reductions of impervious pavements, and redirection of runoff through naturalized basins or buffers before reaching receiving waters of a creek or lake. Ongoing programmatic education with communities and municipalities will continue to promote and highlight projects and opportunities for increased infiltration and absorption of runoff. Permeable pavement projects will continue to be a long-term education effort to ensure stakeholder support of the benefits and long-term cost benefits of permeable pavements. Currently off-road parking and parking lots are being proposed for retrofits from asphalt parking to a permeable pavement system. Recommendations will be for public properties such as park districts for parking lot retrofits but will be contingent on funding opportunities and ongoing education for support.

[41] National Land Cover Database (NLCD). Percent Developed Imperviousness Database, 2011. (https://www.mrlc.gov/nlcd2011.php).
[42] Lake County GIS. Planimetric GIS data: Buildings, Edge of Pavement, and Parking Lots.
[43] Lake County SMC. Des Plaines River Watershed-Based Plan- impervious cover assessment data, 2018.

Figure 27: Buffalo Creek Percent Impervious Cover Assessment



5.2.4 Stormwater Retrofit Inventory

Introduction

Stormwater retrofits are a valuable tool to improve water quality in areas where the natural soil, vegetation or drainage has been altered and/or impacted. Stormwater retrofit opportunities included treating runoff from parking lots, inlet retrofits, and conversion/inspection of existing stormwater management detention and retention facilities. Retrofit locations will seek to ensure sufficient pervious area is available to treat a portion of stormwater runoff from impervious surfaces. Retrofit opportunities promote infiltration or filtration of stormwater runoff with BMPs. BMPs such as infiltration trenches, naturalized basins, or bio-retention solutions incorporate native vegetation and filter media through which stormwater passes. This reduces the volume and velocity of water, pollutants, and water temperature of the runoff prior to groundwater recharge or entering the stream/lake system.

Methods

Stormwater retrofit opportunities are effective in areas of medium and high impervious cover. Areas of high and medium impervious cover (30-100%) are presumed to have been altered from their natural state to include some form of development. The development thereby reduces the available green space to a range of 0-70% of land cover while also impacting and potentially impeding natural drainage pathways. Field investigations were conducted by a

windshield survey of the adjoining community within the study area, in addition to aerial imagery interpretation, and GIS data analysis[44,45,46]. The feasibility of implementing a stormwater retrofit project at each site was evaluated by investigating drainage patterns, drainage boundaries, impervious cover, available space, and other site constraints (e.g., conflicts with existing utilities and land uses, site access and potential impacts to natural areas). As discussed in section 5.2.3.2, impervious cover can also be attributed to open spaces and properties with compacted soils in the landscape or areas with limited vegetation establishment that do not support sufficient water infiltration. Project recommendations are determined by existing conditions at the sites and potential level of community support for BMP implementation and maintenance. Parcel size, ownership, value of existing vegetation, neighbor proximity and adjacency considerations have been assessed to identify sites with good potential as a stormwater retrofit location were also noted during the assessment.

Results and Discussion

Many viable stormwater retrofit opportunities existing in the SWAAP-BC, but the immediate project recommendations seek immediate benefits for water quality improvement. Key project recommendations seek to rehabilitate, enhance and/or naturalize existing stormwater management detention and retention facilities to increase infiltration, filtration and pollutant reduction of overland runoff through identified drainage pathways. Additional project recommendations seek to convert open turf patches into mixed use vegetative landscapes for passive recreational use.

5.3 Buffalo Creek Study Area Small Watershed Assessment Summary

In sections 5.1 and 5.2, results of the desktop and field assessments indicate that the natural habitat of the SWAAP-BC has been impacted significantly by land use and land function. The impact of development has contributed to increased volume and velocity of runoff via roofs, roads, and stormwater pipes based on the assessed erosion issues in the field and validated via GIS analyses. The available open space needed for runoff to infiltrate or be filtered has been severely impacted by current land uses and has increased the sediment and pollutant load of Buffalo Creek. Water chemistry issues observed in Buffalo Creek will continue to be observed until appropriate programmatic and field actions are pursued to mitigate and reduce the impacts of upstream runoff into Buffalo Creek.

Water quality impacts include the following:

- Nonpoint water quality impacts from urbanization, runoff volumes and velocity contribute and increase soil erosion, turbidity, nutrient introduction, and upland habitat loss to Buffalo Creek.
- Aquatic life is inconsistent due to the lack of upstream stream continuity, channelization, and elevated/perched stormsewer structures under bridge decks or roadways.
- Streambank stability and streambank function are a foreseeable concern until appropriate stabilization practices are completed.

[44] National Land Cover Database (NLCD). Percent developed imperviousness database, 2011.
[45] Lake County GIS. Planimetric GIS data: Buildings, Edge of Pavement, and Parking Lots.
[46] Lake County SMC, Des Plaines River Watershed-Based Plan- impervious cover assessment data, 2018.

Programmatic and field project recommendations for stakeholders to incorporate in their community will include:

- Pesticide awareness on property management.
- Fertilizer awareness on property management.
- Site specific water infiltration/reuse awareness
    - Downspout disconnect information for riparian land owners and upland land owners.
    - Rain water harvesting opportunities.
    - Retrofitting of natural depression or drainage paths with rain gardens or bio-swales.
    - Native vegetation inclusion/incorporation with landscaped areas.
    - Tree preservation/tree planting for stormwater runoff reductions.
- Stormwater runoff education
    - Storm drain stenciling/marking.
    - Street Cleaning.
    - Permeable pavement surfaces.
    - Reduced vegetative debris storing on slopes or drainage paths.
    - Proper trash disposal or use of hazardous household collection or recycling facilities for disposal.

6. Inventory of Watershed Restoration Opportunities in Buffalo Creek Study Area

6.1 Stream & Stream Corridor Restoration Opportunities in Buffalo Creek Study Area

Stream and stream corridor restoration practices have been selected to enhance the appearance, stability, and function of the stream corridors. Applicable practices range from vegetative bank stabilization and localized grade control, to comprehensive restoration projects, such as full channel redesign and re-alignment. Stream and stream corridor restoration practices are often combined with stormwater retrofits and upland restoration programs and practices to meet subwatershed restoration objectives. Based on the results of the stream assessment, recommendations will include examples of: stream restoration, streambank/shoreline stabilization, vegetative buffer enhancement, and stream cleanups.

6.1.2 Potential Stream & Stream Corridor Restoration Programs

This section of the plan will provide a summary of the program-type opportunities (i.e., non-site specific or watershed-wide opportunities) identified during the field assessment work or developed to address issues identified during the field assessment work. Individual program opportunities may be further developed through the identification of the next steps toward program implementation.

In following are identified stakeholder support and outreach program recommendations to continue ongoing awareness, education, or housekeeping activities. SMC offers an array of educational stormwater best practice resources for the Lake County Community (https://lakecountyil.gov/2261/Stormwater-Best-Practices).

- Stakeholders to offer native vegetation management reference resources.
- Stakeholders to offer invasive species identification reference resources (terrestrial, aquatic, plants, animals, insects).
- Pesticide awareness on property management.
- Fertilizer awareness on property management.
- Site specific water infiltration/reuse awareness
    - Downspout disconnect information for riparian land owners and upland land owners.
    - Rain water harvesting opportunities.
    - Top of streambank buffer enhancement, maintenance, or preservation.
- Stream clean-up includes removing trash, tires and other debris from waterways.
- Stormwater runoff education
    - Eliminate the storage of vegetative debris on slopes or in drainage paths (i.e. grass clippings, wood piles).
    - Removal of instream vegetative debris obstructions.
    - Proper trash disposal or use of hazardous household collection or recycling facilities for disposal.

6.1.3 Potential Stream & Stream Corridor Restoration Projects

This section of the plan will provide a summary of the project-type opportunities (i.e., site- or reach-specific opportunities) identified during the field assessment work or developed to address issues identified during the field assessment work. Individual projects for which preliminary concept designs were not developed may be further developed through the identification of the next steps toward project implementation.

Table 12: Buffalo Creek Vegetation Management Projects

Vegetation Management[47]										
PROJECT ID	**PROJECT DESCRIPTION**	**ACRES**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCVM01	Primary vegetation management: clearing of invasive/aggressive woody species diameter at breast height (DBH) <6" and stump treatment herbicides. Clearing of select trees >6" DBH. Salvaging intact trees and root systems for root revetments. Follow up spot herbiciding of grass/forbs.	6.34	$27,000.00	$171,180.00	Bridgewater Farms HOA, Buffalo Grove Park District	High	N/A	N/A	N/A	N/A
BCVM02	Secondary vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive and/or aggressive trees. Follow up spot herbiciding of grass/forbs.	1.73	$20,000.00	$34,600.00	Long Grove Park District	Medium	N/A	N/A	N/A	N/A

[47] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

BCVM03	Secondary vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive and/or aggressive trees. Follow up spot herbiciding of grass/forbs.	1.16	$20,000.00	$23,200.00	Long Grove Park District	Medium	N/A	N/A	N/A	N/A
BCVM04	Secondary vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	2.72	$20,000.00	$54,400.00	Village of Long Grove, Buffalo Grove Park District	Medium	N/A	N/A	N/A	N/A
BCVM05	Secondary vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	0.47	$20,000.00	$9,400.00	Buffalo Grove Park District	Medium	N/A	N/A	N/A	N/A
BCVM06	Secondary vegetation management: clearing of invasive/aggressive woody species DBH <6" and stump treatment herbicides. Clearing of invasive/aggressive trees. Follow up spot herbiciding of grass/forbs.	1.01	$20,000.00	$20,200.00	Buffalo Grove Park District	Medium	N/A	N/A	N/A	N/A

Table 13: Buffalo Creek Gabion Basket Streambank Stabilization Projects

Gabion Basket Streambank Stabilization[48]										
PROJECT ID	**PROJECT DESCRIPTION**	**FACE FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCGW01	Proposed stabilization of highly eroded left streambank with gabion basket wall.	2250.00	$40.00	$90,000.00	Private Property, Buffalo Grove Park District	High	4.13	1.59	8.26	2.24

Table 14: Buffalo Creek Streambank Stone Toe & Tree Root Revetment Projects

Streambank Stone Toe & Tree Root Revetments[49]										
PROJECT ID	**PROJECT DESCRIPTION**	**LN FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCTRR01	Proposed streambank stabilization with onsite tree trunk and root systems removed as part of the canopy thinning and vegetation management program.	183.00	$300.00	$54,900.00	Long Grove Park District	High	2.35	0.91	4.70	1.28
BCTRR02	Proposed streambank stabilization with onsite tree trunk and root systems removed as part of the canopy thinning and vegetation management program.	194.00	$300.00	$58,200.00	Private Property, Long Grove Park District	High	2.49	0.96	4.98	1.35

[48] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions
[49] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

BCTRR03	Proposed streambank stabilization with onsite tree trunk and root systems removed as part of the canopy thinning and vegetation management program.	179.00	$300.00	$53,700.00	Long Grove Park District	High	2.30	0.89	4.60	1.25
BCTRR04	Proposed streambank stabilization with onsite tree trunk and root systems removed as part of the canopy thinning and vegetation management program.	156.00	$200.00	$31,200.00	Buffalo Grove Park District	High	2.00	0.77	4.01	1.09

Table 15: Buffalo Creek Streambank Stone Toe Stabilization - Left Bank Projects

Stone Toe Stabilization - Left Bank[50]										
PROJECT ID	**PROJECT DESCRIPTION**	**LN FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCSSLT01	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	35.00	$150.00	$5,250.00	Bridgewater Farms HOA	Low	0.34	0.13	0.69	0.19
BCSSLT02	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	48.00	$150.00	$7,200.00	Bridgewater Farms HOA	Low	0.47	0.18	0.94	0.26
BCSSLT03	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	59.00	$300.00	$17,700.00	Bridgewater Farms HOA, Long Grove Park District	High	0.58	0.22	1.16	0.32

[50] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

BCSSLT04	Proposed streambank stabilization with onsite tree trunk and root systems removed as part of the canopy thinning and vegetation management program.	117.00	$200.00	$23,400.00	Long Grove Park District	Medium	1.15	0.44	2.30	0.63
BCSSLT05	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	71.00	$200.00	$14,200.00	Long Grove Park District	Medium	0.70	0.27	1.40	0.38
BCSSLT06	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	40.00	$300.00	$12,000.00	Private Property, Long Grove Park District	High	0.39	0.15	0.79	0.21
BCSSLT07	Proposed streambank stabilization with onsite tree trunk and root systems removed as part of the canopy thinning and vegetation management program.	169.00	$200.00	$33,800.00	Long Grove Park District	Medium	1.66	0.64	3.33	0.90
BCSSLT08	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	124.00	$300.00	$37,200.00	Private Property	High	1.22	0.47	2.44	0.66
BCSSLT09	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	34.00	$200.00	$6,800.00	Long Grove Park District	Medium	0.33	0.13	0.67	0.18
BCSSLT10	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	32.00	$300.00	$9,600.00	Long Grove Park District	High	0.31	0.12	0.63	0.17
BCSSLT11	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	38.00	$150.00	$5,700.00	Long Grove Park District	Low	0.37	0.14	0.75	0.20

BCSSLT12	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	37.00	$300.00	$11,100.00	Private Property, Long Grove Park District	High	0.36	0.14	0.73	0.20
BCSSLT13	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	18.00	$200.00	$3,600.00	Private Property	Medium	0.18	0.07	0.35	0.10
BCSSLT14	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	41.00	$150.00	$6,150.00	Private Property	Low	0.40	0.16	0.81	0.22
BCSSLT15	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	59.00	$300.00	$17,700.00	Buffalo Grove Park District	High	0.58	0.22	1.16	0.32
BCSSLT16	Proposed streambank stabilization with onsite tree trunk and root systems removed as part of the canopy thinning and vegetation management program.	68.00	$200.00	$13,600.00	Buffalo Grove Park District	Medium	0.67	0.26	1.34	0.36
BCSSLT17	Identified section of left streambank requiring stone toe stabilization to minimize bank loss.	365.00	$300.00	$109,500.00	Buffalo Grove Park District	High	3.59	1.38	7.18	1.95

Table 16: Buffalo Creek Streambank Stone Toe Stabilization - Right Bank Projects

Streambank Stone Toe Stabilization - Right Bank[51]										
PROJECT ID	**PROJECT DESCRIPTION**	**LN FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCSSRT01	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	39.00	$300.00	$11,700.00	Bridgewater Farms HOA	High	0.42	0.16	0.84	0.23

[51] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

BCSSRT02	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	45.00	$150.00	$6,750.00	Bridgewater Farms HOA	Low	0.49	0.19	0.97	0.26
BCSSRT03	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	36.00	$200.00	$7,200.00	Bridgewater Farms HOA, Long Grove Park District	Medium	0.39	0.15	0.78	0.21
BCSSRT04	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	22.00	$200.00	$4,400.00	Long Grove Park District	Medium	0.24	0.09	0.48	0.13
BCSSRT05	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	50.00	$150.00	$7,500.00	Long Grove Park District	Low	0.54	0.21	1.08	0.29
BCSSRT06	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	242.00	$300.00	$72,600.00	Private Property, Long Grove Park District	High	2.62	1.01	5.23	1.42
BCSSRT07	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	242.00	$300.00	$72,600.00	Private Property, Long Grove Park District	High	2.62	1.01	5.23	1.42
BCSSRT08	Proposed streambank stabilization with onsite tree trunk and root systems removed as part of the canopy thinning and vegetation management program.	163.00	$200.00	$32,600.00	Long Grove Park District	Medium	1.77	0.68	3.52	0.95
BCSSRT09	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	95.00	$300.00	$28,500.00	Long Grove Park District	High	1.03	0.40	2.05	0.56
BCSSRT10	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	17.00	$150.00	$2,550.00	Long Grove Park District	Low	0.18	0.07	0.37	0.10

BCSSRT11	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	40.00	$150.00	$6,000.00	Private Property, Long Grove Park District	Low	0.43	0.17	0.86	0.23
BCSSRT12	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	36.00	$200.00	$7,200.00	Private Property, Long Grove Park District	Medium	0.39	0.15	0.78	0.21
BCSSRT13	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	28.00	$150.00	$4,200.00	Buffalo Grove Park District	Low	0.30	0.12	0.61	0.16
BCSSRT14	Identified section of right streambank requiring stone toe stabilization to minimize bank loss.	448.00	$300.00	$134,400.00	Buffalo Grove Park District	High	4.86	1.88	9.69	2.62

Table 17: Buffalo Creek Proposed In-stream Stabilization Projects

Proposed In-stream Stabilization[52]										
PROJECT ID	**PROJECT DESCRIPTION**	**SQ FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCSR01	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	821.12	$33.00	$27,096.96	IL DOT, Bridgewater Farms HOA	High	N/A	N/A	N/A	N/A
BCSR02	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	450.42	$33.00	$14,863.86	Bridgewater Farms HOA	High	N/A	N/A	N/A	N/A
BCSR03	In stream riffle to filter out sediment and nutrients, dissipate stream energy and	597.49	$33.00	$19,717.17	Long Grove Park District	High	N/A	N/A	N/A	N/A

[52] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

	improve dissolved oxygen levels.									
BCSR04	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	417.38	$33.00	$13,773.54	Long Grove Park District	High	N/A	N/A	N/A	N/A
BCSR05	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	433.87	$33.00	$14,317.71	Long Grove Park District	High	N/A	N/A	N/A	N/A
BCSR06	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	437.58	$33.00	$14,440.14	Long Grove Park District	High	N/A	N/A	N/A	N/A
BCSR07	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	511.65	$33.00	$16,884.45	Private Property	High	N/A	N/A	N/A	N/A
BCSR08	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	405.47	$33.00	$13,380.51	Long Grove Park District	High	N/A	N/A	N/A	N/A
BCSR09	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	328.28	$33.00	$10,833.24	Long Grove Park District	High	N/A	N/A	N/A	N/A
BCSR10	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	463.93	$33.00	$15,309.69	Long Grove Park District	High	N/A	N/A	N/A	N/A
BCSR11	In stream riffle to filter out sediment and nutrients, dissipate stream energy and	454.73	$33.00	$15,006.09	Long Grove Park District	High	N/A	N/A	N/A	N/A

	improve dissolved oxygen levels.									
BCSR12	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	521.62	$33.00	$17,213.46	Private Property	High	N/A	N/A	N/A	N/A
BCSR13	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	383.85	$33.00	$12,667.05	Private Property	High	N/A	N/A	N/A	N/A
BCSR14	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	476.89	$33.00	$15,737.37	Private Property, Long Grove Park District	High	N/A	N/A	N/A	N/A
BCSR15	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	476.35	$33.00	$15,719.55	Private Property, Long Grove Park District	High	N/A	N/A	N/A	N/A
BCSR16	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	449.39	$33.00	$14,829.87	Buffalo Grove Park District	High	N/A	N/A	N/A	N/A
BCSR17	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	529.98	$33.00	$17,489.34	Buffalo Grove Park District	High	N/A	N/A	N/A	N/A
BCSR18	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	468.96	$33.00	$15,475.68	Buffalo Grove Park District	High	N/A	N/A	N/A	N/A
BCSR19	In stream riffle to filter out sediment and nutrients, dissipate stream energy and	479.34	$33.00	$15,818.22	Buffalo Grove Park District	High	N/A	N/A	N/A	N/A

	improve dissolved oxygen levels.									
BCSR20	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	294.53	$33.00	$9,719.49	Buffalo Grove Park District	High	N/A	N/A	N/A	N/A
BCSR21	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	298.09	$33.00	$9,836.97	Buffalo Grove Park District	High	N/A	N/A	N/A	N/A
BCSR22	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	304.65	$33.00	$10,053.45	Buffalo Grove Park District	High	N/A	N/A	N/A	N/A
BCSR23	In stream riffle to filter out sediment and nutrients, dissipate stream energy and improve dissolved oxygen levels.	332.23	$33.00	$10,963.59	Buffalo Grove Park District	High	N/A	N/A	N/A	N/A

General Notes:

1. The Probable Cost Estimates do not include field surveys, permitting costs and engineering services if needed.
2. Cost will vary pending the phasing and scope of work implemented. Probable additional cost dependent on project owner, consultant, contracting team: Permitting/Engineering +30%, Mobilization +10%, Maintenance/Restoration +5%.
3. Pending the project/s and prior to finalizing a scope of work a professional field survey may be needed.
4. Pending the scope of project/s being implemented, soliciting a permit from the municipality, county, state and/or federal government of jurisdiction may be needed.
5. The probable cost does not include costs for bidding services, mobilization, or temporary construction access costs if needed.
6. The probable cost does make an estimated cost based on the presumed material and labor to implement a project.
7. Pending the funding sources and the requirements of the funding sources, permanent drainage and/or conservation easements may be needed if they do not currently exist to implement public funds on private land holdings. Costs for implementing easements are not addressed in the probable cost.

6.2 Pond & Pond Shoreline Restoration Opportunities in Buffalo Creek Study Area

This section of the plan will provide an overview of pond and pond shoreline restoration practices and programs recommended for pond and pond shoreline restoration opportunities identified during the field assessment work or developed to address issues identified during the field assessment work. It will include conceptual designs, complete with planning level cost-estimates and preliminary pollutant load reduction estimates for the potential restoration opportunities.

6.2.1 Potential Pond & Pond Shoreline Restoration Programs

This section of the plan will provide a summary of the project-type opportunities (i.e., site-specific opportunities) identified during the field assessment work developed, to address issues identified during the field assessment work. Individual program opportunities may be further developed through the identification of the next steps toward program implementation.

In following are identified stakeholder support and outreach program recommendations to continue ongoing awareness, education, or housekeeping activities. SMC offers an array of educational stormwater best practice resources for the Lake County Community (https://lakecountyil.gov/2261/Stormwater-Best-Practices).

- Stakeholders to offer native vegetation management reference resources.
- Stakeholders to offer invasive species identification reference resources (terrestrial, aquatic, plants, animals, insects).
- Pesticide awareness on property management.
- Fertilizer awareness on property management.
- Site specific water infiltration/reuse awareness
    - Rain water harvesting opportunities.
    - Shoreline buffer enhancement, maintenance, or preservation.
    - Cleaning of boats or other aquatic recreation items to minimize the transfer of invasive species.
- Stormwater runoff education
    - Eliminate the long-term or temporary storage of vegetative debris in streets, catch basins, or in drainage paths.
    - Proper trash disposal or use of SWALCO hazardous household collection or recycling facilities for disposal.

6.2.2 Potential Pond & Pond Shoreline Restoration Projects

This section of the plan will provide a summary of the project-type opportunities (i.e., site- or reach-specific opportunities) – including stormwater retrofits – identified during the field assessment work or developed to address issues identified during the field assessment work. Individual projects for which preliminary concept designs were not developed may be further developed through the identification of the next steps toward project implementation.

Table 18: Buffalo Creek Pond Shoreline Stabilization Projects

Pond Shoreline Stabilization[53]										
PROJECT ID	**PROJECT DESCRIPTION**	**LN FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCPS01	Stabilize the shoreline of the retention ponds with stone, soil lifts and native vegetation.	849.33	$50.00	$42,466.50	Long Grove Park District	High	1.56	0.60	3.12	0.85
BCPS02	Stabilize the shoreline of the retention ponds with stone, soil lifts and native vegetation.	1375.47	$50.00	$68,773.50	The Crossings Condo Assoc.	High	2.52	0.97	5.05	1.37
BCPS03	Stabilize the shoreline of the retention ponds with stone, soil lifts and native vegetation.	736.26	$50.00	$36,813.00	Buffalo Grove Park District	High	1.35	0.52	2.70	0.73

General Notes:

1. The Probable Cost Estimates do not include field surveys, permitting costs and engineering services if needed.
2. Cost will vary pending the phasing and scope of work implemented. Probable additional cost dependent on project owner, consultant, contracting team: Permitting/Engineering +30%, Mobilization +10%, Maintenance/Restoration +5%.
3. Pending the project/s and prior to finalizing a scope of work a professional field survey may be needed.
4. Pending the scope of project/s being implemented, soliciting a permit from the municipality, county, state and/or federal government of jurisdiction may be needed.
5. The probable cost does not include costs for bidding services, mobilization, or temporary construction access costs if needed.
6. The probable cost does make an estimated cost based on the presumed material and labor to implement a project.
7. Pending the funding sources and the requirements of the funding sources, permanent drainage and/or conservation easements may be needed if they do not currently exist to implement public funds on private land holdings. Costs for implementing easements are not addressed in the probable cost.

6.3 Upland Area Restoration Opportunities in Buffalo Creek Study Area

This section of the plan will provide an overview of upland restoration practices and will present the upland restoration opportunities identified during the field assessment work or developed to address issues identified during the field assessment work. It will include – as applicable – tables and maps, complete with planning level cost-estimates and preliminary pollutant load reduction estimates for the potential restoration opportunities.

[53] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

6.3.1 Potential Upland Area Restoration Programs

This section of the plan will provide a summary of the project-type opportunities (i.e., site-specific opportunities) identified during the field assessment work or developed to address issues identified during the field assessment work. Individual program opportunities may be further developed through the identification of the next steps toward program implementation.

In following are identified stakeholder support and outreach program recommendations to continue ongoing awareness, education, or housekeeping activities.

- Native vegetation management references.
- Invasive species identification references.
- Pesticide awareness on property management.
- Fertilizer awareness on property management.
- Site specific water infiltration/reuse awareness
    - Rain water harvesting opportunities.
    - Shoreline buffer enhancement, maintenance, or preservation.
    - Naturalization of turfed drainage ditches with low-profile native plants.
    - Tree Planting installation program in right of ways and private property where suitable.
- Stormwater runoff education
    - Eliminate vegetative debris storage in street, catch basins, or in drainage paths.
    - Proper trash disposal or use of hazardous household collection or recycling facilities for disposal.
    - Proper siting of housekeeping activities (i.e. pool cleaning, car washes, equipment storage as examples).
    - Storm drain stenciling/marking program for all inlets.

6.3.2 Potential Upland Area Restoration Projects

This section of the plan will provide a summary of the project opportunities, including stormwater retrofits – identified during the field assessment work to address identified issues. Individual projects for which preliminary concept designs were not developed may be further developed through the identification of the next steps toward project implementation.

Table 19: Buffalo Creek Buffer Enhancement/Restoration Projects

Buffer Enhancement/Restoration[54]										
PROJECT ID	**PROJECT DESCRIPTION**	**SQ FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCPR01	Buffer enhancement of retention ponds with native low-profile grass/forb vegetation.	8092.17	$1.00	$8,092.17	Long Grove Park District	High	0.14	0.03	0.85	0.01
BCPR02	Buffer enhancement of retention ponds with native low-profile grass/forb vegetation.	11211.53	$1.00	$11,211.53	Buffalo Grove Park District	Medium	0.20	0.04	1.18	0.01
BCPR03	Conversion of turfgrass field with native low-profile grass/forb vegetation.	49562.24	$0.75	$37,171.68	Long Grove Park District	High	0.86	0.16	5.23	0.04

Table 20: Buffalo Creek Outfall Repair Projects

Outfall Repair[55]										
PROJECT ID	**PROJECT DESCRIPTION**	**UNIT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCOR01	Currently overflow pipe connects pond with creek. Both end of overflow pipe should be stabilized to minimize sediment into the water.	1.00	$10,000.00	$10,000.00	Long Grove Park District	Medium	N/A	N/A	N/A	N/A
BCOR02	Currently creek side invert of overflow pipe sits ~2' above N.W.L. Pipe should be stabilized with stone at streambank. Outfall invert should be	1.00	$5,000.00	$5,000.00	Buffalo Grove Park District	Medium	N/A	N/A	N/A	N/A

[54] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions
[55] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

	reconfigured for downstream flow direction.									

Table 21: Buffalo Creek Bioretention BMP Projects

Bioretention BMP[56]										
PROJECT ID	**PROJECT DESCRIPTION**	**SQ FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCBR01	Proposed conversion of drainage swales into a vegetated bioswale with stone stabilization and native vegetation.	3459.00	$4.00	$13,836.00	Private Property	Medium	0.20	0.03	0.00	0.00
BCBR02	Proposed conversion of drainage swales into a vegetated bioswale with stone stabilization and native vegetation.	6525.00	$4.00	$26,100.00	Private Property	Medium	0.37	0.05	0.00	0.01

Table 22: Buffalo Creek Natural Drainage Stabilization Projects

Natural Drainage Stabilization[57]										
PROJECT ID	**PROJECT DESCRIPTION**	**CU YD**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCDS01	Stabilize drainage path inlet into Buffalo Creek with stone.	172.00	$122.00	$20,984.00	Private Property, Bridgewater Farms HOA	High	0.14	0.02	0.00	0.00
BCDS02	Proposed rock check berm to stabilize drainage	155.00	$122.00	$18,910.00	Long Grove Park District	Medium	0.12	0.02	0.00	0.00

[56] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions
[57] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions

	path inlet into Buffalo Creek.									
BCDS03	Stabilize drainage path inlet into Buffalo Creek with stone.	223.00	$122.00	$27,206.00	Long Grove Park District, Buffalo Grove Park District	High	0.18	0.02	0.00	0.00
BCDS04	Stabilize drainage path inlet into Buffalo Creek with stone.	87.00	$122.00	$10,614.00	Private Property, Buffalo Grove Park District	High	0.07	0.01	0.00	0.00
BCDS05	Stabilize drainage path inlet into Buffalo Creek with stone.	24.00	$122.00	$2,928.00	Long Grove Park District	Medium	0.02	0.00	0.00	0.00
BCDS06	Stabilize drainage path inlet into Buffalo Creek with stone.	62.00	$122.00	$7,564.00	Bridgewater Farms HOA	Medium	0.05	0.01	0.00	0.00
BCDS07	Stabilize drainage path inlet into Buffalo Creek with stone.	1.00	$122.00	$122.00	<Null>	Low	0.00	0.00	0.00	0.00

Table 23: Buffalo Creek Proposed Permeable Pavement Projects

Proposed Permeable Pavement[58]										
PROJECT ID	**PROJECT DESCRIPTION**	**SQ FT**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCPP01	Replace existing impervious parking lot with a permeable pavement parking lot. The current parking lot condition is poor.	6365.00	$12.00	$76,380.00	Private Property, Buffalo Grove Park District	Medium	0.57	0.07	0.00	0.01

[58] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions.

Table 24: Buffalo Creek Proposed Flood Storage Area Projects

Proposed Flood Storage Areas[59]										
PROJECT ID	**PROJECT DESCRIPTION**	**ACRE**	**UNIT COST**	**TOTAL COST**	**PROJECT LOCATION**	**PROJECT PRIORITY**	**N Reduction (lb./year)**	**P Reduction (lb./year)**	**BOD Reduction (lb./year)**	**Sediment Reduction (ton/year)**
BCFS02	Proposed flood reduction location for creek high water events with wetland and upland habitat and to infiltrate residential stormwater runoff.	1.06	$60,000.00	$63,897.23	Long Grove Park District	Low	0.52	0.52	0.52	0.52
BCFS01	Proposed flood reduction location for creek high water events with wetland and upland habitat. Portions of this project require land acquisition.	5.11	$60,000.00	$306,395.30	Private Property, Long Grove Park District	Low	2.50	2.50	2.50	2.50
BCFS01	The flood storage area encompasses public and private ownership. The land is currently undeveloped and land acquisition of the privately held land would be needed to develop the flood storage area.	5.23	$191,204.59	$1,000,000.00	Private Property	Low	2.55	2.55	2.55	2.55

General Notes:

1. The Probable Cost Estimates do not include field surveys, permitting costs and engineering services if needed.
2. Cost will vary pending the phasing and scope of work implemented. Probable additional cost dependent on project owner, consultant, contracting team: Permitting/Engineering +30%, Disposal +10%, Mobilization +10%, Maintenance/Restoration +5%.
3. Pending the project/s and prior to finalizing a scope of work a professional field survey may be needed.
4. Pending the scope of project/s being implemented, soliciting a permit from the municipality, county, state and/or federal government of jurisdiction may be needed.
5. The probable cost does not include costs for bidding services, mobilization, or temporary construction access costs if needed.
6. The probable cost does make an estimated cost based on the presumed material and labor to implement a project.
7. Pending the funding sources and the requirements of the funding sources, permanent drainage and/or conservation easements may be needed if they do not currently exist to implement public funds on private land holdings. Costs for implementing easements are not addressed in the probable cost.

[59] Spreadsheet Tool for Estimating Pollutant Load – STEPL, Preliminary Pollutant Load Reductions.

7. Buffalo Creek Study Area Small Watershed Action Plan – Implementation Strategy

The watershed restoration opportunities and goals recommended in this plan are based on the results of the desktop & field assessment work. The intent of this report is to empower stakeholder support in maintaining an implementation strategy for watershed restoration programs and projects in the small watershed study area. The SWAAP-BC report focused on high priority practices – where prioritization is based on evaluation and prioritization criteria goals.

Although there are a significant number of stormwater-related issues found within the SWAAP-BC area, promising opportunities exist to address these issues through a sustainable approach to stormwater management. As reflected in the summary of potential solutions and recommendations presented in Section 6.0, Inventory of Watershed Restoration Opportunities in Buffalo Creek Study Area, stormwater-related damage to structures and infrastructure can be reduced and stormwater-related maintenance problems can be fixed through the implementation of projects that achieve the community's stormwater management goals.

In addition to the technical information presented in both Section 5 and 6 and Appendix B regarding the actions and/or projects that could be used to address each of the problem areas found within the community, SMC staff has developed additional information to assist the SWAAP-BC stakeholders in budgeting for, funding, and implementing projects that will resolve the community's stormwater-related issues. This information is presented below.

Preliminary Cost Estimates

SMC staff has developed a preliminary cost estimate for each of the potential solutions and recommendations presented in Section 6. The preliminary cost estimates provide SWAAP-BC stakeholders a budget target. Stakeholders can use the detailed information to solicit and/or secure funding to implement projects that will resolve the community's stormwater-related issues. It should be noted that the preliminary cost estimates provided in Section 6 tables are based on the potential solutions and recommendations presented in the preliminary concept designs presented in Appendix B.

Such solutions, recommendations, and preliminary concept designs were developed based on a preliminary assessment of site conditions and preliminary engineering analyses performed in accordance with acceptable engineering practices. They are provided for planning purposes only. Actual construction costs may vary depending on the results of additional engineering analyses, further assessment of site conditions, timing of construction, availability of materials, construction methods, and other related factors.

Phased Implementation

SMC staff recognizes that the implementation of the potential solutions and recommendations presented in Section 6 will be limited by the amount of funding available. For that reason, the SWAAP-BC stakeholders should take a phased, multi-year approach to resolving the stormwater-related issues found within the community. Each table in section 6, ranks the

community's stormwater-related. This may be used by the SWAAP-BC stakeholders to prioritize future actions to addressing the community's stormwater-related issues (i.e., project selection, funding, and implementation).

Additionally, it should be noted that each of the detailed preliminary concept designs presented in Appendix B includes several individual elements that, when implemented as part of a single, comprehensive project, are expected to fully resolve the stormwater-related issue found within the associated problem area. SMC staff recognizes that the implementation of the individual preliminary concept designs may be limited by the amount of funding available and that, for this reason, the individual elements described in the preliminary concept designs may not be implemented as part of single, comprehensive projects. For this reason, the SWAAP-BC stakeholders may take a phased approach to implementation of the individual preliminary concept designs, selecting the individual elements that will address the community's most immediate and pressing needs for early implementation and delaying implementation of the remainder of the individual elements until additional funding has been compiled

Potential Funding Sources

Several grants may be available to assist the SWAAP-BC stakeholders with the implementation of projects that follow this plan's guiding principle and achieve the community's comprehensive stormwater management goals. Some potential funding sources are outlined below.

- SMC Watershed Management Board Grant Program: SMC's Watershed Management Board grant program helps fund the planning, design, and implementation of stormwater management projects. Nine project prioritization criteria are considered by SMC staff in the evaluation of grant applications, with the highest priority placed on flood damage prevention/mitigation projects. However, water quality improvement, natural resource preservation and restoration, and green infrastructure projects are also considered. There is a 50% local match requirement, which can be in the form of cash, in-kind services, or both. Applications for Watershed Management Board grant funds are accepted on an annual basis, typically in early October, and approximately $67,620/year of grant funding is typically awarded to projects located in the Des Plaines River Watershed through the program. More information about SMC's Watershed Management Board grant program can be found online: https://lakecountyil.gov/3635/Watershed-Management-Board-WMB.
- Illinois EPA Section 319(h) Grant Program: The Illinois EPA makes grants available to local units of government and other organizations for projects that address nonpoint source pollution through its Section 319(h) grant program. Projects funded under the Section 319(h) grant program must address water quality issues relating directly to nonpoint source pollution. Grant funds can be used for the implementation of Illinois EPA-approved watershed-based plans, including the development of information/education programs and the implementation of best management practices. Illinois EPA receives these grant funds through Section 319(h) of the Clean Water Act and administers the program within Illinois. The maximum federal funding available is 60%, meaning that there is a minimum 40% local match requirement. Applications for Section 319(h) grant funds are accepted on an annual basis, between June 1 and August 1, and between $3,000,000/year and $4,000,000/year have been awarded to projects

around the state through the program in recent years. More information about Illinois EPA's Section 319(h) grant program can be found online: http://www.epa.illinois.gov/topics/water-quality/watershed-management/nonpoint-sources/faqs/index.

Potential Project Partners

Generally, the stormwater stormsewer infrastructure serving the SWAAP-BC area is owned and operated by the Village of Buffalo Creek or the Village of Long Grove. However, some of the community's natural stormwater infrastructure is located on land owned by public and private entities and several of the problem areas identified during the field assessment work are located, at least in part, upon land owned by multiple landowners. The stormwater-related issues found within these problem areas are negatively impacting water quality, as well as adjacent land owners property. SMC staff recommends that the SWAAP-BC stakeholders develop a partnership with their respective municipality to implement projects that will resolve the community's stormwater-related issues located in the study area. The resolution of such issues will benefit all stakeholders of the SWAAP-BC study area and downstream communities.

Assistance with Final Design, Permitting, & Construction

Stakeholders pursing recommended projects should consult with SMC or their local municipality on whether a professional engineering firm is required to assist with the implementation of actions and/or projects requiring additional design, permitting, and/or land description revisions. Stakeholders should review experience and body of work when evaluating and selecting, consultants, contractors, and/or construction oversight. Stakeholder's may use the conceptual designs in Appendix B as needed to support the completion of the additional tasks (e.g., additional site investigation, final design, general and technical specification development, permit acquisition, bidding and contract document preparation, contract award, construction observation, construction management) to implement any portion of the recommendations projects. While the implementation of many of the solutions and recommendations presented in this plan may not require the completion of additional design or permitting tasks, SMC staff recommends that the stakeholders review its planned actions and/or projects with the relevant local municipality and/or its selected consultant to identify any additional necessary or beneficial design or permitting tasks, such as permit acquisition and bidding and contract document preparation.

Acknowledgements:

Watershed Stakeholders involved in development of the SWAAP report:

- United States Environmental Protection Agency
- Illinois Environmental Protection Agency
- Lake County Geographic Information System (GIS) Division
- Michael Novotney
- Patricia Werner
- Jacob Jozefowski, Lake County Stormwater Management Commission
- Mike Prusila, Lake County Stormwater Management Commission
- Loch Lomond Homeowners Association
- Loch Lomond Homeowners Association, Lakes Committee
- Buffalo Grove Park District
- Long Grove Park District
- Village of Buffalo Grove
- Village of Mundelein
- Buffalo Creek Clean Watershed Partnership

Appendix A –

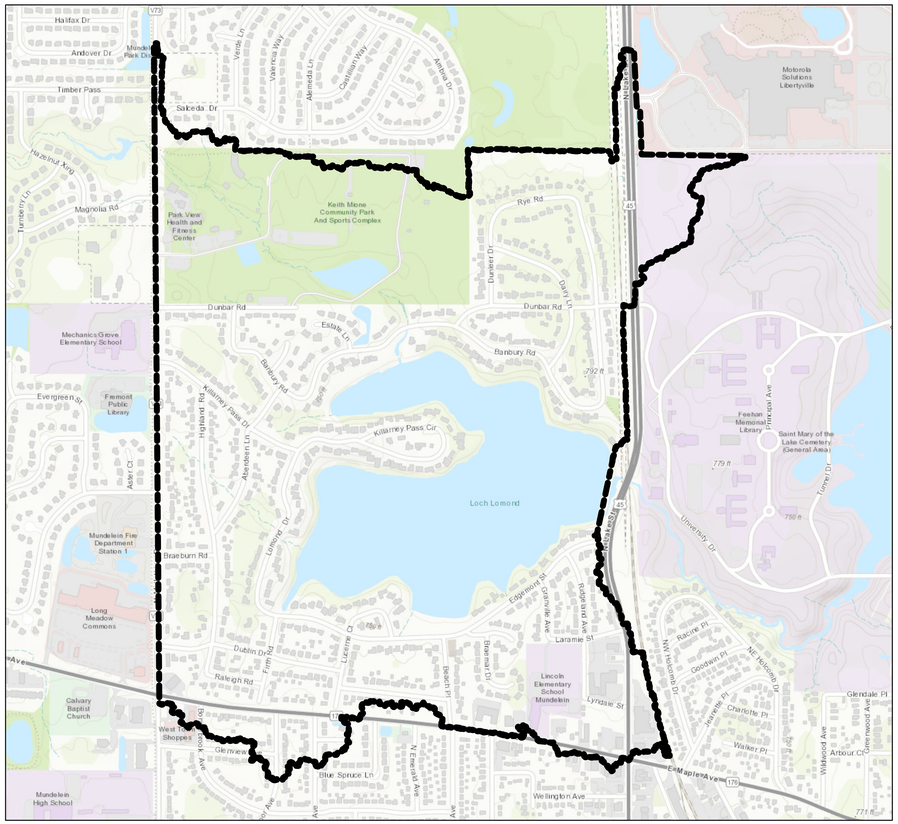
Loch Lomond Stormwater Improvement Projects

Preliminary Concept Designs

SMALL WATERSHED ASSESSMENT AND ACTION PLAN (SWAAP) - Water Quality Improvement Projects Conceptual Design

Conceptual Design Documents - March 3, 2018

PROJECT LOCATION MAP



FOR UNDERGROUND UTILITY LOCATIONS, CALLJ.U.L.I.E.
TOLL FREE TEL. 1-800-892-0123
24 HOURS/DAY
CALL 48 HOURS PRIOR TO DIGGING
JULIE SUBURBS AND DIGG CHICAGO

YELLOW _____GAS
RED_____ELECTRICAL
ORANGE_____PHONE / TV COMMUNICATION
BLUE_____WATER
GREEN_____SEWERS
WHITE_____SAFE TO DIG

Sheet Index

SHEET C 0.0 - COVER SHEET

SHEET C 1.0 - LOCH LOMOND PLANNING AREA OVERVIEW
SHEET C 1.1 - LOCH LOMOND SHEET REFERENCE

SHEET C 2.1 - LOCH LOMOND PROPOSED PROJECTS
SHEET C 2.2 - LOCH LOMOND PROPOSED PROJECTS
SHEET C 2.3 - LOCH LOMOND PROPOSED PROJECTS
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SHEET C 2.13 - LOCH LOMOND PROPOSED PROJECTS

SHEET C 3.0 - LOCH LOMOND DETAILS
SHEET C 3.1 - LOCH LOMOND DETAILS
SHEET C 3.2 - LOCH LOMOND DETAILS

Benchmarks

The topography and elevation data utilized for this project is based on LiDAR derived data points taken in 2007 and made available by Lake County Illinois GIS department.

Field survey by a certified professional land surveyor wiill be needed in future project permitting, bidding, and construction activities.

NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION
LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN
02/01/2018 CONCEPTUAL DESIGN REVISIONS
10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

C0.0 COVER SHEET

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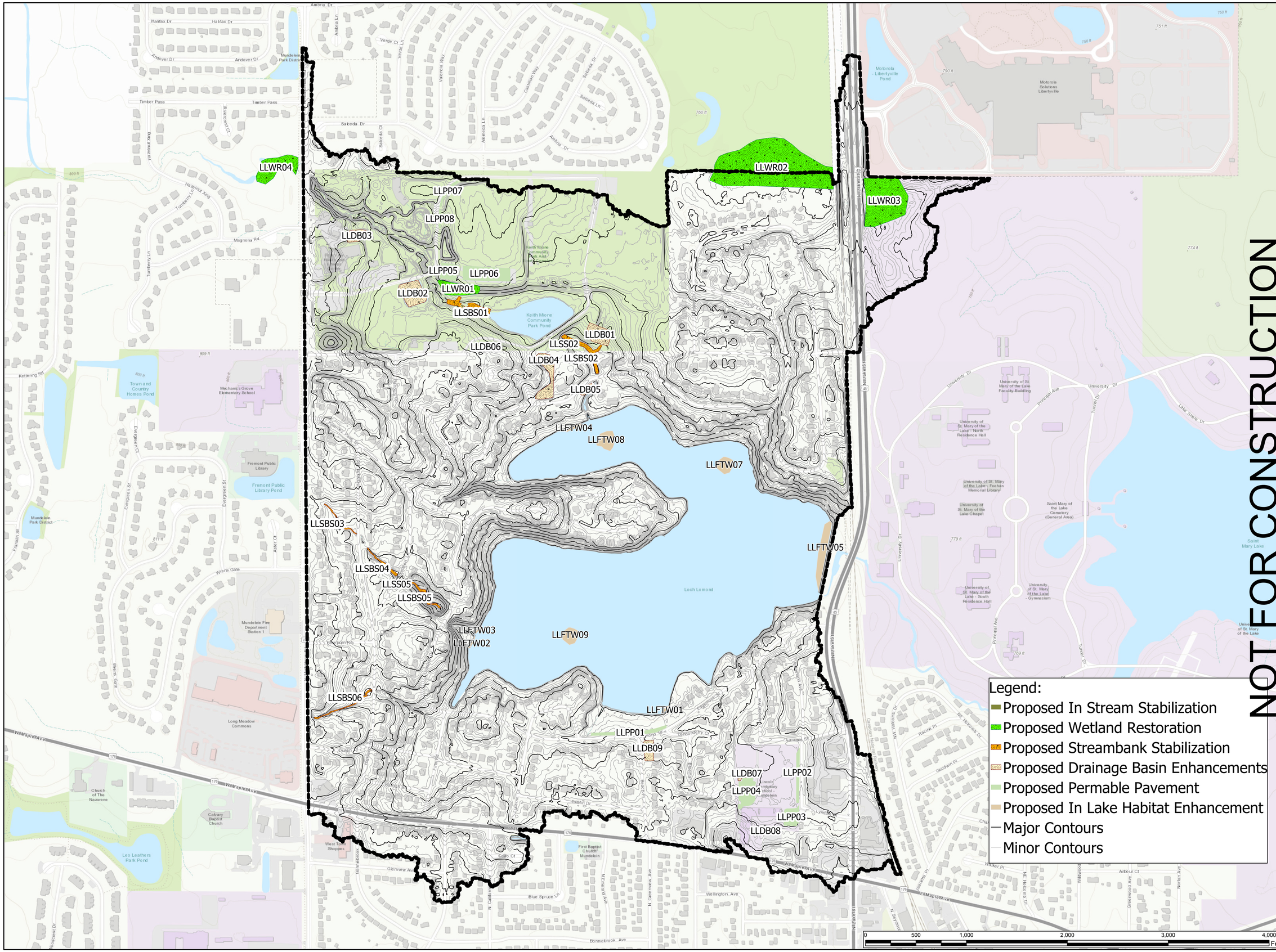
	DATE	10/30/2017
	SCALE	Text



NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

REVISIONS:

DATE:	DESCRIPTION OF REVISION
10/30/2017	DRAFT CONCEPTUAL DESIGN
02/01/2018	CONCEPTUAL DESIGN REVISIONS
10/30/2017	DRAFT CONCEPTUAL DESIGN

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 1.0
LOCH LOMOND
PLANNING AREA OVERVIEW

SHEET NO.		
	DESIGNED	EH
	DRAWN	EH
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	DATE	10/30/2017
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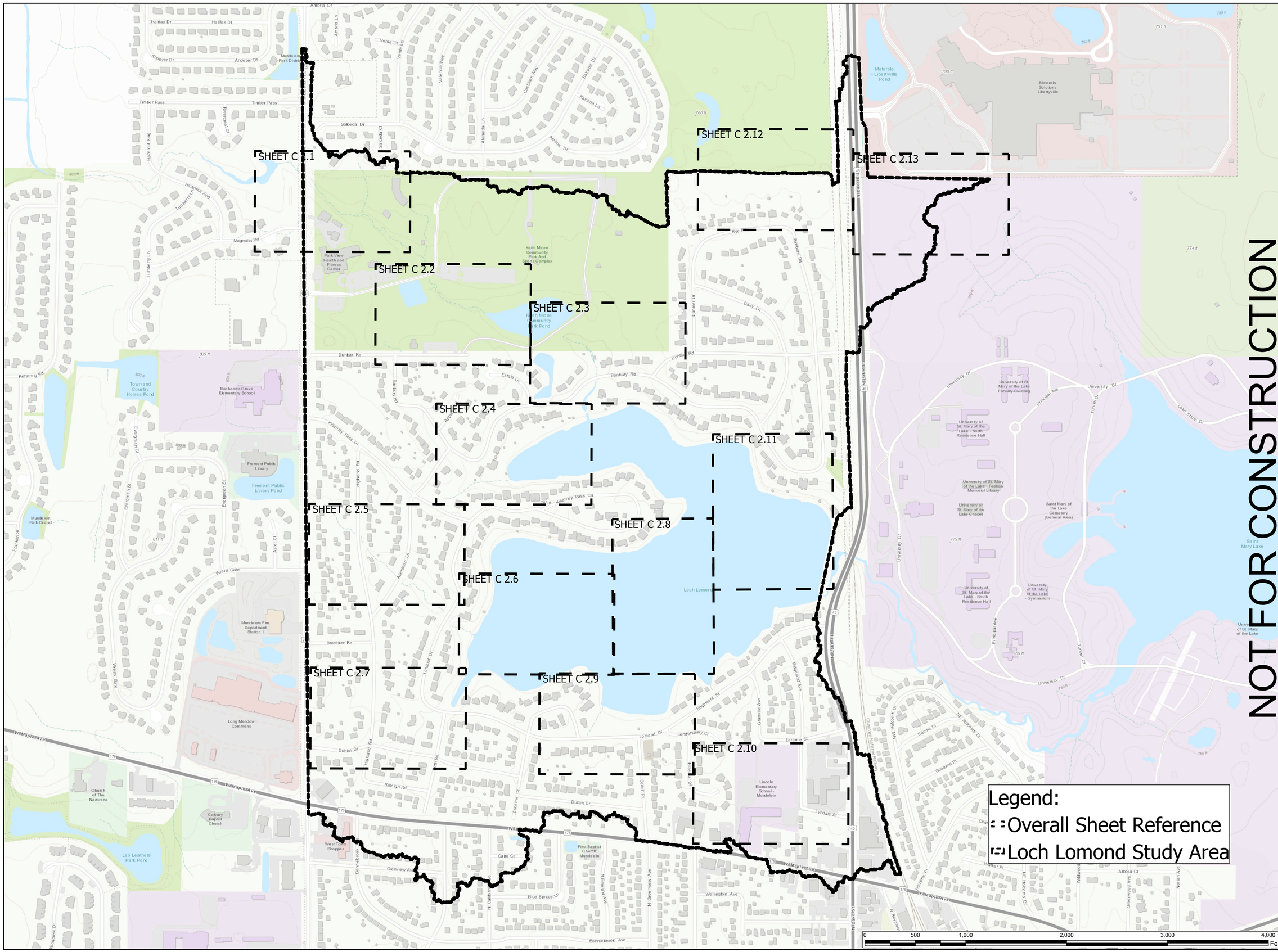

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STORMWATER MANAGEMENT COMMISSION

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REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

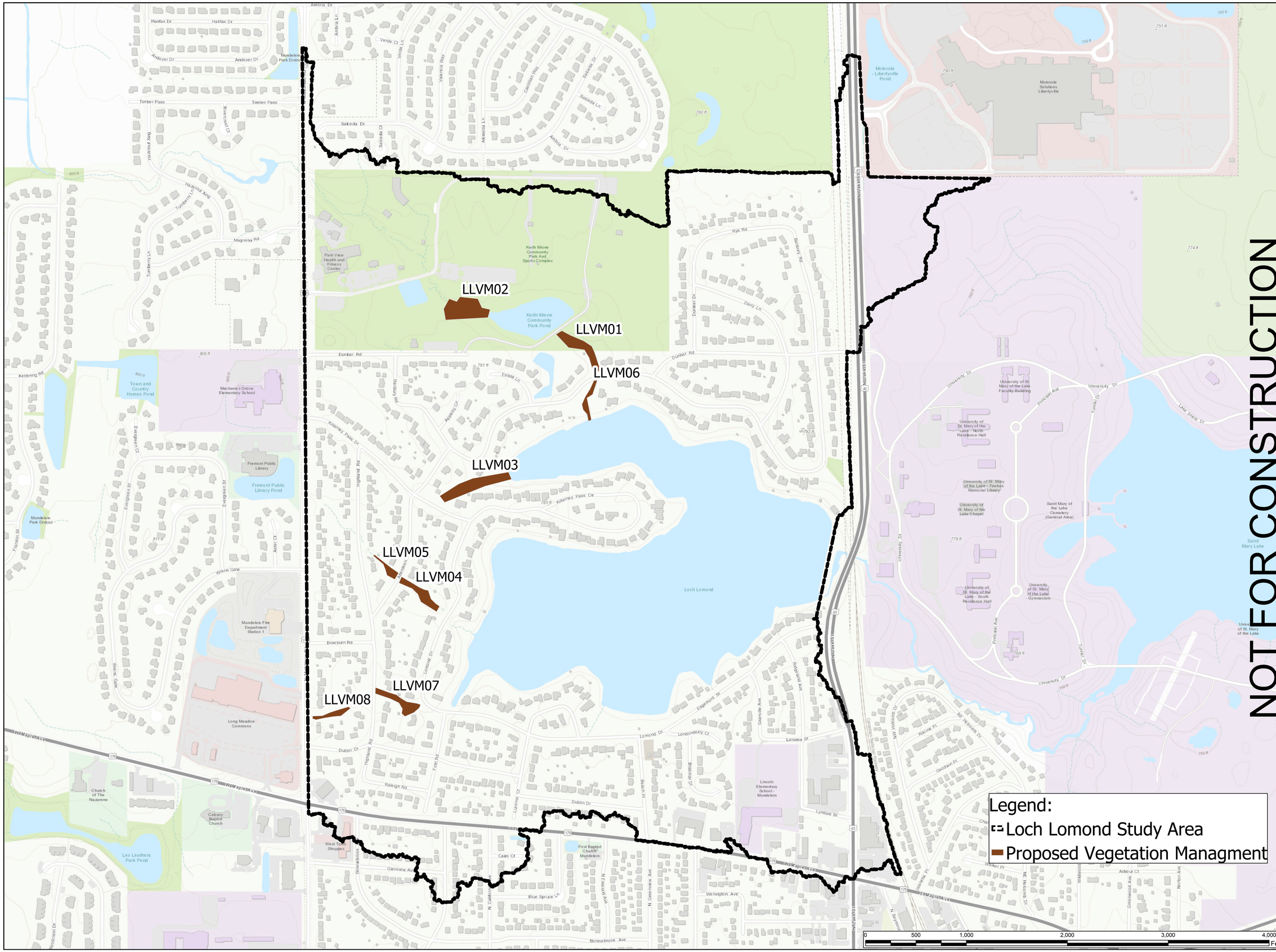
DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 1.1
LOCH LOMOND
SHEET REFERENCE

SHEET NO.	DESIGNED	EH
	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
	DATE	10/30/2017
FILE: LAKE COUNTY STORMWATER COMMISSION	SCALE	1:4,790



NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

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SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.0
LOCH LOMOND
PROJECT SHEET

SHEET NO.

DESIGNED	EH
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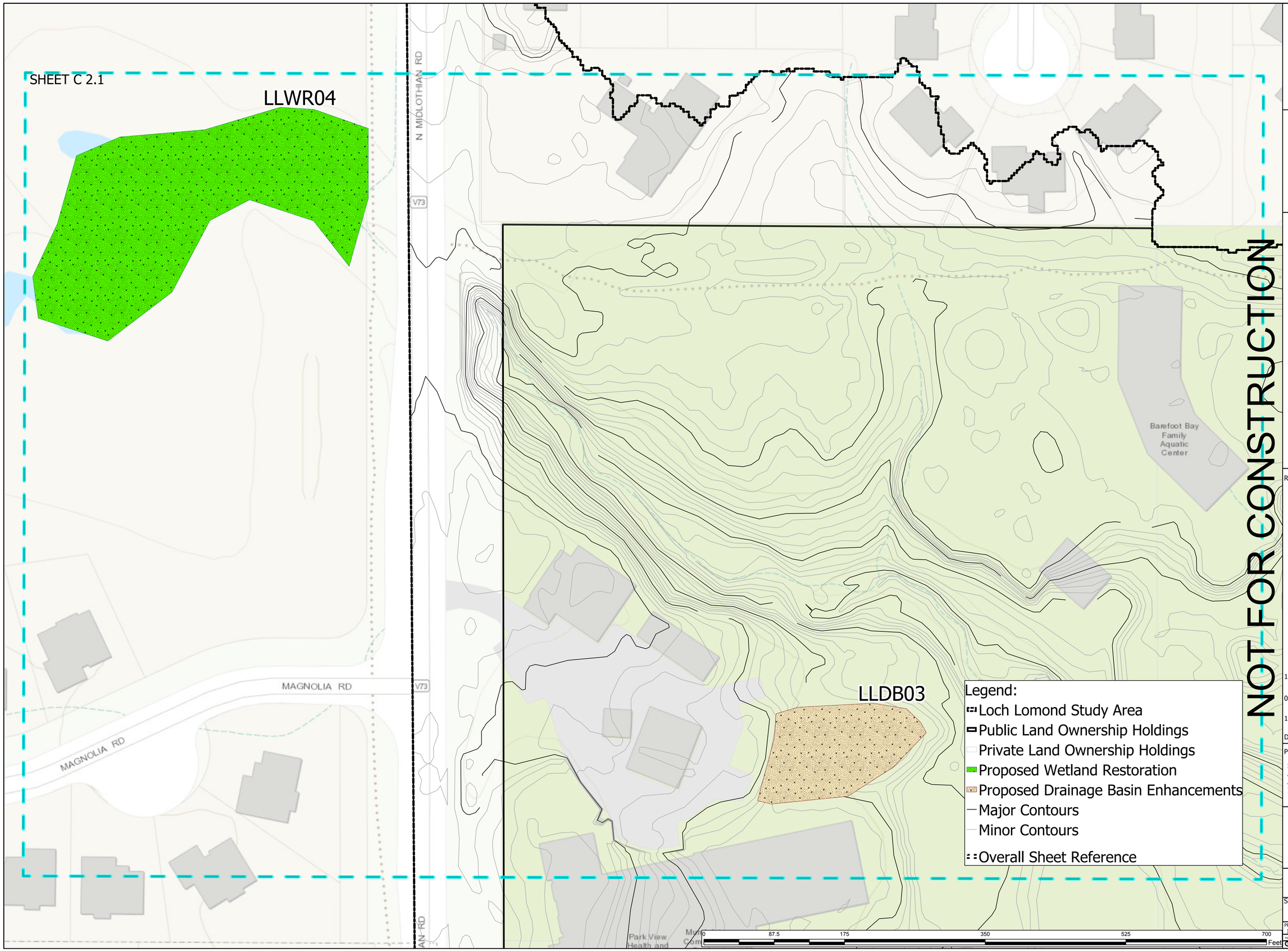
APPROVED	N/A
DATE	10/30/2017
SCALE	1:4,790

PROJECT NUMBER: 17.dpr.swapp

FILE:

LAKE COUNTY STORMWATER COMMISSION



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

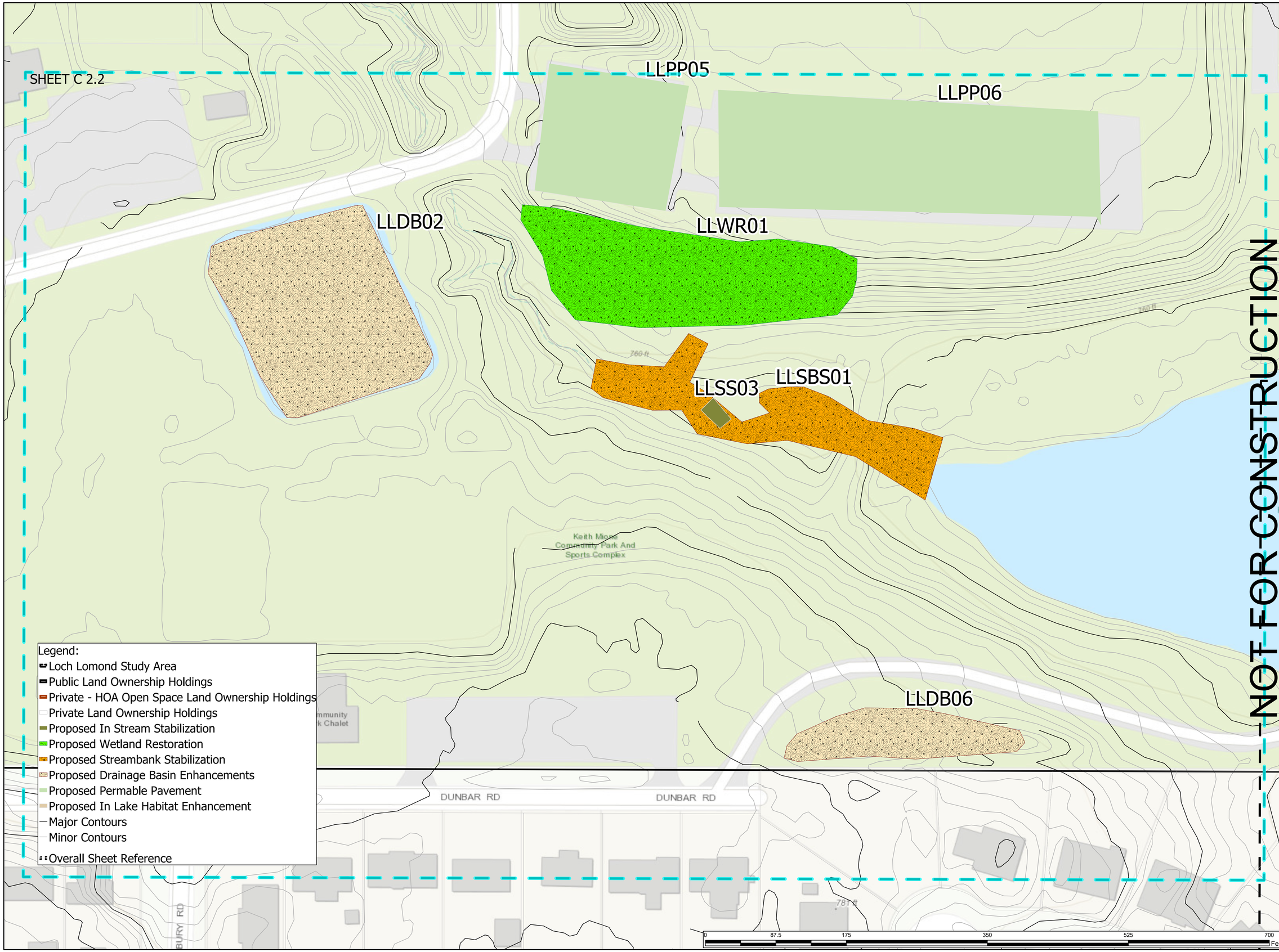
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.1
LOCH LOMOND
PROPOSED PROJECTS

SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600



NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

DATE:	DESCRIPTION OF REVISION
10/30/2017	DRAFT CONCEPTUAL DESIGN
02/01/2018	CONCEPTUAL DESIGN REVISIONS
10/30/2017	DRAFT CONCEPTUAL DESIGN

PROJECT:
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.2
LOCH LOMOND
PROPOSED PROJECTS

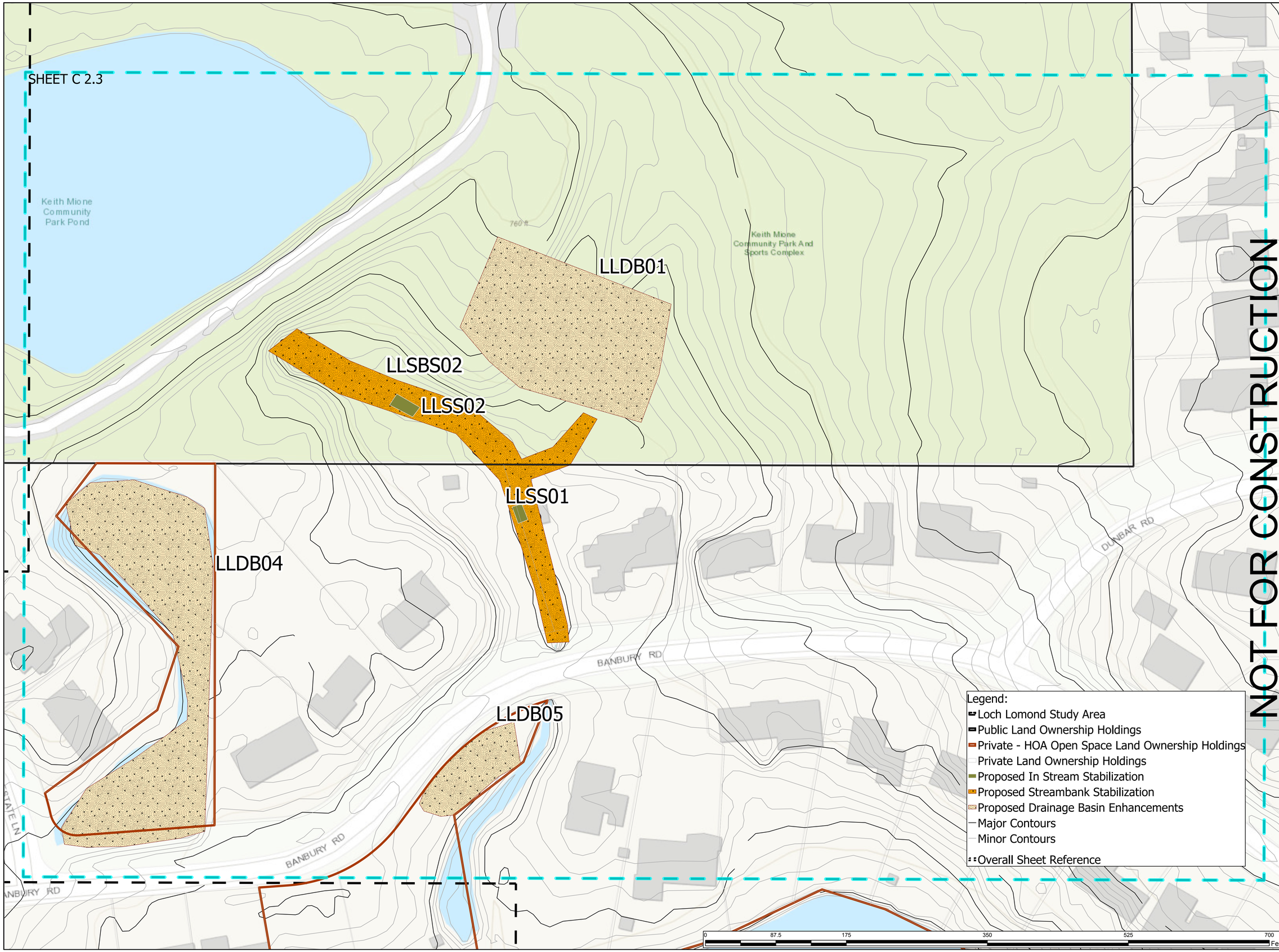
SHEET NO.

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600

PROJECT NUMBER: 17.dpr.swapp

FILE:

LAKE COUNTY STORMWATER COMMISSION



NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

DATE:	DESCRIPTION OF REVISION
10/30/2017	DRAFT CONCEPTUAL DESIGN
02/01/2018	CONCEPTUAL DESIGN REVISIONS
10/30/2017	DRAFT CONCEPTUAL DESIGN

PROJECT:
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

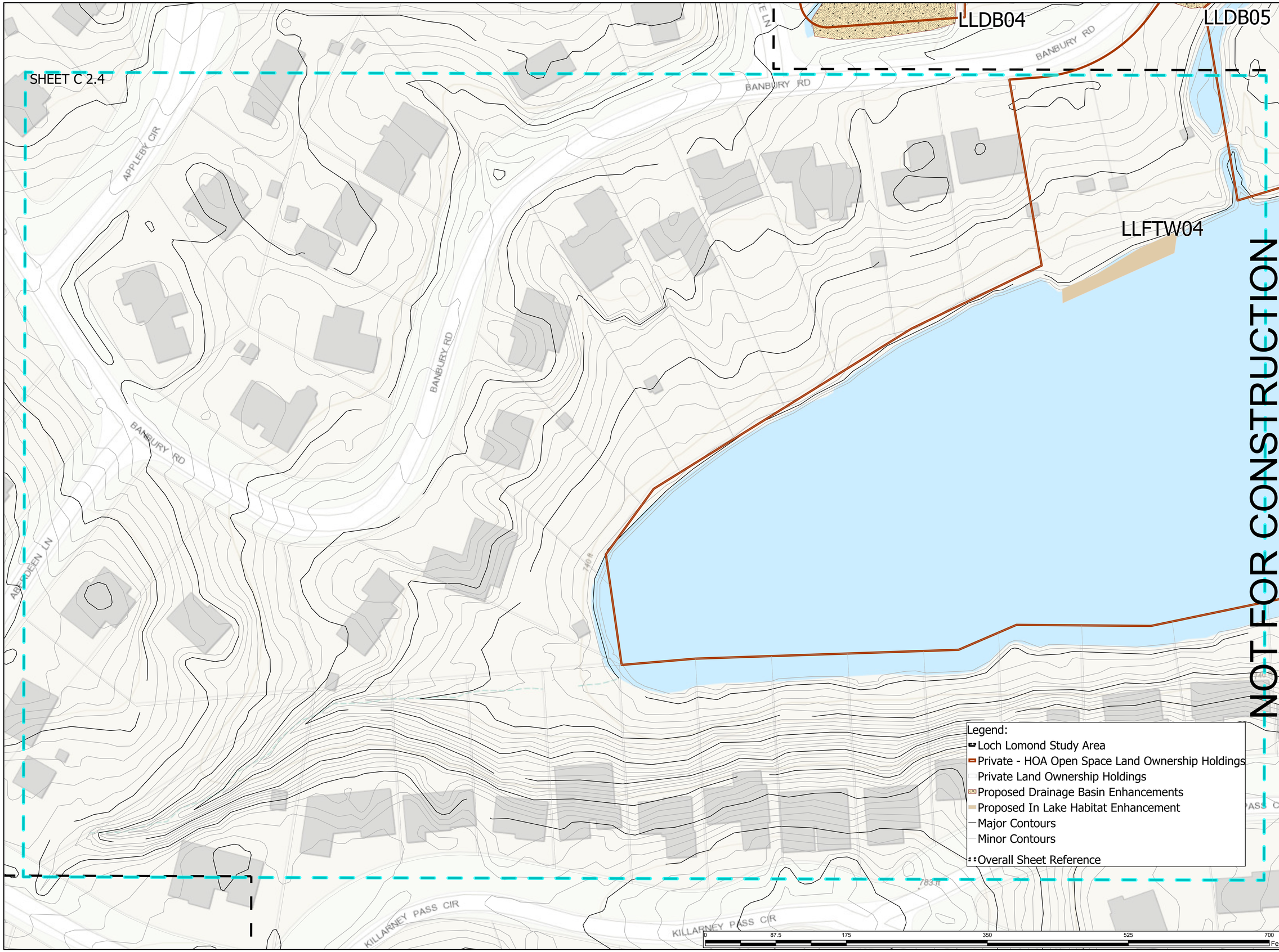
SHEET C 2.3
LOCH LOMOND
PROPOSED PROJECTS

SHEET NO.

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600

PROJECT NUMBER: 17.dpr.swapp

FILE: LAKE COUNTY STORMWATER COMMISSION



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

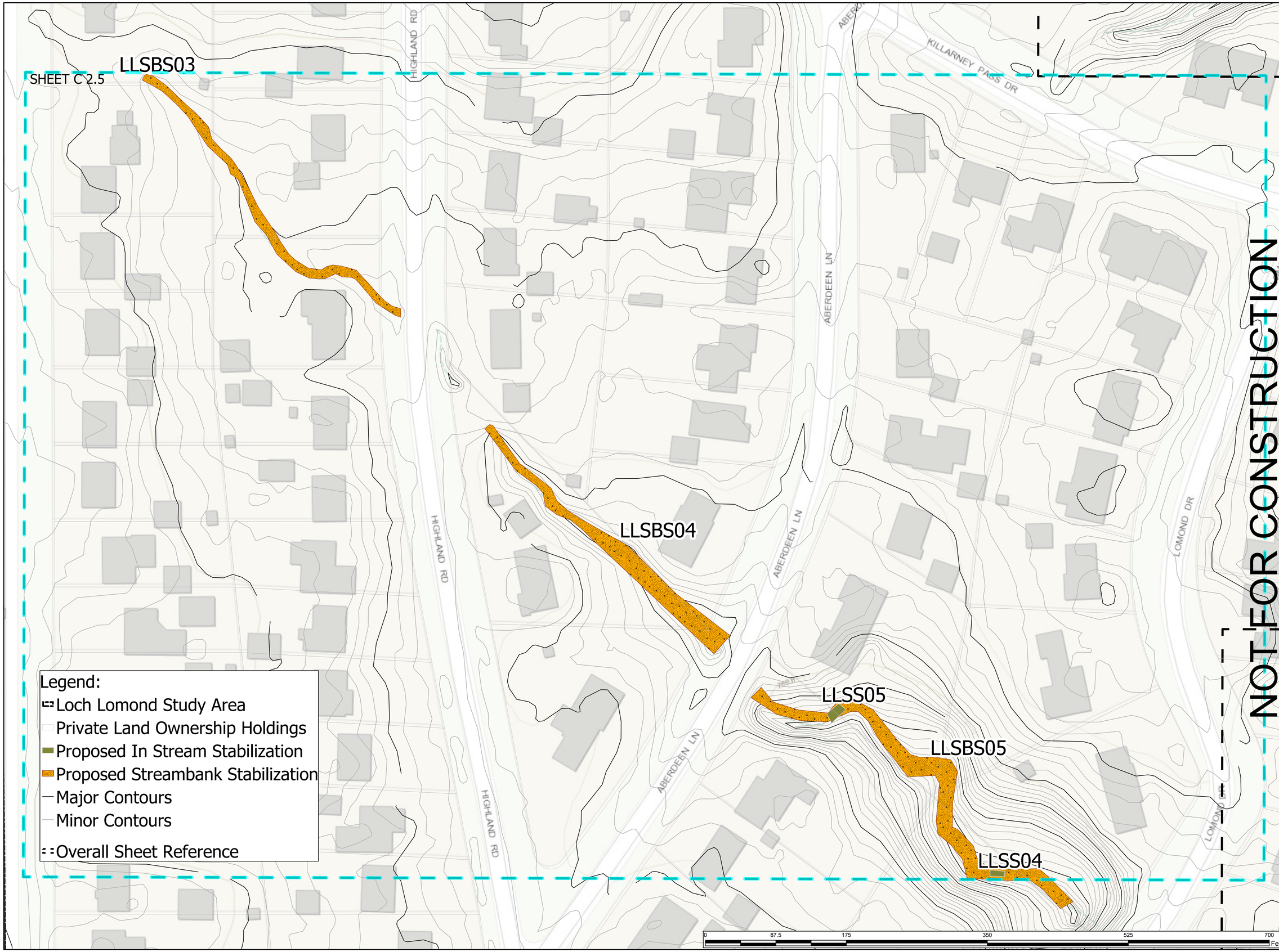
SHEET C 2.4
LOCH LOMOND
PROPOSED PROJECTS

SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

FILE: LAKE COUNTY STORMWATER COMMISSION

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

DATE:	DESCRIPTION OF REVISION
10/30/2017	DRAFT CONCEPTUAL DESIGN
02/01/2018	CONCEPTUAL DESIGN REVISIONS
10/30/2017	DRAFT CONCEPTUAL DESIGN

PROJECT:
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

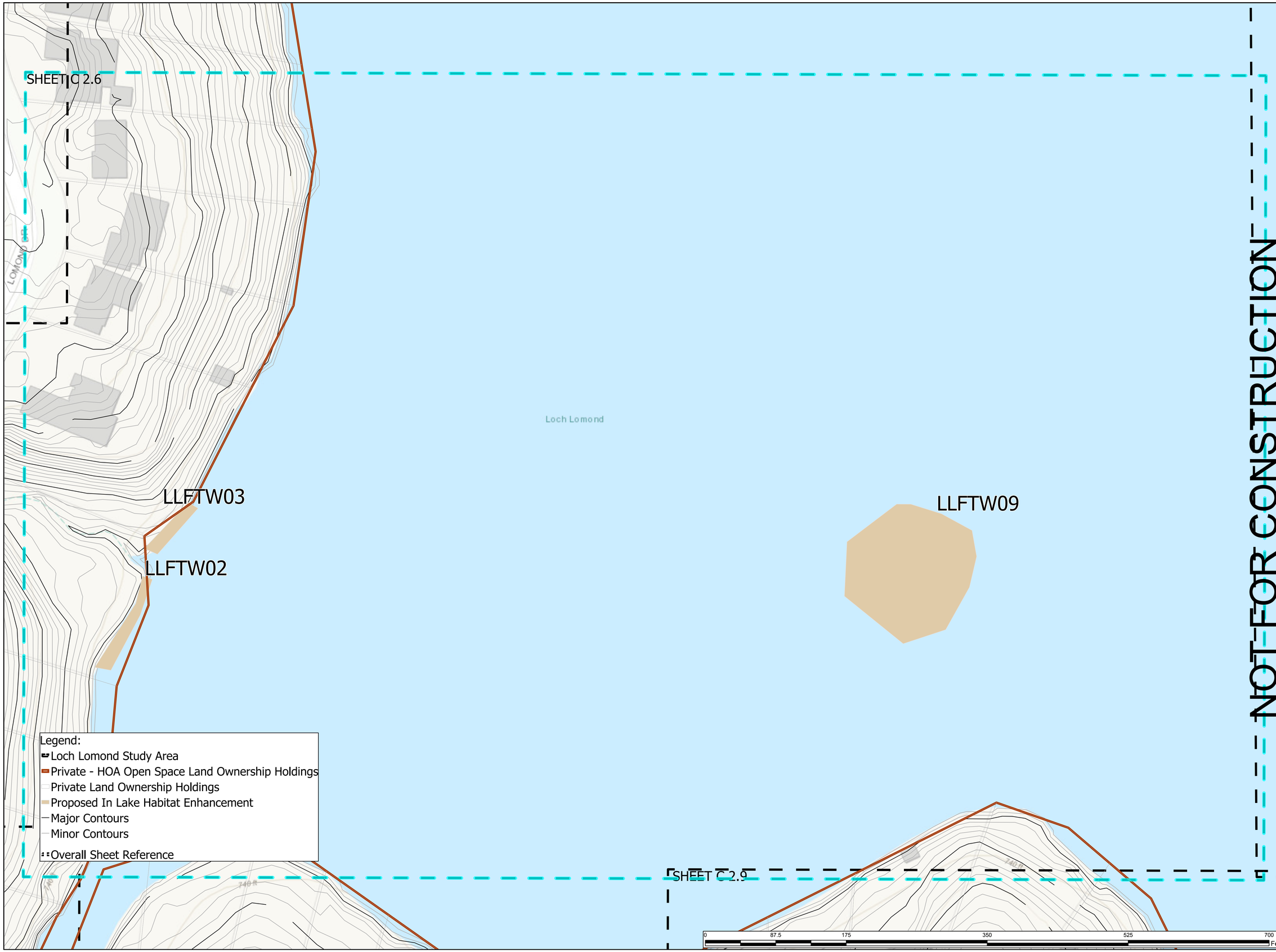
SHEET C 2.5
LOCH LOMOND
PROPOSED PROJECTS

SHEET NO.

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600

PROJECT NUMBER: 17.dpr.swapp

FILE: LAKE COUNTY STORMWATER COMMISSION



NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.6
LOCH LOMOND
PROPOSED PROJECTS

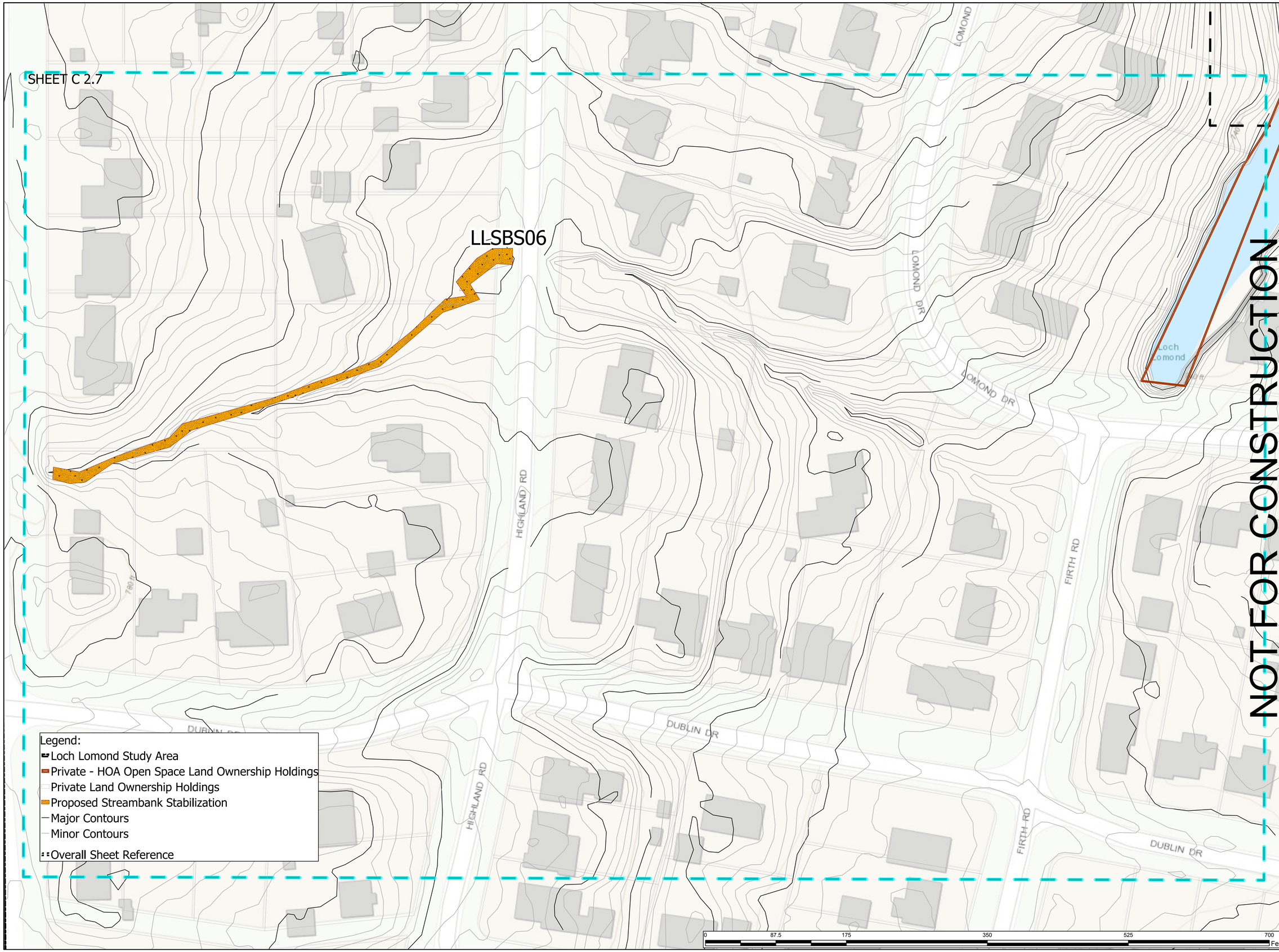
SHEET NO.

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600

PROJECT NUMBER: 17.dpr.swapp

FILE:

LAKE COUNTY STORMWATER COMMISSION



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.7
LOCH LOMOND
PROPOSED PROJECTS

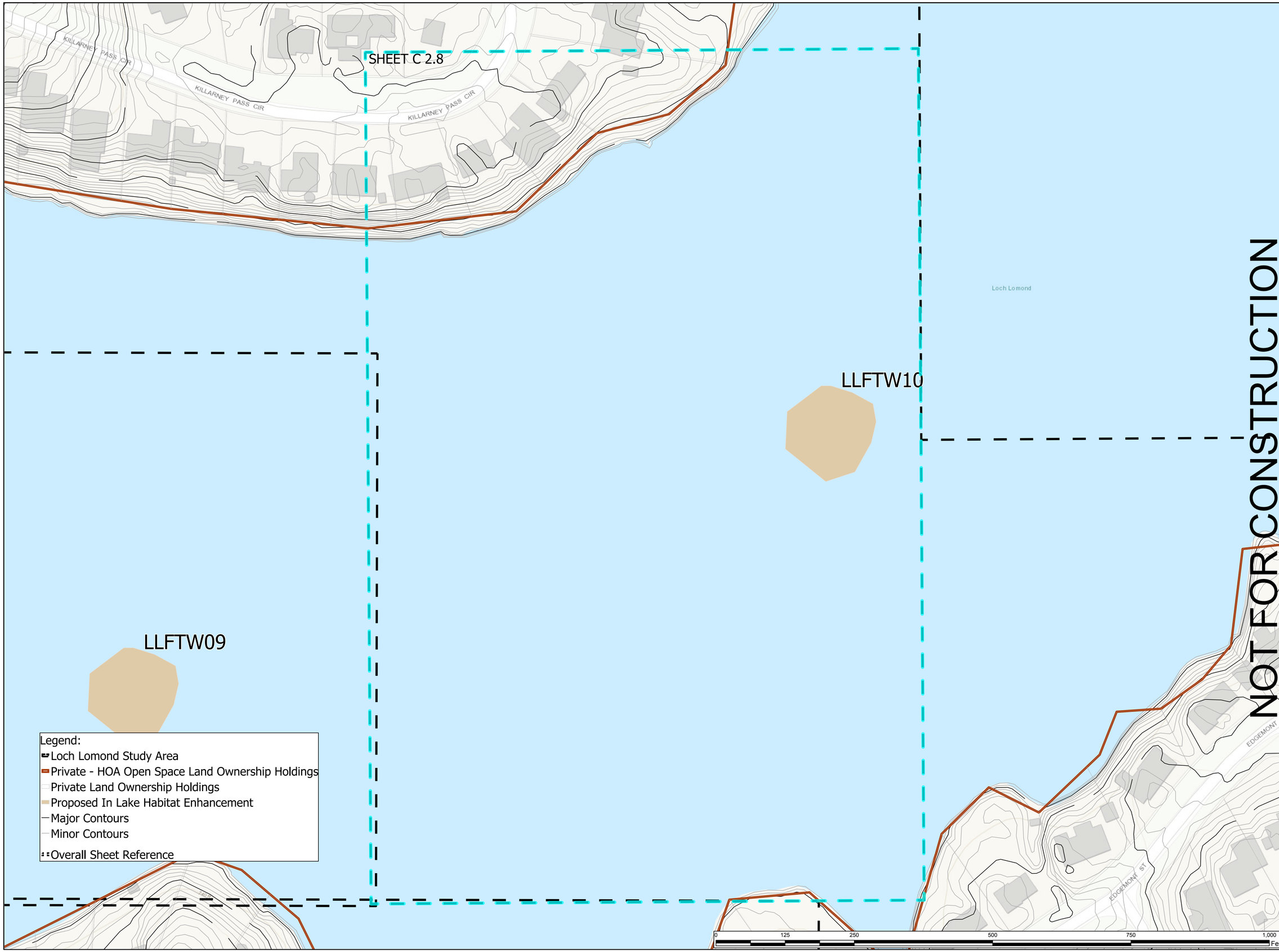
SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

FILE:

LAKE COUNTY STORMWATER COMMISSION

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

DATE:	DESCRIPTION OF REVISION
10/30/2017	DRAFT CONCEPTUAL DESIGN
02/01/2018	CONCEPTUAL DESIGN REVISIONS
10/30/2017	DRAFT CONCEPTUAL DESIGN

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.8
LOCH LOMOND
PROPOSED PROJECTS

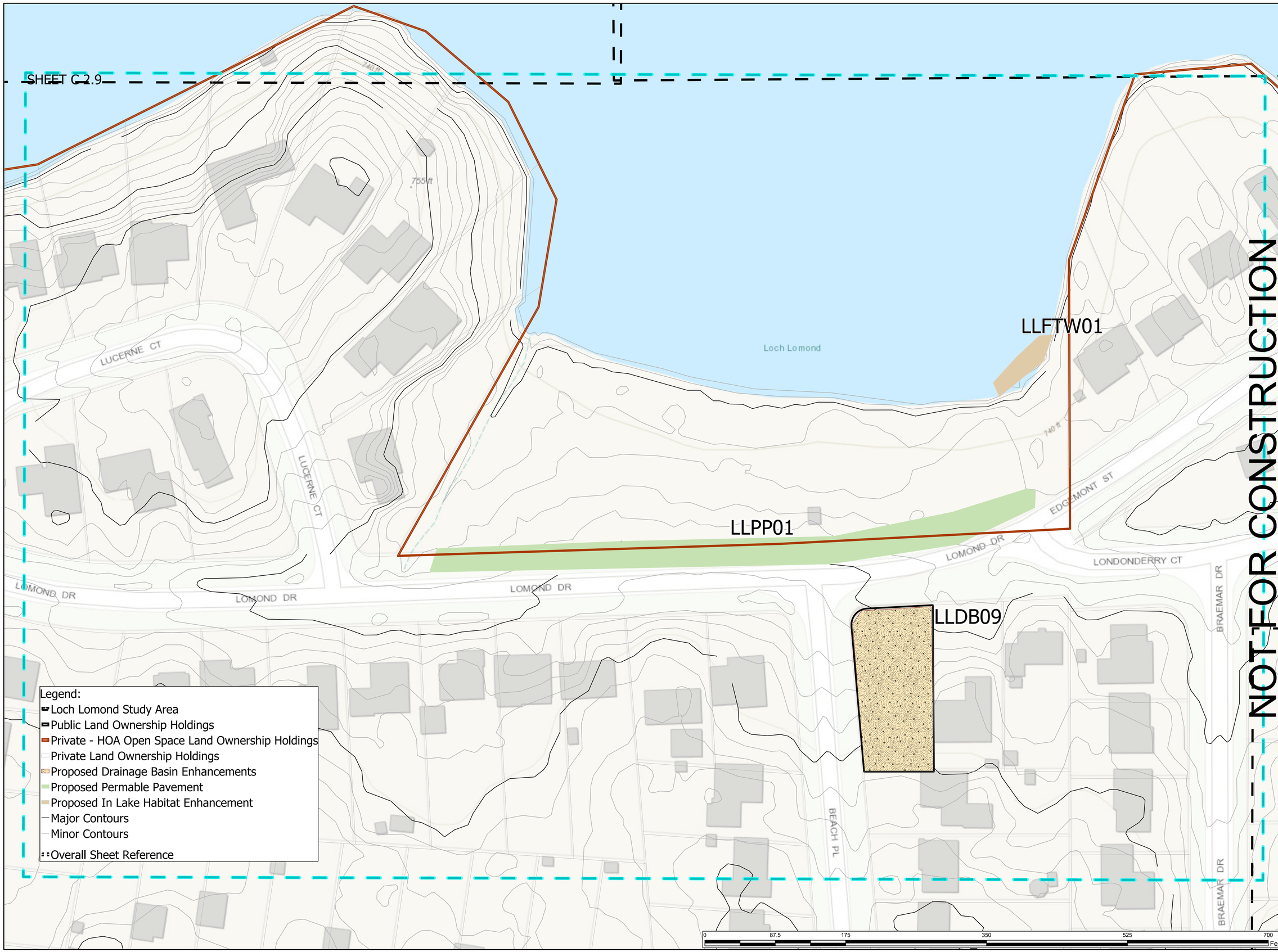
SHEET NO.

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:874

PROJECT NUMBER:
17.dpr.swapp

FILE:

LAKE COUNTY STORMWATER COMMISSION



NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

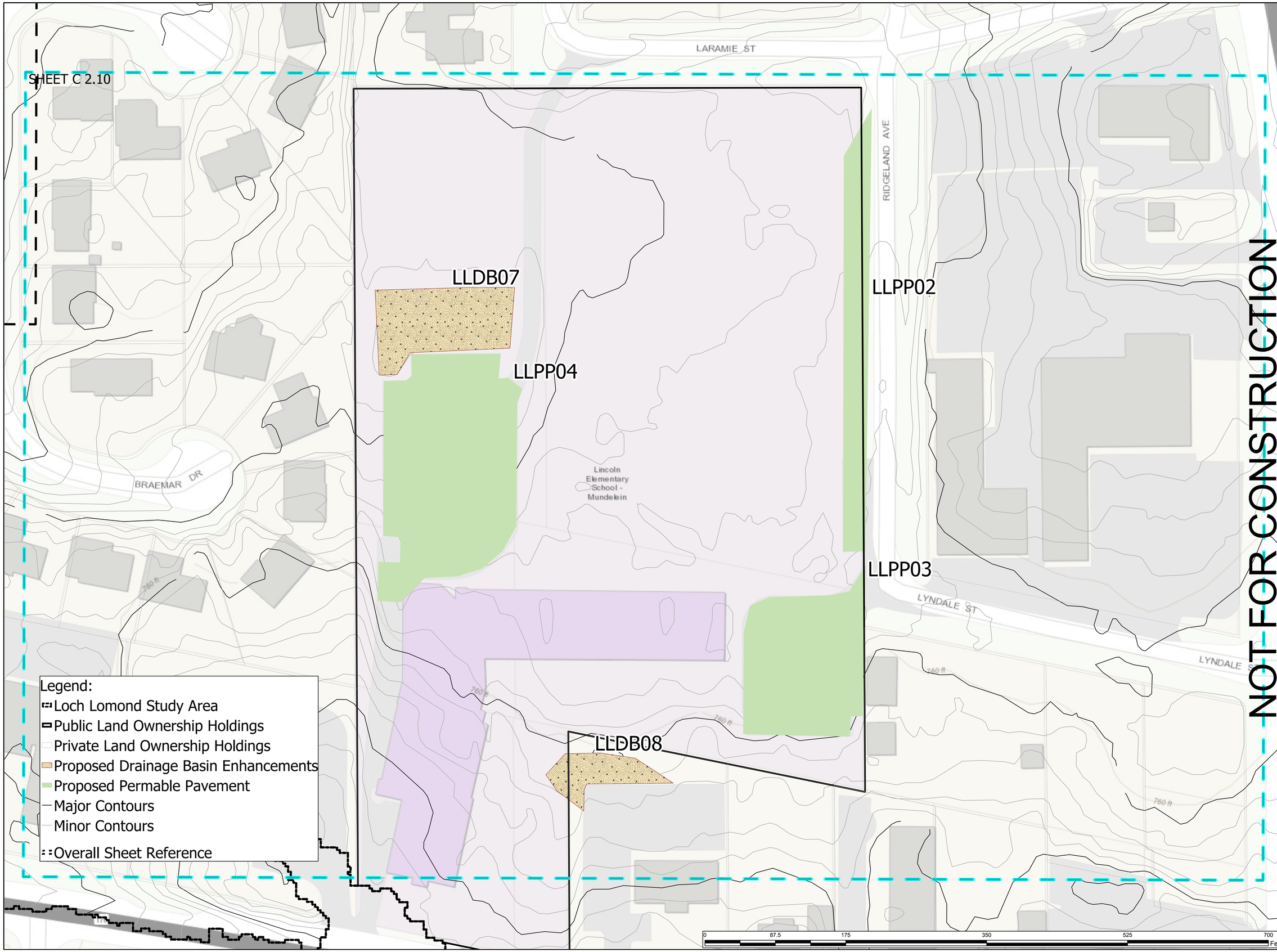
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.9
LOCH LOMOND
PROPOSED PROJECTS

SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

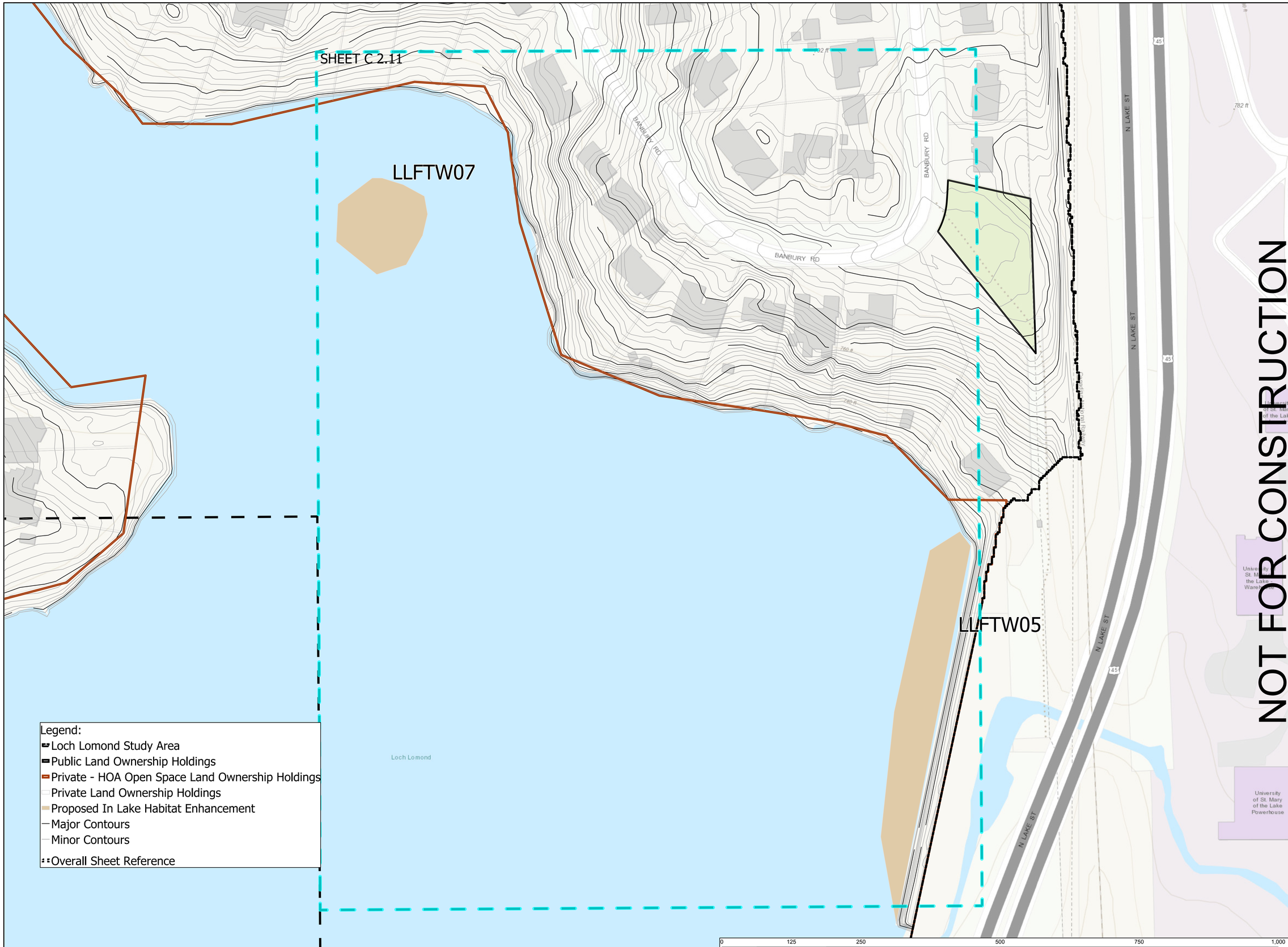
SHEET C 2.10
LOCH LOMOND
PROPOSED PROJECTS

SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600

LAKE COUNTY STORMWATER COMMISSION



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

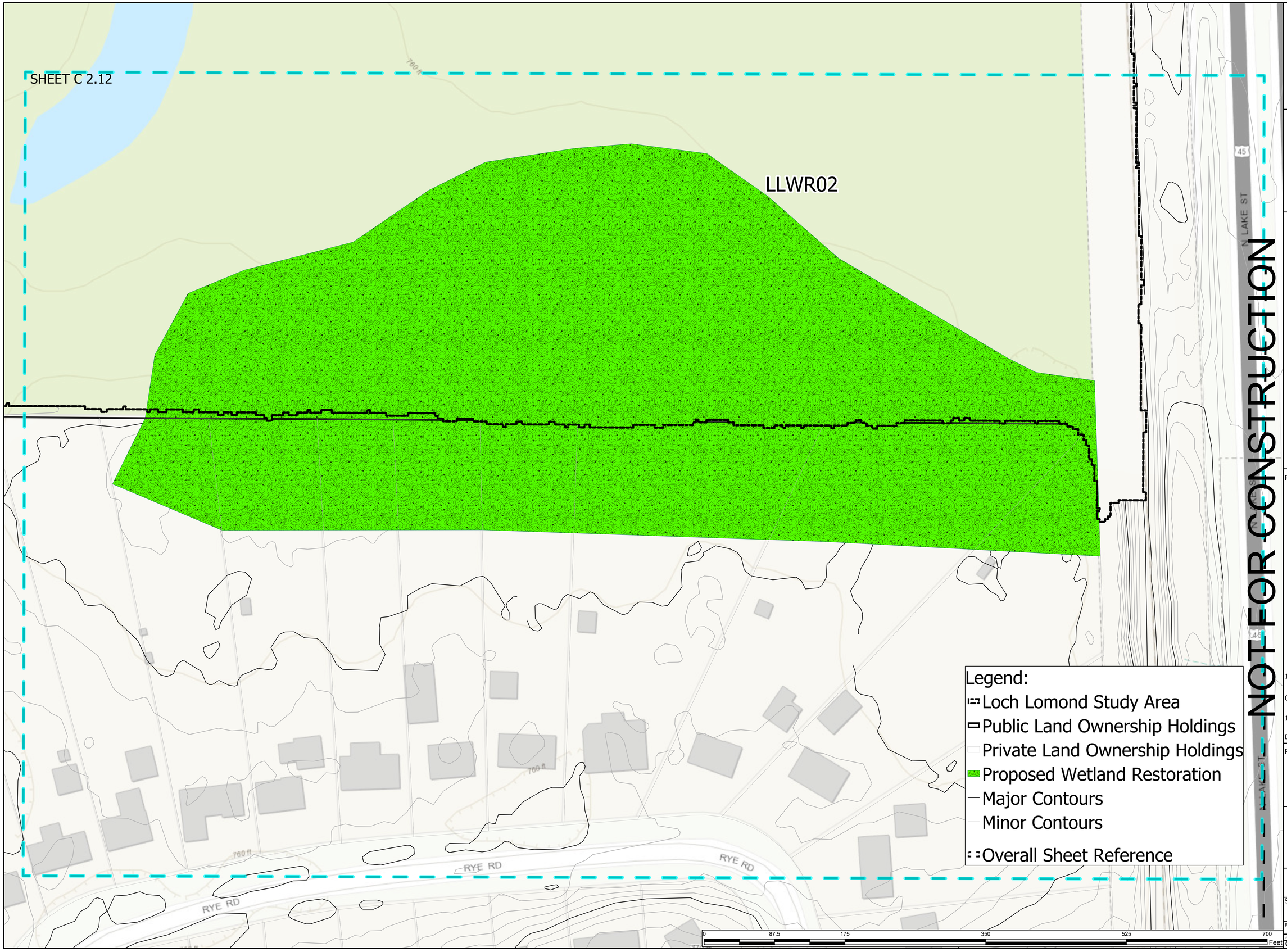
DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.11
LOCH LOMOND
PROPOSED PROJECTS

SHEET NO.	DESIGNED	EH
	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
	DATE	10/30/2017
	SCALE	1:875



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

DATE:	DESCRIPTION OF REVISION
10/30/2017	DRAFT CONCEPTUAL DESIGN
02/01/2018	CONCEPTUAL DESIGN REVISIONS
10/30/2017	DRAFT CONCEPTUAL DESIGN

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

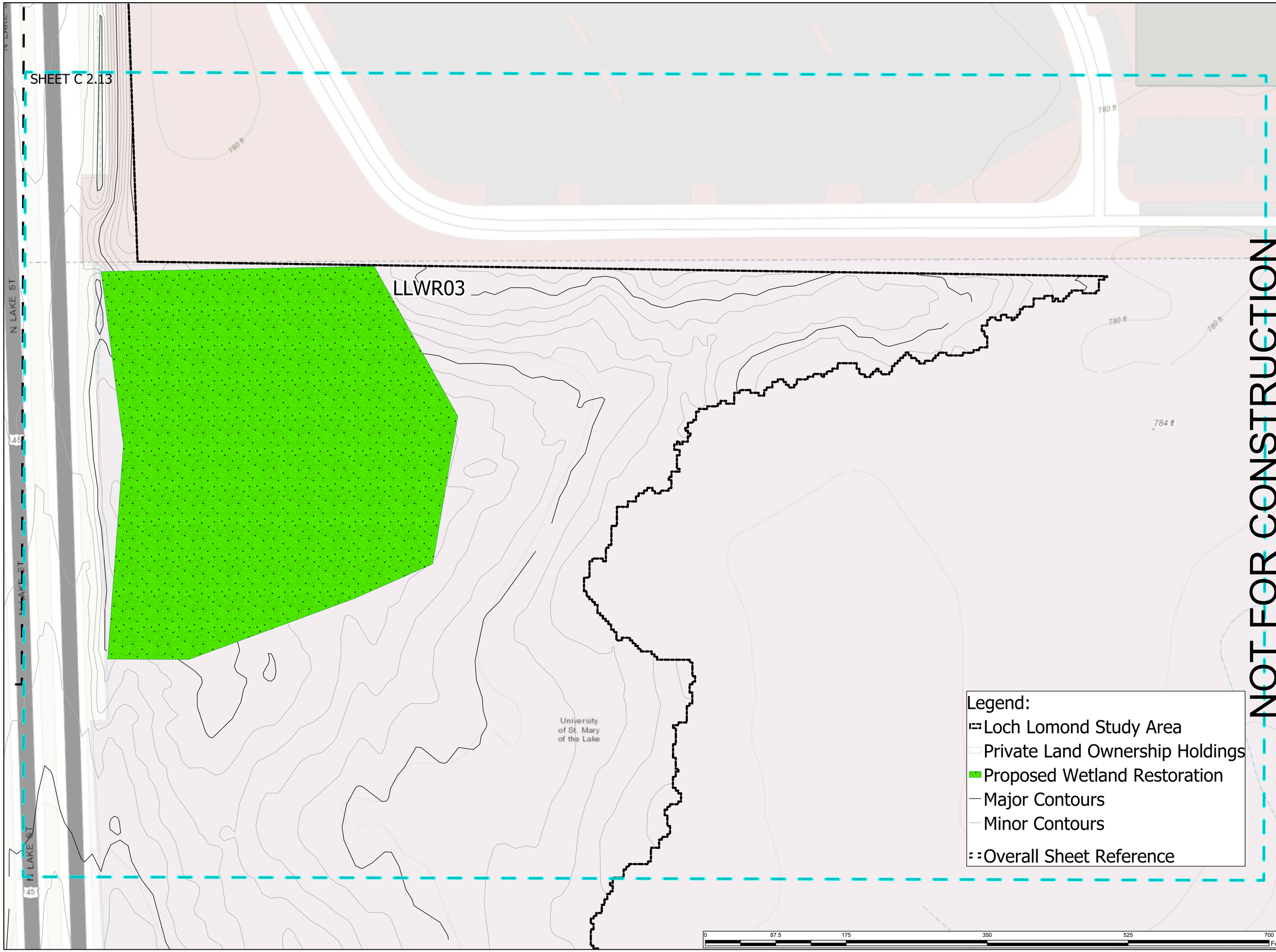
SHEET C 2.12
LOCH LOMOND
PROPOSED PROJECTS

SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

FILE: LAKE COUNTY STORMWATER COMMISSION

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600



NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.13
LOCH LOMOND
PROPOSED PROJECTS

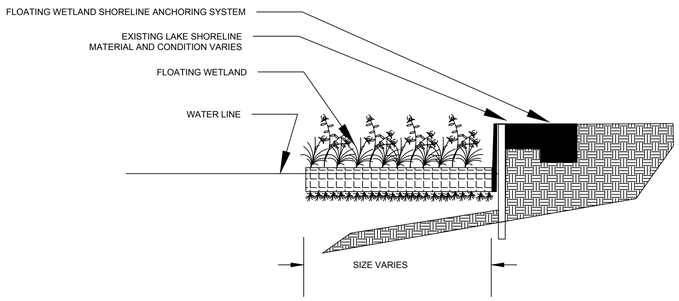
SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

FILE:

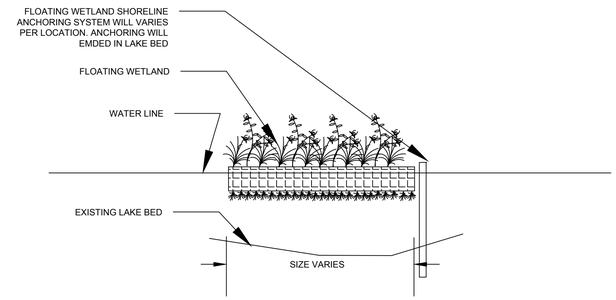
LAKE COUNTY STORMWATER COMMISSION

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:600



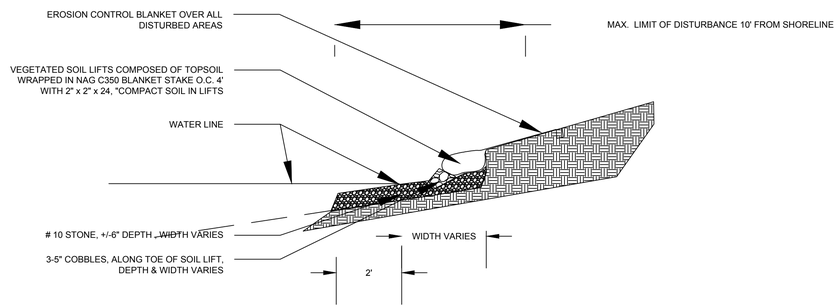
SHORELINE STABILIZATION FLOATING TREATMENT WETLAND

Scale: ###" = ###"



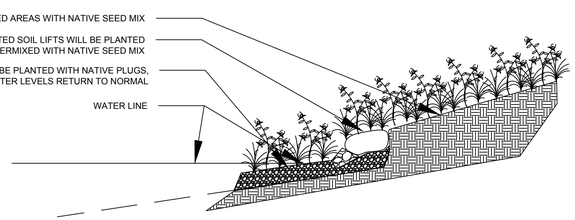
OPEN WATER FLOATING TREATMENT WETLAND

Scale: ###" = ###"



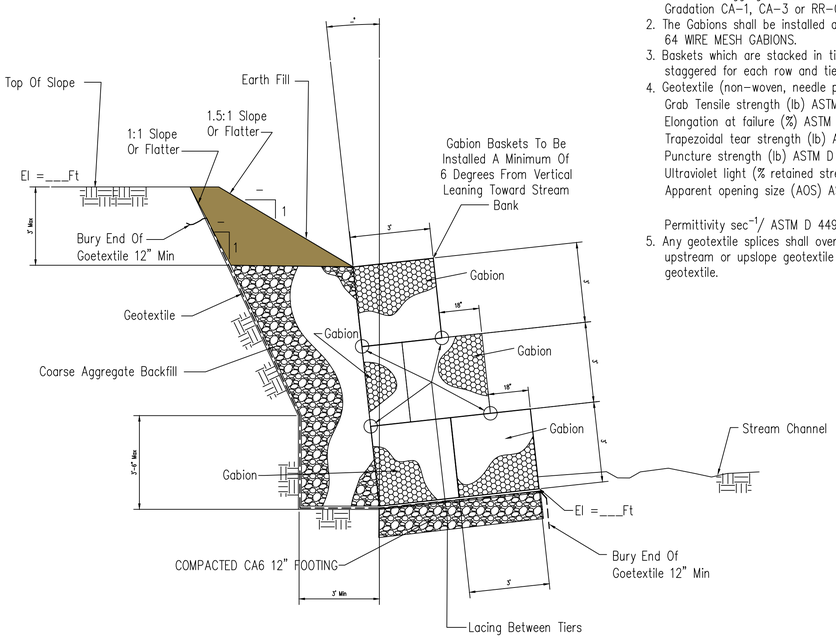
SHORELINE STABILIZATION HARDSCAPE SECTION

Scale: ###" = ###"



SHORELINE STABILIZATION PLANTING SECTION

Scale: ###" = ###"



SECTION

NOTES:

1. The coarse aggregate backfill shall meet the IDOT requirement for Gradation CA-1, CA-3 or RR-Gradation 1 Riprap.
2. The Gabions shall be installed according to construction specification 64 WIRE MESH GABIONS.
3. Baskets which are stacked in tiers shall have vertical seams staggered for each row and tier.
4. Geotextile (non-woven, needle punched) min. criteria:
   - Grab Tensile strength (lb) ASTM D 4632_____202
   - Elongation at failure (%) ASTM D 4632_____≥50
   - Trapezoidal tear strength (lb) ASTM D 4533_____79
   - Puncture strength (lb) ASTM D 6241 _____433
   - Ultraviolet light (% retained strength) ASTM 4355_____min 50
   - Apparent opening size (AOS) ASTM D 4751____ max 0.22 mm (US sieve size 70)
   - Permittivity sec^{-1}/ ASTM D 4491_____min 0.70
5. Any geotextile splices shall overlap a minimum of 18 inches, with upstream or upslope geotextile overlapping the abutting downslope geotextile.

Date | Designed | Drawn | Checked
19/1/13 | M. QUINONES

STRUCTURAL STREAMBANK STABILIZATION GABIONS 3 BASKETS HIGH W/O MAT

NOT FOR CONSTRUCTION

United States Department of Agriculture
Natural Resources Conservation Service

File No. IL-ENG-54
Drawing No.
Page 1 of 1
Sheet of

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

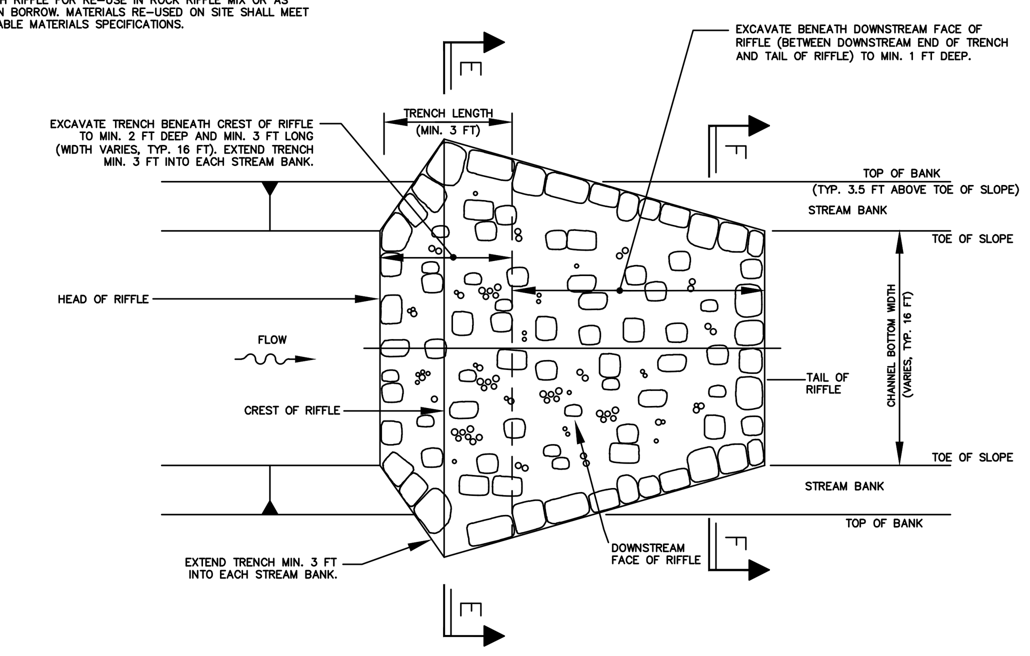
PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

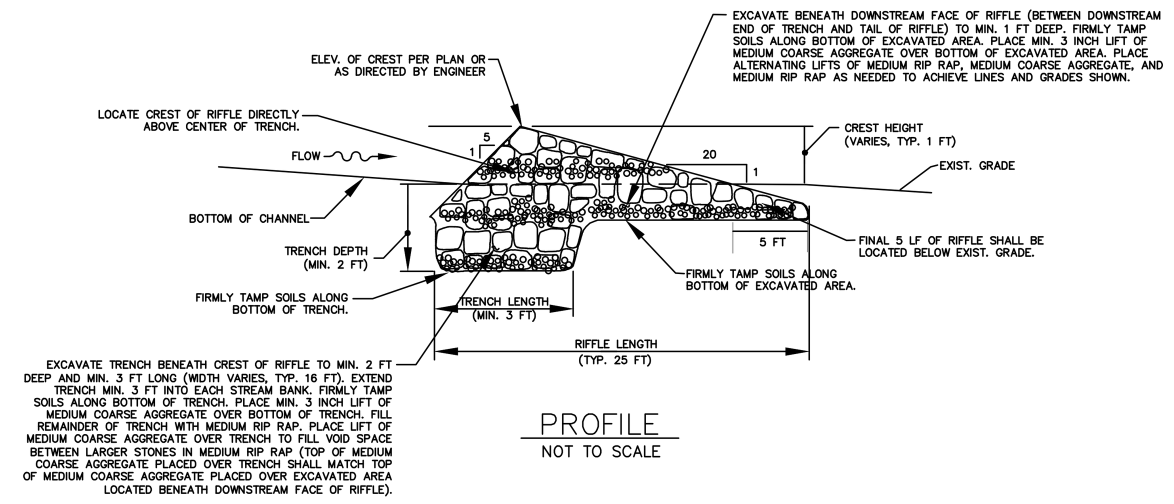
SHEET C 3.0
LOCH LOMOND
SHEET REFERENCE

SHEET N0.	DESIGNED	EH
	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
FILE:	DATE	10/30/2017
LAKE COUNTY STORMWATER COMMISSION	SCALE	

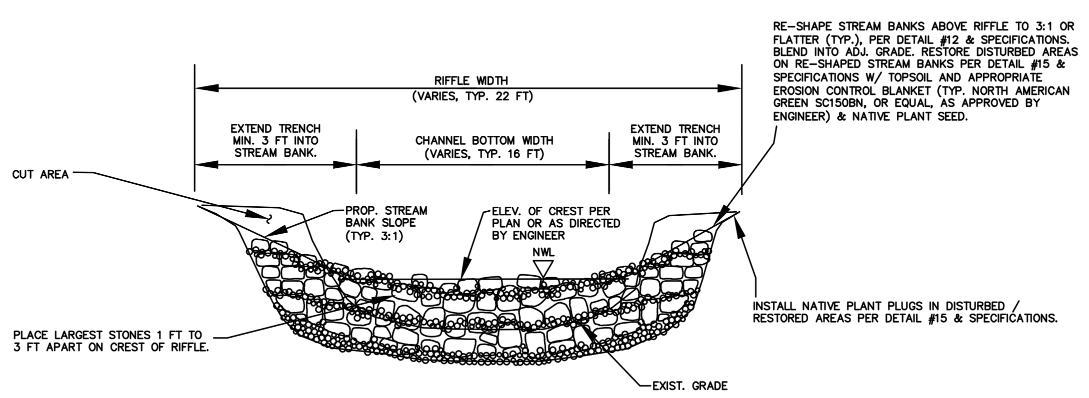
NOTE:
REMOVE LOOSE BOULDERS AND COBBLE IN STREAM BED BENEATH RIFFLE FOR RE-USE IN ROCK RIFFLE MIX OR AS COMMON BORROW. MATERIALS RE-USED ON SITE SHALL MEET APPLICABLE MATERIALS SPECIFICATIONS.



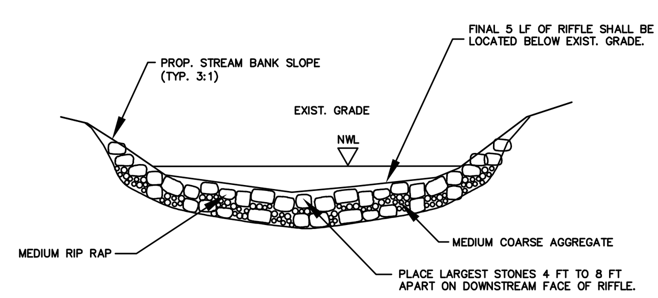
PLAN VIEW
NOT TO SCALE



PROFILE
NOT TO SCALE



ELEVATION AT CREST (E SECTION)
NOT TO SCALE



ELEVATION ON DOWNSTREAM FACE (F SECTION)
NOT TO SCALE

INSTALLATION

1. REMOVE LOOSE BOULDERS AND COBBLE IN STREAM BED BENEATH RIFFLE FOR RE-USE IN ROCK RIFFLE MIX OR AS COMMON BORROW. MATERIALS RE-USED ON SITE SHALL MEET APPLICABLE MATERIALS SPECIFICATIONS.
2. EXCAVATE TRENCH BENEATH CREST OF RIFFLE TO MIN. 2 FT DEEP AND MIN. 3 FT LONG (WIDTH VARIES, TYP. 16 FT). EXTEND TRENCH MIN. 3 FT INTO EACH STREAM BANK.
3. EXCAVATE BENEATH DOWNSTREAM FACE OF RIFFLE, BETWEEN DOWNSTREAM END OF TRENCH AND TAIL OF RIFFLE, TO MIN. 1 FT DEEP.
4. FIRMLY TAMP SOILS ALONG BOTTOM OF TRENCH AND ALONG BOTTOM OF EXCAVATED AREA LOCATED BENEATH DOWNSTREAM FACE OF RIFFLE.
5. PLACE MIN. 3 INCH LIFT OF MEDIUM COARSE AGGREGATE OVER BOTTOM OF TRENCH AND OVER BOTTOM OF EXCAVATED AREA LOCATED BENEATH DOWNSTREAM FACE OF RIFFLE.
6. FILL REMAINDER OF TRENCH WITH MEDIUM RIP RAP.
7. PLACE LIFT OF MEDIUM COARSE AGGREGATE OVER TRENCH TO FILL VOID SPACE BETWEEN LARGER STONES IN MEDIUM RIP RAP (TOP OF MEDIUM COARSE AGGREGATE PLACED OVER TRENCH SHALL MATCH TOP OF MEDIUM COARSE AGGREGATE PLACED OVER BOTTOM OF EXCAVATED AREA LOCATED BENEATH DOWNSTREAM FACE OF RIFFLE).
8. PLACE ALTERNATING LIFTS OF MEDIUM RIP RAP, MEDIUM COARSE AGGREGATE, AND MEDIUM RIP RAP AS NEEDED TO ACHIEVE LINES AND GRADES SHOWN. MEDIUM COARSE AGGREGATE SHALL FILL VOID SPACE BETWEEN LARGER STONES IN MEDIUM RIP RAP.
9. ON CREST OF RIFFLE, LARGEST STONES SHALL BE PLACED 1 FT TO 3 FT APART.
10. ON DOWNSTREAM FACE OF RIFFLE, LARGEST STONES SHALL BE PLACED 4 FT TO 8 FT APART.
11. PLACE FINAL LIFT OF MEDIUM COARSE AGGREGATE OVER RIFFLE. SURFACE OF RIFFLE SHALL BE ROUGH AND NATURAL IN APPEARANCE AND SHALL NOT BE SMOOTHED.
12. RE-SHAPE STREAM BANKS ABOVE RIFFLE TO 3:1 OR FLATTER (TYP.), PER DETAIL #12 & SPECIFICATIONS. BLEND INTO ADJ. GRADE.
13. RESTORE DISTURBED AREAS ON RE-SHAPED STREAM BANKS PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
14. RESTORE DISTURBED AREAS ABOVE RE-SHAPED STREAM BANKS PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
15. INSTALL NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

ROCK RIFFLE MIX

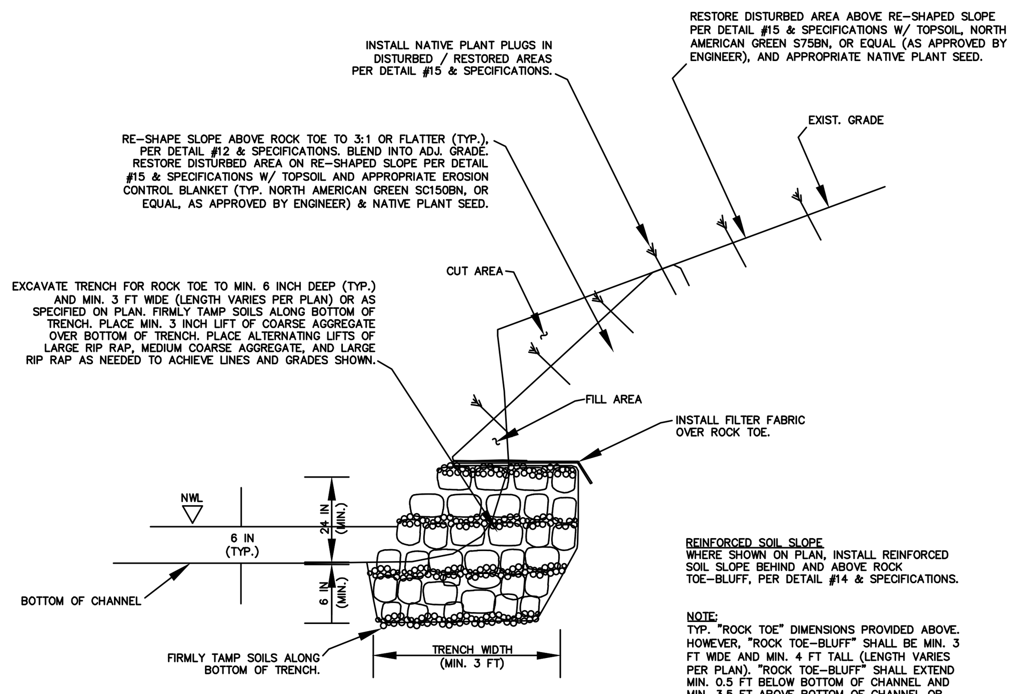
67% OF ROCK RIFFLE MIX = MEDIUM RIP RAP:
D100 = 18 INCH (~ 300 LB)
D75 = 12 INCH (~ 90 LB)
D50 = 9 INCH (~ 40 LB)
D10 = 3 INCH (~ 1 LB)

33% OF ROCK RIFFLE MIX = MEDIUM COARSE AGGREGATE:
D100 = 1 INCH
D50 = 0.50 INCH
D10 = 0.1875 INCH

ROCK TYPE:
RIP RAP SHALL BE STONE, QUARRIED FROM UNDISTURBED, CONSOLIDATED DEPOSITS (LEDGES) OF ROCK REASONABLY FREE OF SHALE AND SHALY STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

COARSE AGGREGATE SHALL BE GRAVEL, CRUSHED GRAVEL, OR CRUSHED STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

ROCK RIFFLE
NOT TO SCALE



REINFORCED SOIL SLOPE
WHERE SHOWN ON PLAN, INSTALL REINFORCED SOIL SLOPE BEHIND AND ABOVE ROCK TOE-BLUFF, PER DETAIL #14 & SPECIFICATIONS.

NOTE:
TYP. "ROCK TOE" DIMENSIONS PROVIDED ABOVE. HOWEVER, "ROCK TOE-BLUFF" SHALL BE MIN. 3 FT WIDE AND MIN. 4 FT TALL (LENGTH VARIES PER PLAN). "ROCK TOE-BLUFF" SHALL EXTEND MIN. 0.5 FT BELOW BOTTOM OF CHANNEL AND MIN. 3.5 FT ABOVE BOTTOM OF CHANNEL OR AS SPECIFIED ON PLAN.

PROFILE
NOT TO SCALE

INSTALLATION

1. EXCAVATE TRENCH FOR ROCK TOE TO MIN. 6 INCH DEEP (TYP.) AND MIN. 3 FT WIDE (LENGTH VARIES PER PLAN) OR AS SPECIFIED ON PLAN.
2. FIRMLY TAMP SOILS ALONG BOTTOM OF TRENCH.
3. PLACE MIN. 3 INCH LIFT OF MEDIUM COARSE AGGREGATE OVER BOTTOM OF TRENCH.
4. PLACE ALTERNATING LIFTS OF LARGE RIP RAP, MEDIUM COARSE AGGREGATE, AND LARGE RIP RAP AS NEEDED TO ACHIEVE LINES AND GRADES SHOWN. MEDIUM COARSE AGGREGATE SHALL FILL VOID SPACE BETWEEN LARGER STONES IN LARGE RIP RAP. ROCK TOE SHALL EXTEND MIN. 6 INCH BELOW BOTTOM OF CHANNEL AND MIN. 2 FT ABOVE BOTTOM OF CHANNEL OR AS SPECIFIED ON PLAN.
5. INSTALL FILTER FABRIC OVER ROCK TOE, AS SHOWN AND PER SPECIFICATIONS.
6. RE-SHAPE SLOPE ABOVE ROCK TOE TO 3:1 OR FLATTER (TYP.), PER DETAIL #12 & SPECIFICATIONS. BLEND INTO ADJ. GRADE.
7. TRIM FILTER FABRIC EXTENDING BEYOND TOE OF RE-SHAPED SLOPE. FILTER FABRIC SHALL NOT EXTEND MORE THAN 3 INCH BEYOND TOE OF RE-SHAPED SLOPE.
8. RESTORE DISTURBED AREA ON RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
9. RESTORE DISTURBED AREA ABOVE RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
10. INSTALL NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

ROCK TOE / ROCK POINT MIX

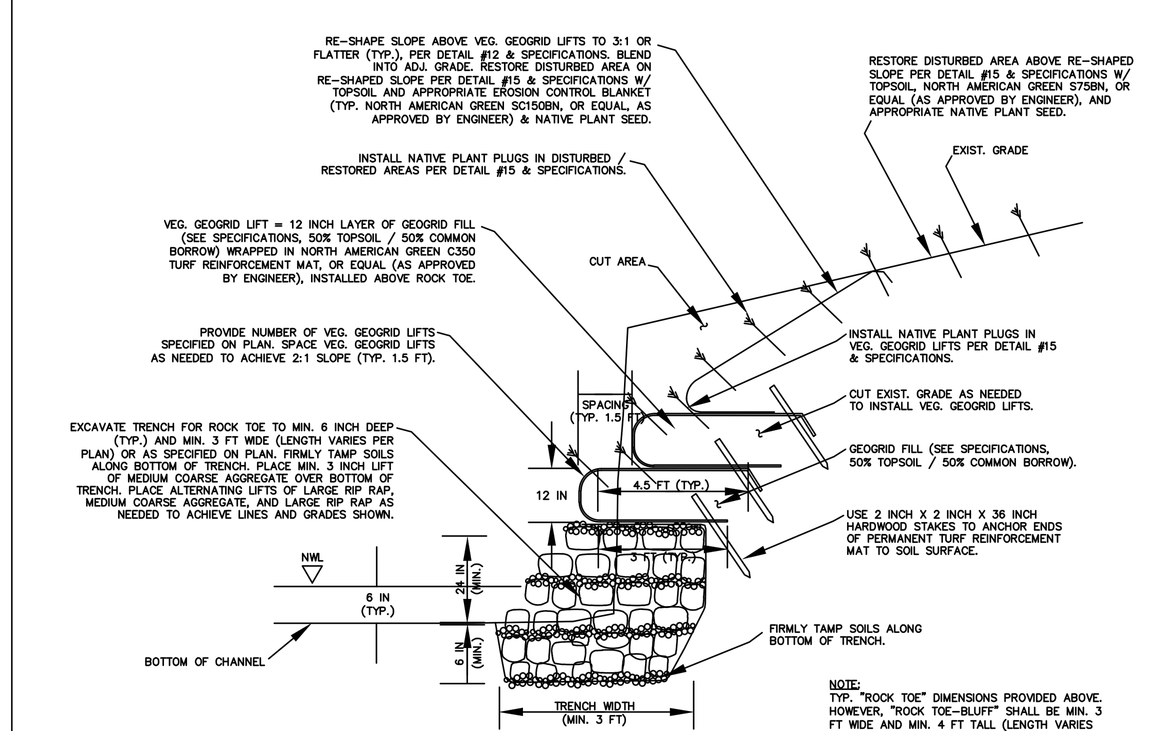
67% OF ROCK TOE / ROCK POINT MIX = LARGE RIP RAP:
D100 = 21 INCH (~ 400 LB)
D75 = 15 INCH (~ 170 LB)
D50 = 12 INCH (~ 90 LB)
D10 = 4 INCH (~ 3 LB)

33% OF ROCK TOE / ROCK POINT MIX = MEDIUM COARSE AGGREGATE:
D100 = 1 INCH
D50 = 0.50 INCH
D10 = 0.1875 INCH

ROCK TYPE:
RIP RAP SHALL BE STONE, QUARRIED FROM UNDISTURBED, CONSOLIDATED DEPOSITS (LEDGES) OF ROCK REASONABLY FREE OF SHALE AND SHALY STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

COARSE AGGREGATE SHALL BE GRAVEL, CRUSHED GRAVEL, OR CRUSHED STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

6 ROCK TOE / RE-SHAPE SLOPE
NOT TO SCALE



NOTE:
TYP. "ROCK TOE" DIMENSIONS PROVIDED ABOVE. HOWEVER, "ROCK TOE-BLUFF" SHALL BE MIN. 3 FT WIDE AND MIN. 4 FT TALL (LENGTH VARIES PER PLAN). "ROCK TOE-BLUFF" SHALL EXTEND MIN. 0.5 FT BELOW BOTTOM OF CHANNEL AND MIN. 3.5 FT ABOVE BOTTOM OF CHANNEL OR AS SPECIFIED ON PLAN.

PROFILE
NOT TO SCALE

INSTALLATION

1. EXCAVATE TRENCH FOR ROCK TOE TO MIN. 6 INCH DEEP (TYP.) AND MIN. 3 FT WIDE (LENGTH VARIES PER PLAN), OR AS SPECIFIED ON PLAN.
2. FIRMLY TAMP SOILS ALONG BOTTOM OF TRENCH.
3. PLACE MIN. 3 INCH LIFT OF MEDIUM COARSE AGGREGATE OVER BOTTOM OF TRENCH.
4. PLACE ALTERNATING LIFTS OF LARGE RIP RAP, MEDIUM COARSE AGGREGATE, AND LARGE RIP RAP AS NEEDED TO ACHIEVE LINES AND GRADES SHOWN. MEDIUM COARSE AGGREGATE SHALL FILL VOID SPACE BETWEEN LARGER STONES IN LARGE RIP RAP. ROCK TOE SHALL EXTEND MIN. 6 INCH BELOW BOTTOM OF CHANNEL AND MIN. 2 FT ABOVE BOTTOM OF CHANNEL OR AS SPECIFIED ON PLAN.
5. CUT EXIST. GRADE ABOVE ROCK TOE AS NEEDED TO INSTALL VEG. GEOGRID LIFTS.
6. INSTALL VEG. GEOGRID LIFTS ABOVE ROCK TOE. ROLL OUT TURF REINFORCEMENT MAT (NORTH AMERICAN GREEN C350, OR EQUAL, AS APPROVED BY ENGINEER) TO MIN. WIDTH OF 3 FT (TYP.), AS MEASURED FROM FACE OF SLOPE. ANCHOR END OF TURF REINFORCEMENT MAT TO SOIL SURFACE W/ 2 INCH X 2 INCH X 36 INCH HARDWOOD STAKES INSTALLED AT MAX. 4 FT O.C.
7. PLACE AND COMPACT MAX. 6 INCH LIFTS OF GEOGRID FILL (SEE SPECIFICATIONS, 50% TOPSOIL / 50% COMMON BORROW) OVER TURF REINFORCEMENT MAT AS NEEDED TO ACHIEVE 12 INCH LAYER OF COMPACTED GEOGRID FILL OVER TURF REINFORCEMENT MAT. FOLLOWING COMPACTION, THE DRY DENSITY OF THE COMPACTED GEOGRID FILL SHALL BE AT LEAST 85% OF THE LABORATORY STANDARD (STANDARD PROCTOR) DRY DENSITY.
8. INSTALL APPROPRIATE NATIVE PLANT SEED INTO GEOGRID FILL, PER DETAIL #15 & SPECIFICATIONS.
9. WRAP TURF REINFORCEMENT MAT AROUND AND OVER GEOGRID FILL AND ROLL OUT TO MIN. WIDTH OF 4.5 FT (TYP.) ON TOP OF GEOGRID FILL, AS MEASURED FROM FACE OF SLOPE. FASTEN TURF REINFORCEMENT MAT TO UNDERLYING GEOGRID FILL, PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDED STAPLE PATTERN, W/ MIN. 12 INCH STAPLES AND ANCHOR END OF TURF REINFORCEMENT MAT TO SOIL SURFACE W/ 2 INCH X 2 INCH X 36 INCH HARDWOOD STAKES INSTALLED AT MAX. 4 FT O.C.
10. PROVIDE NUMBER OF VEG. GEOGRID LIFTS SPECIFIED ON PLAN. SPACE VEG. GEOGRID LIFTS AS NEEDED TO ACHIEVE 2:1 SLOPE (TYP. 1.5 FT).
11. RE-SHAPE SLOPE ABOVE VEG. GEOGRID LIFTS TO 3:1 OR FLATTER (TYP.), PER DETAIL #12 & SPECIFICATIONS. BLEND INTO ADJ. GRADE.
12. RESTORE DISTURBED AREA ON RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
13. RESTORE DISTURBED AREA ABOVE RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
14. INSTALL NATIVE PLANT PLUGS IN VEG. GEOGRID LIFTS AND DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

ROCK TOE / ROCK POINT MIX

67% OF ROCK TOE / ROCK POINT MIX = LARGE RIP RAP:
D100 = 21 INCH (~ 400 LB)
D75 = 15 INCH (~ 170 LB)
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33% OF ROCK TOE / ROCK POINT MIX = MEDIUM COARSE AGGREGATE:
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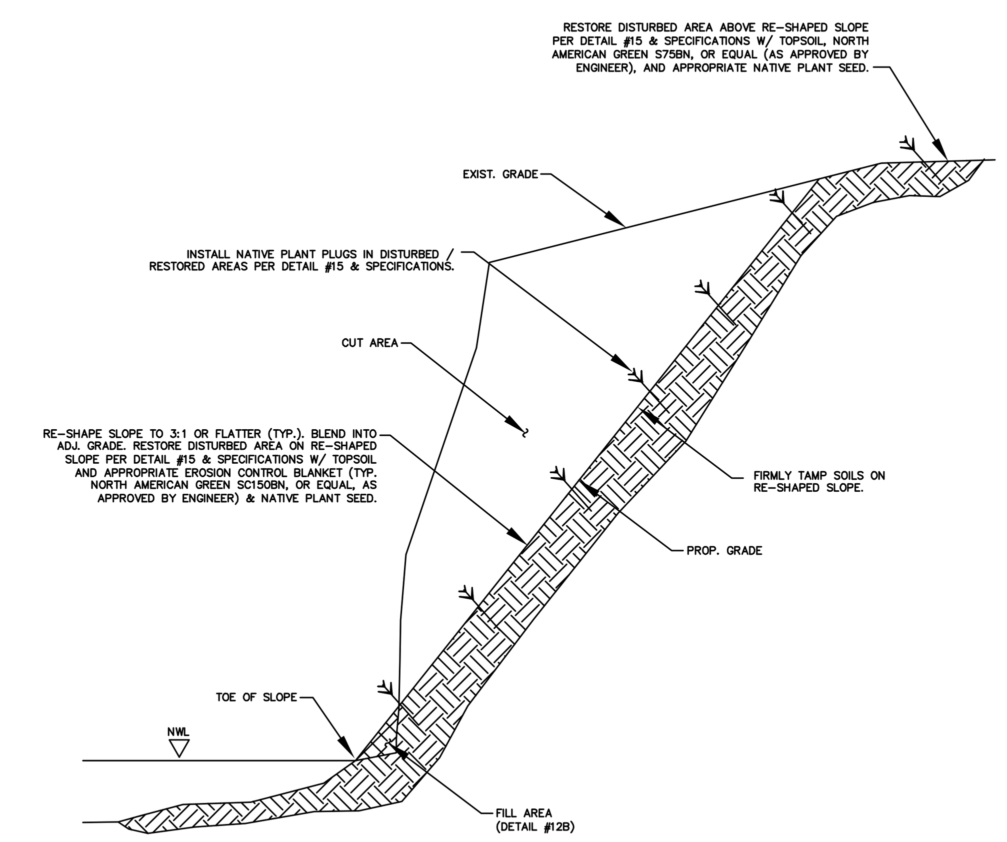
ROCK TYPE:
RIP RAP SHALL BE STONE, QUARRIED FROM UNDISTURBED, CONSOLIDATED DEPOSITS (LEDGES) OF ROCK REASONABLY FREE OF SHALE AND SHALY STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

COARSE AGGREGATE SHALL BE GRAVEL, CRUSHED GRAVEL, OR CRUSHED STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

ROCK TOE / VEG. GEOGRID LIFTS / RE-SHAPE SLOPE
NOT TO SCALE

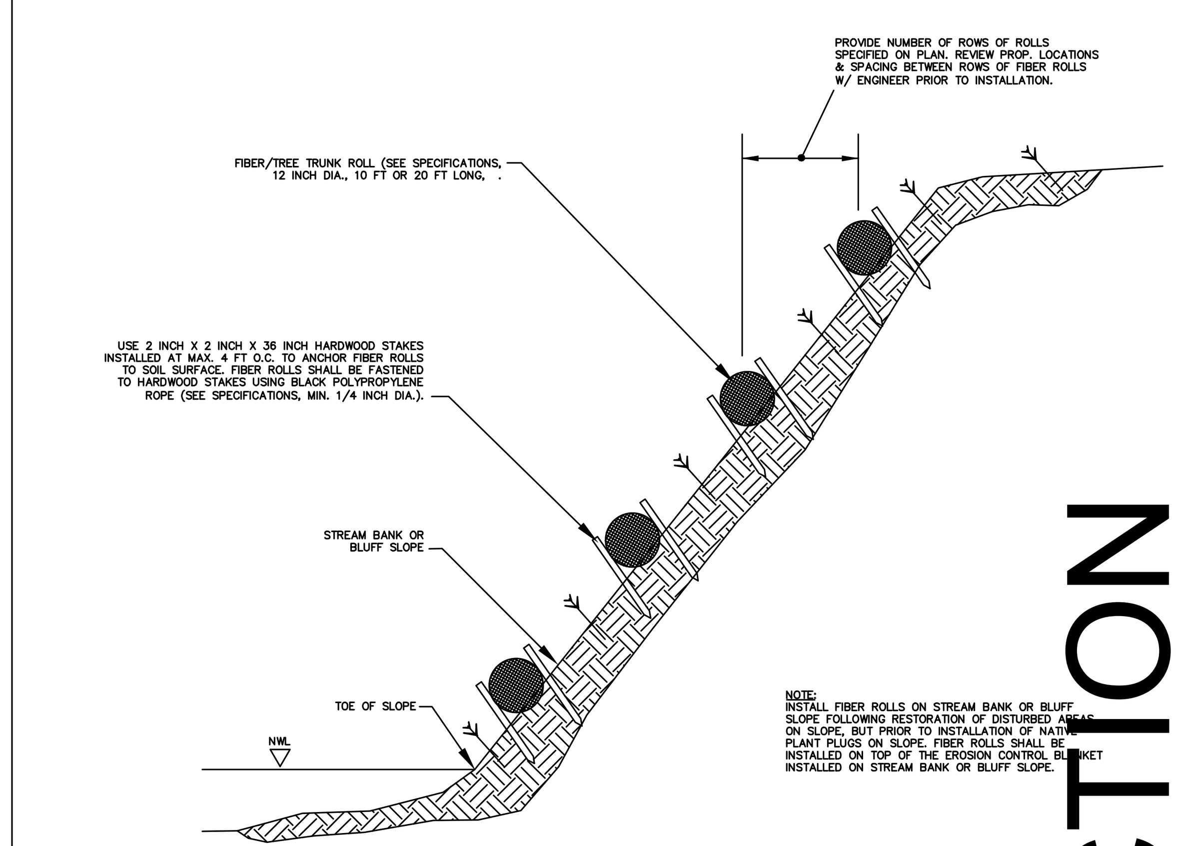


PROFILE
NOT TO SCALE

INSTALLATION

1. CUT EXIST. GRADE AS NEEDED TO RE-SHAPE SLOPE TO 3:1 OR FLATTER (TYP.). SHAPE, TRIM, & FINISH RE-SHAPED SLOPE AND BLEND INTO ADJ. GRADE. FIRMLY TAMP SOILS ON RE-SHAPED SLOPE.
2. RESTORE DISTURBED AREA ON RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
3. RESTORE DISTURBED AREA ABOVE RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
4. INSTALL NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

RE-SHAPE SLOPE (CUT)
NOT TO SCALE



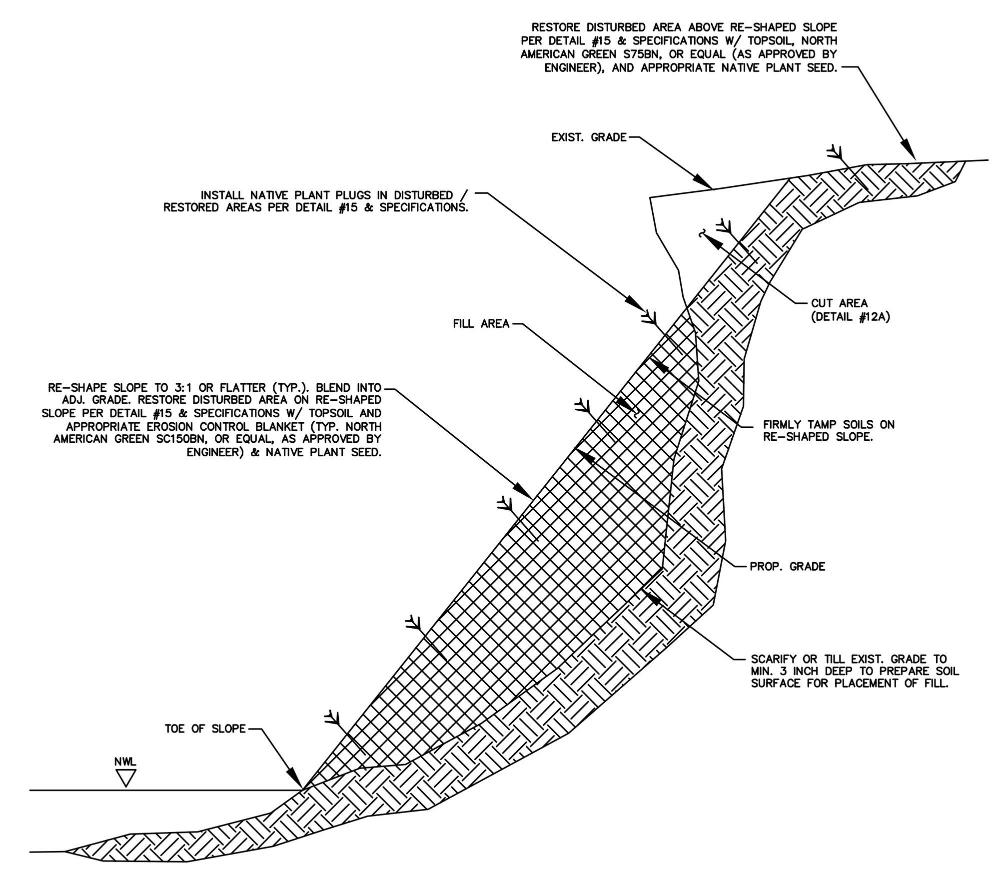
NOTE:
INSTALL FIBER ROLLS ON STREAM BANK OR BLUFF SLOPE FOLLOWING RESTORATION OF DISTURBED AREAS ON SLOPE, BUT PRIOR TO INSTALLATION OF NATIVE PLANT PLUGS ON SLOPE. FIBER ROLLS SHALL BE INSTALLED ON TOP OF THE EROSION CONTROL BLANKET INSTALLED ON STREAM BANK OR BLUFF SLOPE.

PROFILE
NOT TO SCALE

INSTALLATION

1. INSTALL FIBER ROLLS ON STREAM BANK OR BLUFF SLOPE FOLLOWING RESTORATION OF DISTURBED AREAS ON SLOPE, BUT PRIOR TO INSTALLATION OF NATIVE PLANT PLUGS ON SLOPE. FIBER ROLLS SHALL BE INSTALLED ON TOP OF THE EROSION CONTROL BLANKET INSTALLED ON STREAM BANK OR BLUFF SLOPE. PROVIDE NUMBER OF ROWS OF FIBER ROLLS SPECIFIED ON PLAN. REVIEW PROP. LOCATIONS & SPACING BETWEEN ROWS OF FIBER ROLLS W/ ENGINEER PRIOR TO INSTALLATION.
2. USE 2 INCH X 2 INCH X 36 INCH HARDWOOD STAKES INSTALLED AT MAX. 4 FT O.C. TO ANCHOR FIBER ROLLS TO SOIL SURFACE.
3. FASTEN FIBER ROLLS TO WOOD STAKES USING BLACK POLYPROPYLENE ROPE (SEE SPECIFICATIONS, MIN. 1/4 INCH DIA.).

TERRACE ROLL
NOT TO SCALE



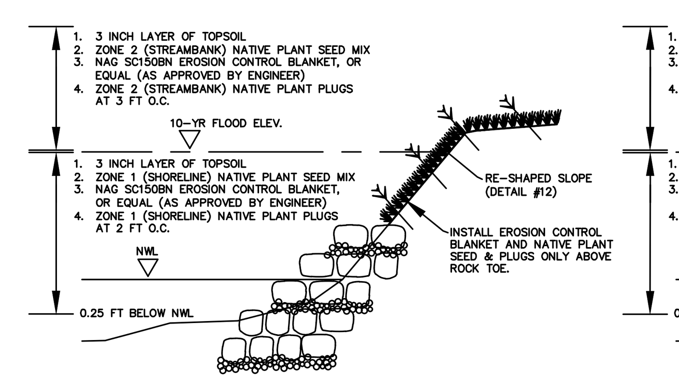
PROFILE
NOT TO SCALE

INSTALLATION

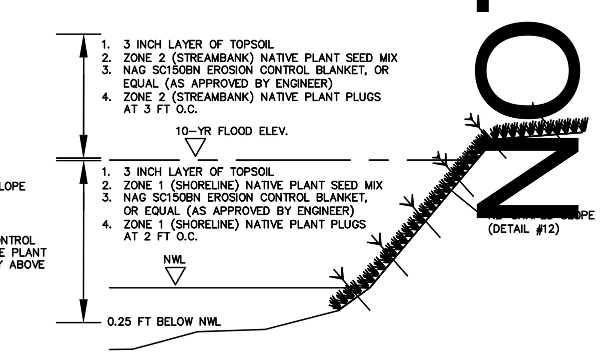
1. SCARIFY OR TILL EXIST. GRADE TO MIN. 3 INCH DEEP TO PREPARE SOIL SURFACE FOR PLACEMENT OF FILL.
2. FILL (USING COMMON BORROW) ABOVE TOE OF SLOPE AS NEEDED TO RE-SHAPE SLOPE TO 3:1 OR FLATTER (TYP.). SHAPE, TRIM, & FINISH RE-SHAPED SLOPE AND BLEND INTO ADJ. GRADE. FIRMLY TAMP SOILS ON RE-SHAPED SLOPE.
3. RESTORE DISTURBED AREA ON RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
4. RESTORE DISTURBED AREA ABOVE RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
5. INSTALL NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

RE-SHAPE SLOPE (FILL)
NOT TO SCALE

NOTE:
INSTALL TOPSOIL, NATIVE PLANT SEED, EROSION CONTROL BLANKET, & NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS AS SHOWN AND PER SPECIFICATIONS.



ROCK TOE / RE-SHAPE SLOPE



RE-SHAPE SLOPE

NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

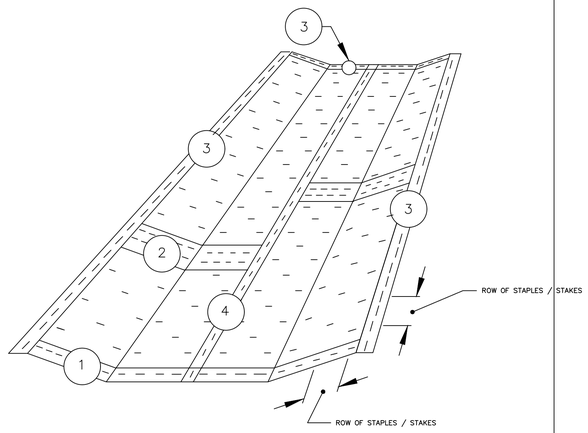
PROJECT:

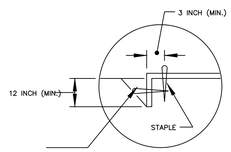
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 3.1
LOCH LOMOND
SHEET REFERENCE

SHEET N0.	DESIGNED	EH
	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
FILE :	DATE	10/30/2017
© LAKE COUNTY STORMWATER COMMISSION	SCALE	

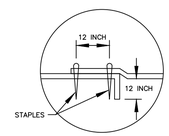
SEE ALSO IL URBAN MANUAL IL-530A / IL-530B





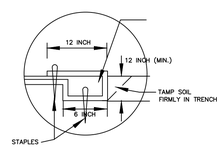
TERMINAL FOLD

DETAIL 1



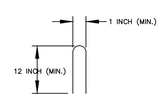
JUNCTION SLOT

DETAIL 2



ANCHOR SLOT

DETAIL 3



STAPLE DETAIL

DETAIL 4

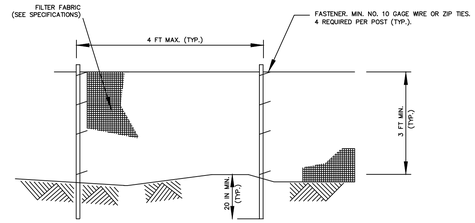
NOTES:

1. IF HEIGHT OF SLOPE TO BE RESTORED IS GREATER THAN 4 FT, EROSION CONTROL BLANKET SHALL BE INSTALLED VERTICALLY UP THE SLOPE, PERPENDICULAR TO THE STREAM BANK. IF HEIGHT OF SLOPE TO BE RESTORED IS 4 FT OR LESS, EROSION CONTROL BLANKET SHALL BE INSTALLED HORIZONTALLY ALONG THE SLOPE, PARALLEL TO THE STREAM BANK.
2. EROSION CONTROL BLANKET SHALL BE PLACED FIRMLY IN CONTACT WITH SOIL SURFACE. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES, PER MANUFACTURER'S RECOMMENDED STAPLE PATTERN.
3. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS. EACH EDGE OF BLANKET SHALL BE SECURED USING ANCHOR SLOT OR TERMINAL FOLD, PER MANUFACTURER'S INSTRUCTIONS. DO NOT USE LAP JOINTS BETWEEN SECTIONS OF EROSION CONTROL BLANKET.
4. PER MANUFACTURER'S RECOMMENDED STAPLE PATTERN, APPROXIMATELY 1.15 STAPLES REQUIRED PER SQ. YD. OF EROSION CONTROL BLANKET INSTALLED IN AREAS RE-SHAPED TO A SLOPE OF 3:1 OR FLATTER, APPROXIMATELY 1.7 STAPLES REQUIRED PER SQ. YD OF EROSION CONTROL BLANKET INSTALLAED IN AREAS RE-SHAPED TO A SLOPE OF 2:1 OR FLATTER, AND APPROXIMATELY 3.4 STAPLES REQUIRED PER SQ. YD OF EROSION CONTROL BLANKET INSTALLED IN AREAS RE-SHAPED TO 1:1 OR FLATTER.

EROSION CONTROL BLANKET

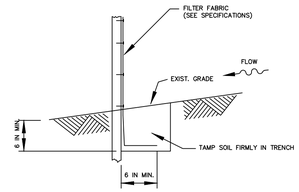
NOT TO SCALE

SEE ALSO IL URBAN MANUAL IL-620A



ELEVATION

NOT TO SCALE



ANCHOR DETAIL

NOT TO SCALE

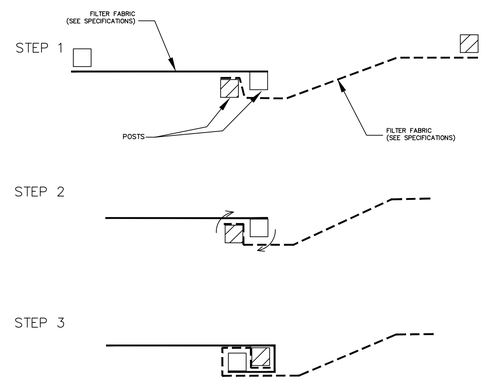
NOTES:

1. SEE SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL PLAN. IF INCLUDED AS PART OF SOIL EROSION AND SEDIMENT CONTROL PLAN, SILT FENCE SHALL BE INSTALLED PRIOR TO THE START OF LAND DISTURBING ACTIVITIES, AS INDICATED ON PLAN. SILT FENCE SHALL BE MAINTAINED THROUGHOUT CONSTRUCTION AND REMOVED IN CONJUNCTION WITH FINAL SITE AND SITE STABILIZATION.
2. SILT FENCE SHALL MEET THE PROVISIONS OF AASHTO M288 AND IL URBAN MANUAL IL-620. WHICHEVER STANDARD IS MORE RESTRICTIVE SHALL PREVAIL.
3. FILTER FABRIC USED ON SILT FENCES SHALL BE CLASSIFIED AS SUPPORTED (WITH A WIRE OR POLYMERIC MESH BACKING) OR UNSUPPORTED (NO BACKING).
4. FILTER FABRIC SHALL MEET THE REQUIREMENTS OF AASHTO M288 WITH MIN. AVG. ROLL VALUES (MARV) OF AT LEAST 90-LB FORCE (BEFORE THE FABRIC TEARS) FOR SUPPORTED SILT FENCE, OR 124-LB FORCE PARALLEL TO THE MACHINE DIRECTION & 100-LB FORCE PERPENDICULAR TO THE MACHINE DIRECTION FOR UNSUPPORTED SILT FENCE. PERMITTIVITY SHALL BE TESTED IN ACCORDANCE WITH ASTM D4491 AND MARV PERMITTIVITY SHALL BE 0.05 / SEC OR GREATER. APPARENT OPENING SIZE SHALL BE TESTED IN ACCORDANCE WITH ASTM D4751 AND MARV APPARENT OPENING SIZE SHALL BE 0.024 INCHES OR LESS. UV STABILITY SHALL BE TESTED IN ACCORDANCE WITH ASTM D4355 AND MARV UV STABILITY SHALL BE 70% RETAINED STRENGTH AFTER 500 HOURS OF EXPOSURE OR GREATER.
5. POST SPACING SHALL BE MAX. 4 FT O.C. FOR SUPPORTED FILTER FABRIC OR UNSUPPORTED FILTER FABRIC ELONGATED TO $\geq$ 50% AS MEASURED IN ACCORDANCE WITH ASTM D4632. POST SPACING SHALL BE MAX 6 FT O.C. FOR UNSUPPORTED FILTER FABRIC ELONGATED < 50% AS MEASURED IN ACCORDANCE WITH ASTM D4632.
6. POSTS SHALL BE COMPOSED OF HARDWOOD, STEEL, OR SYNTHETIC MATERIAL. POSTS SHALL BE A MIN. OF 56 IN LONG (3 FT ABOVE GRADE, 20 IN BELOW GRADE). HARDWOOD POSTS SHALL BE A MIN. OF 1.2 INCH X 1.2 INCH. STEEL POSTS MAY BE U, T, L, OR C SHAPE, WEIGHING 1.3 LBS PER FT (MIN.).

18 SILT FENCE

NOT TO SCALE

SEE ALSO IL URBAN MANUAL IL-620B



ATTACHING TWO SILT FENCES

NOTES:

1. PLACE THE END POST OF THE SECOND FENCE INSIDE THE END POST OF THE FIRST FENCE.
2. ROTATE BOTH POSTS AT LEAST 180 DEGREES IN A CLOCKWISE DIRECTION TO CREATE A TIGHT SEAL WITH THE FABRIC MATERIAL.
3. DRIVE BOTH POSTS A MINIMUM OF 20 INCHES INTO THE GROUND AND BURY THE FLAP.

SILT FENCE FASTENING

NOT TO SCALE

NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
LOCH LOMOND IDENTIFIED STUDY AREA

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 3.2
LOCH LOMOND
SHEET REFERENCE

SHEET N0.	DESIGNED	EH
	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
FILE:	DATE	10/30/2017
LAKE COUNTY STORMWATER COMMISSION	SCALE	

Appendix B –

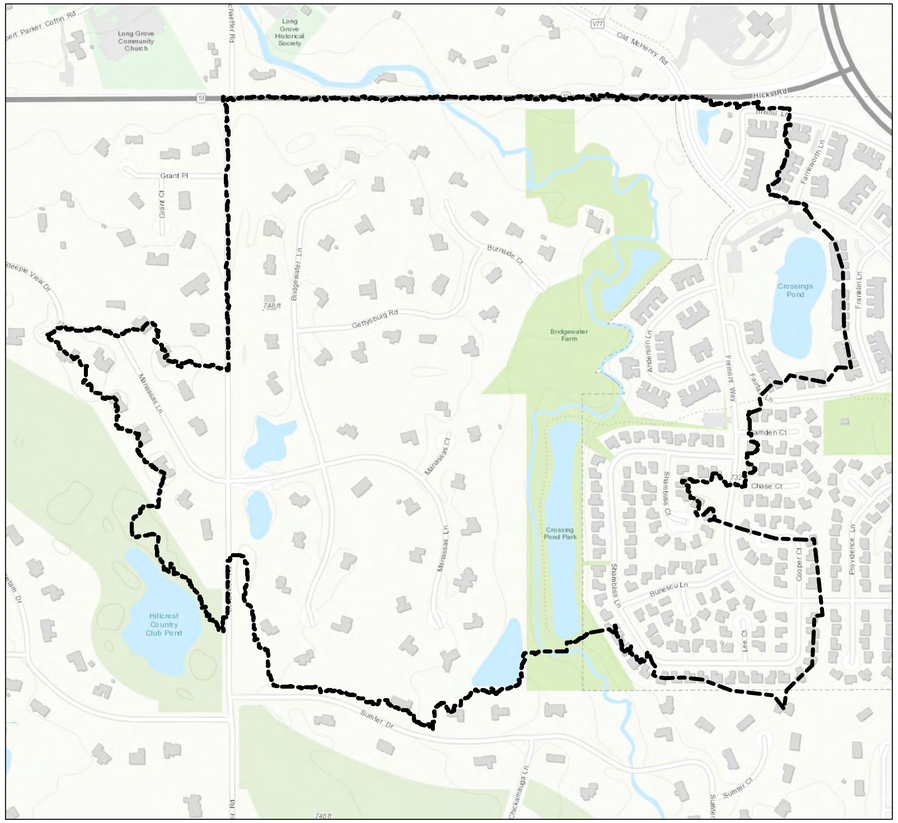
Buffalo Creek Stormwater Improvement Projects

Preliminary Concept Designs

SMALL WATERSHED ASSESSMENT AND ACTION PLAN (SWAAP) - Water Quality Improvement Projects Conceptual Design

Conceptual Design Documents - March 3, 2018

PROJECT LOCATION MAP



FOR UNDERGROUND UTILITY LOCATIONS, CALLJ.U.L.I.E.
TOLL FREE TEL. 1-800-892-0123
24 HOURS/DAY
CALL 48 HOURS PRIOR TO DIGGING
JULIE SUBURBS AND DIGG CHICAGO

YELLOW _____GAS
RED_____ELECTRICAL
ORANGE_____PHONE / TV COMMUNICATION
BLUE_____WATER
GREEN_____SEWERS
WHITE_____SAFE TO DIG

Sheet Index

SHEET C 0.0 - COVER SHEET

SHEET C 1.0 - BUFFALO CREEK PLANNING AREA OVERVIEW
SHEET C 1.1 - BUFFALO CREEK SHEET REFERENCE

SHEET C 2.1 - BUFFALO CREEK PROPOSED PROJECTS
SHEET C 2.2 - BUFFALO CREEK PROPOSED PROJECTS
SHEET C 2.3 - BUFFALO CREEK PROPOSED PROJECTS
SHEET C 2.4 - BUFFALO CREEK PROPOSED PROJECTS
SHEET C 2.5 - BUFFALO CREEK PROPOSED PROJECTS
SHEET C 2.6 - BUFFALO CREEK PROPOSED PROJECTS
SHEET C 2.7 - BUFFALO CREEK PROPOSED PROJECTS
SHEET C 2.8 - BUFFALO CREEK PROPOSED PROJECTS
SHEET C 2.9 - BUFFALO CREEK PROPOSED PROJECTS

SHEET C 3.0 - BUFFALO CREEK DETAILS
SHEET C 3.1 - BUFFALO CREEK DETAILS
SHEET C 3.2 - BUFFALO CREEK DETAILS

NOT FOR CONSTRUCTION

Benchmarks

The topography and elevation data utilized for this project is based on LiDAR derived data points taken in 2007 and made available by Lake County Illinois GIS department.

Field survey by a certified professional land surveyor wiill be needed in future project permitting, bidding, and construction activities.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION
LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK IDENTIFIED STUDY AREA

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

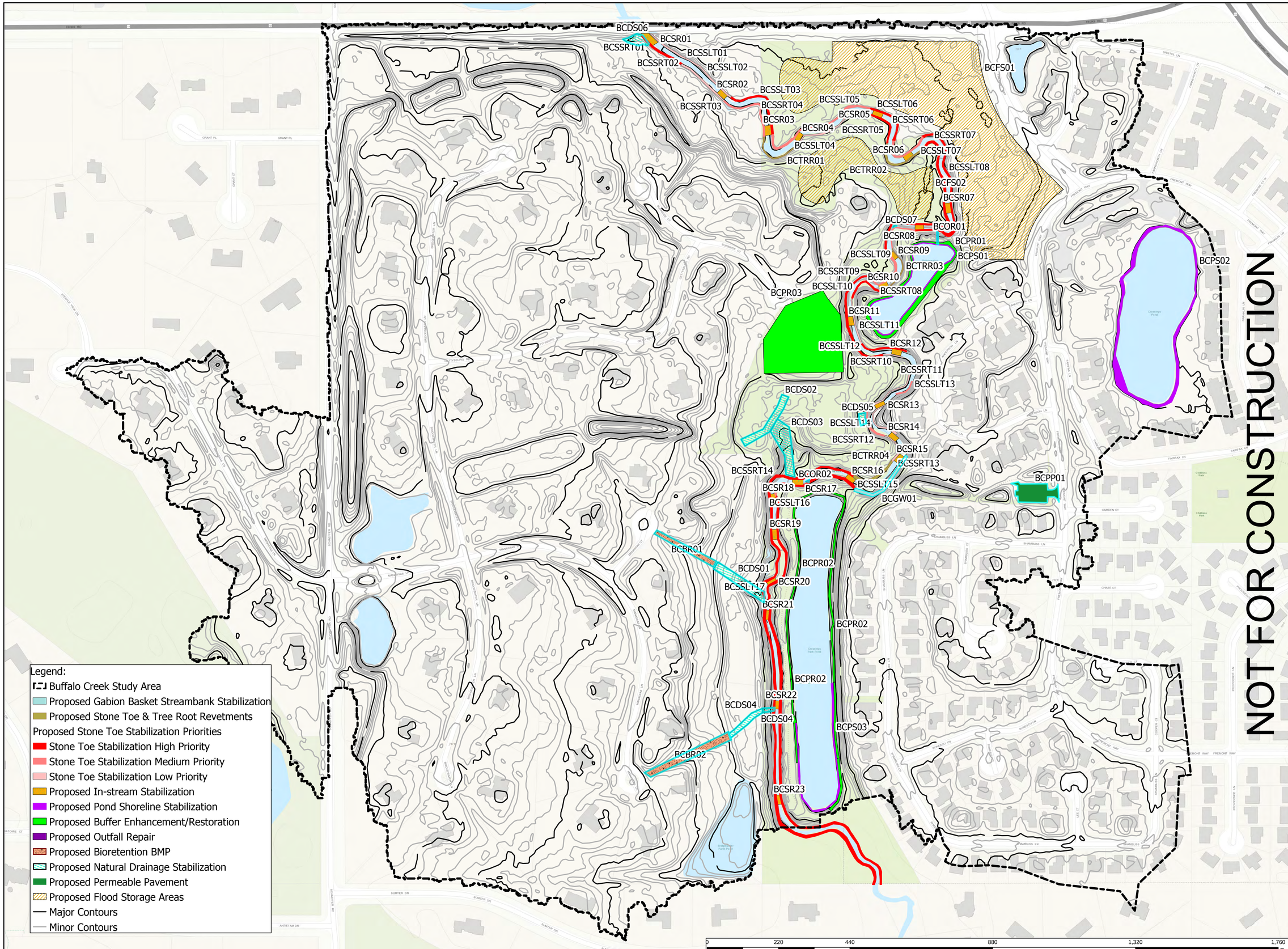
PROJECT:
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

C0.0 COVER SHEET

SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	Text



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK
IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 1.0
BUFFALO CREEK
PROPOSED PROJECTS

SHEET NO.	DESIGNED	EH
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PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
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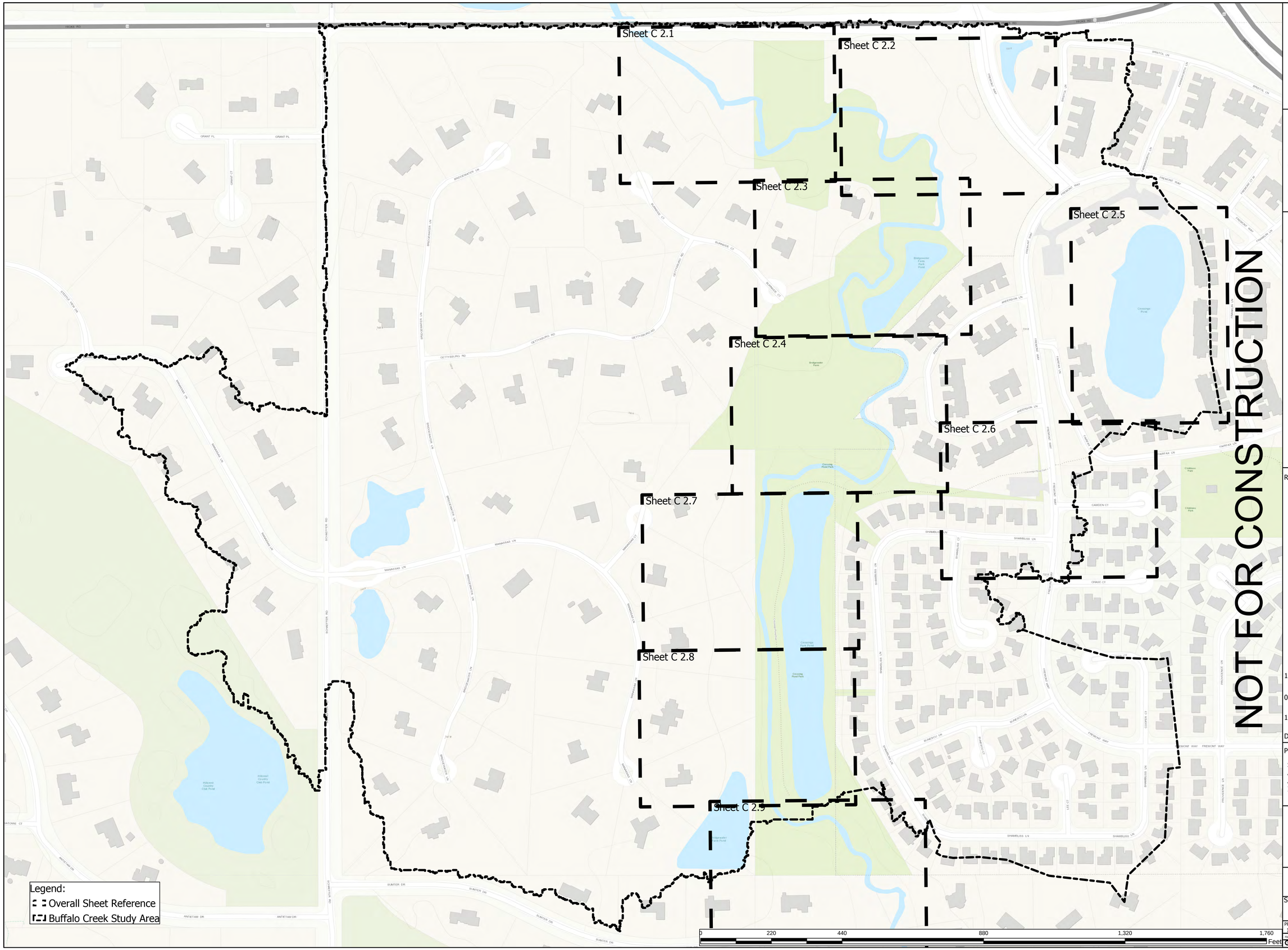

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SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 1.1
BUFFALO CREEK
SHEET REFERENCE

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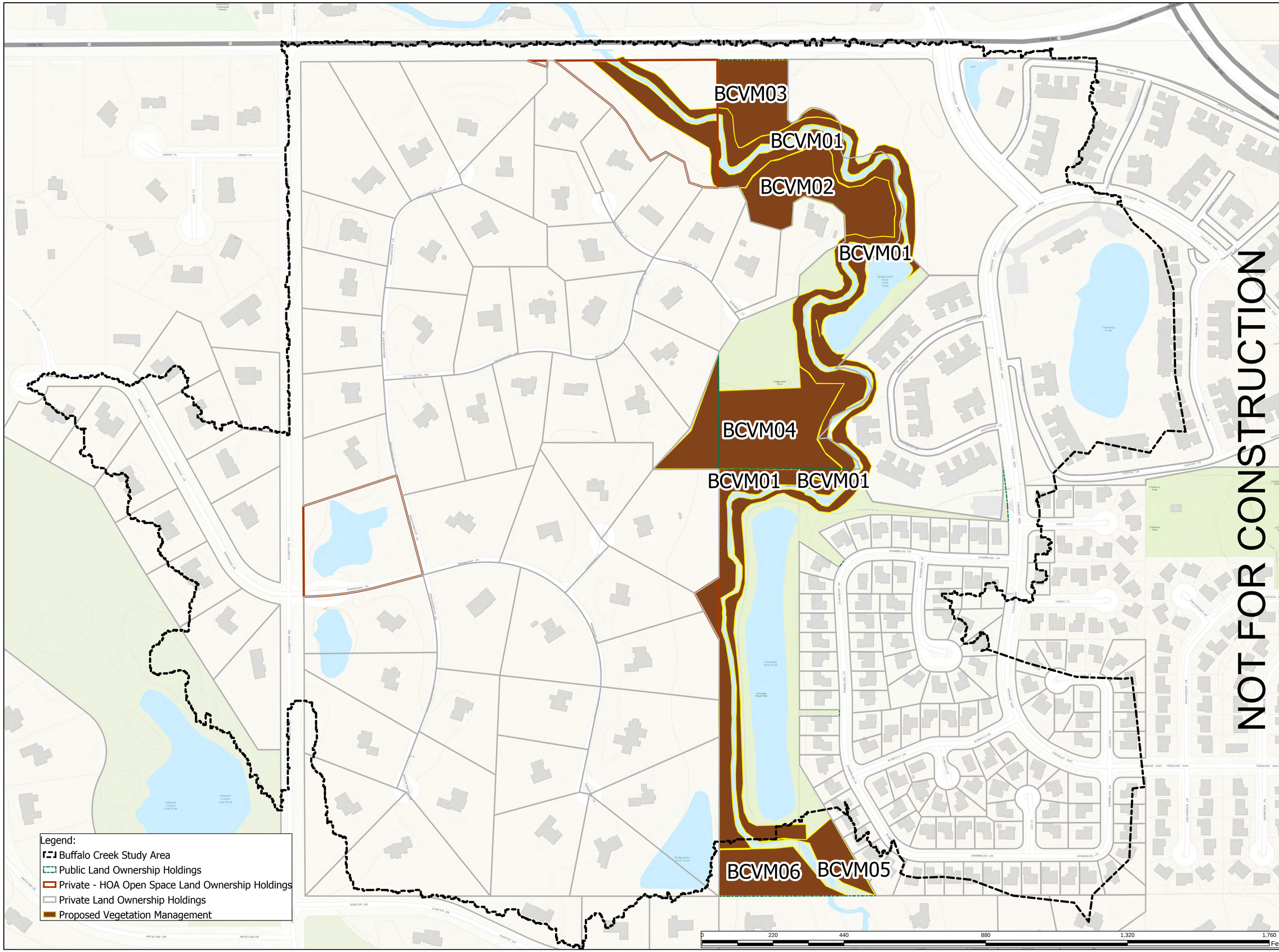

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.0
BUFFALO CREEK
PROPOSED PROJECTS

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	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
	DATE	10/30/2017
	SCALE	1:1,500

FILE: LAKE COUNTY STORMWATER COMMISSION

Sheet C 2.1

BCDS06
BCSR01
BCSSLT01
BCSSRT01
BCSSLT02
BCSSRT02
BCSR02
BCSSLT03
BCSSRT03
BCSSRT04
BCSR03
BCSSLT05
BCSSRT05
BCSR04
BCSSLT04
BCTRR01
BCFS01
BCFS02

NOT FOR CONSTRUCTION

Sheet C 2.3

Legend:
- Overall Sheet Reference
- Buffalo Creek Study Area
- Proposed Stone Toe & Tree Root Revetments

Proposed Stone Toe Stabilization Priorities
- Stone Toe Stabilization High Priority
- Stone Toe Stabilization Medium Priority
- Stone Toe Stabilization Low Priority
- Proposed In-stream Stabilization
- Proposed Natural Drainage Stabilization
- Proposed Flood Storage Areas

0 37.5 75 150 225 300 Feet

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK
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SHEET C 2.1
BUFFALO CREEK
PROPOSED PROJECTS

SHEET NO.	DESIGNED	EH
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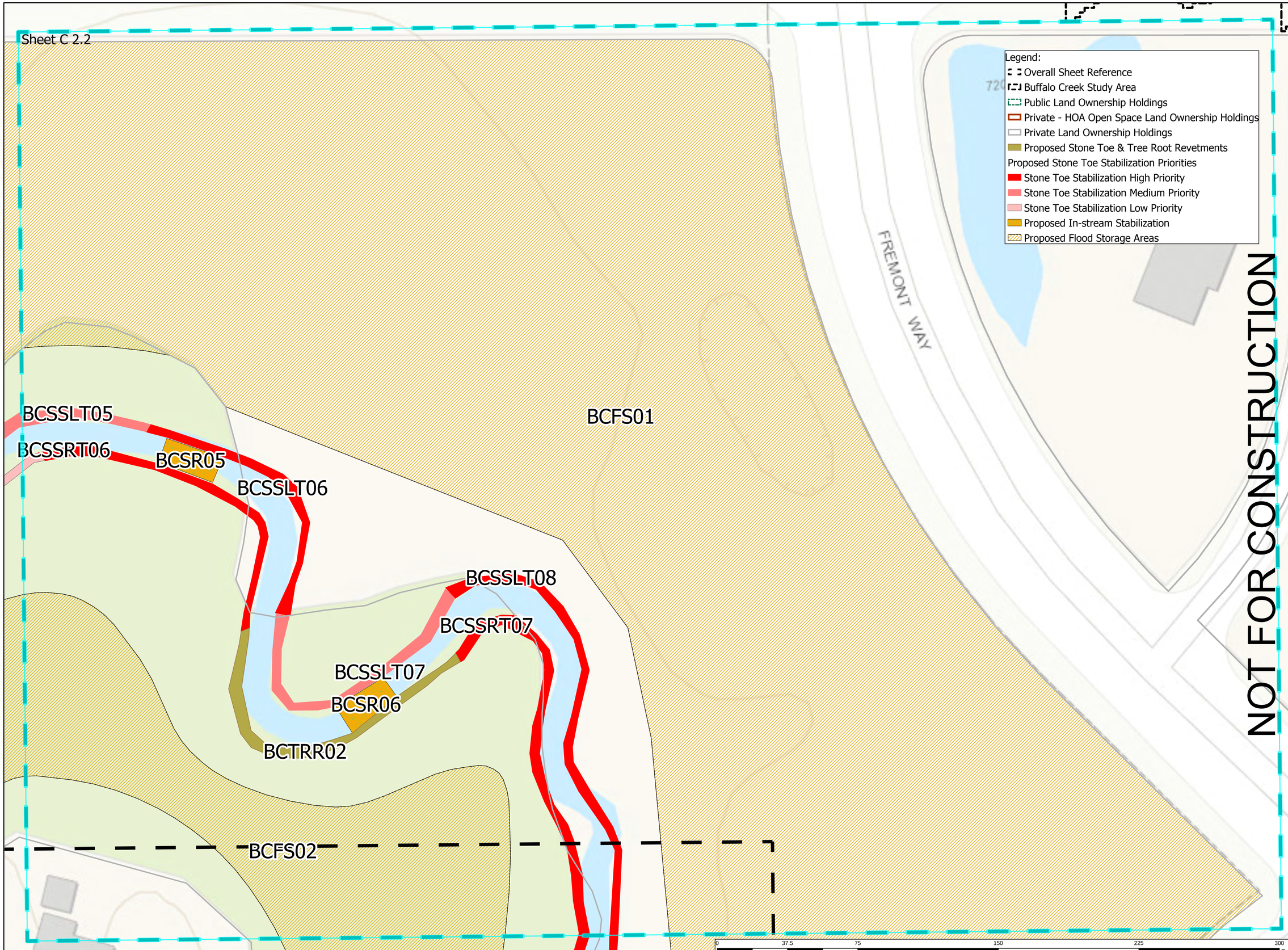
FILE LAKE COUNTY STORMWATER COMMISSION	SCALE	1:260



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK
IDENTIFIED STUDY AREA

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REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.2
BUFFALO CREEK
PROPOSED PROJECTS

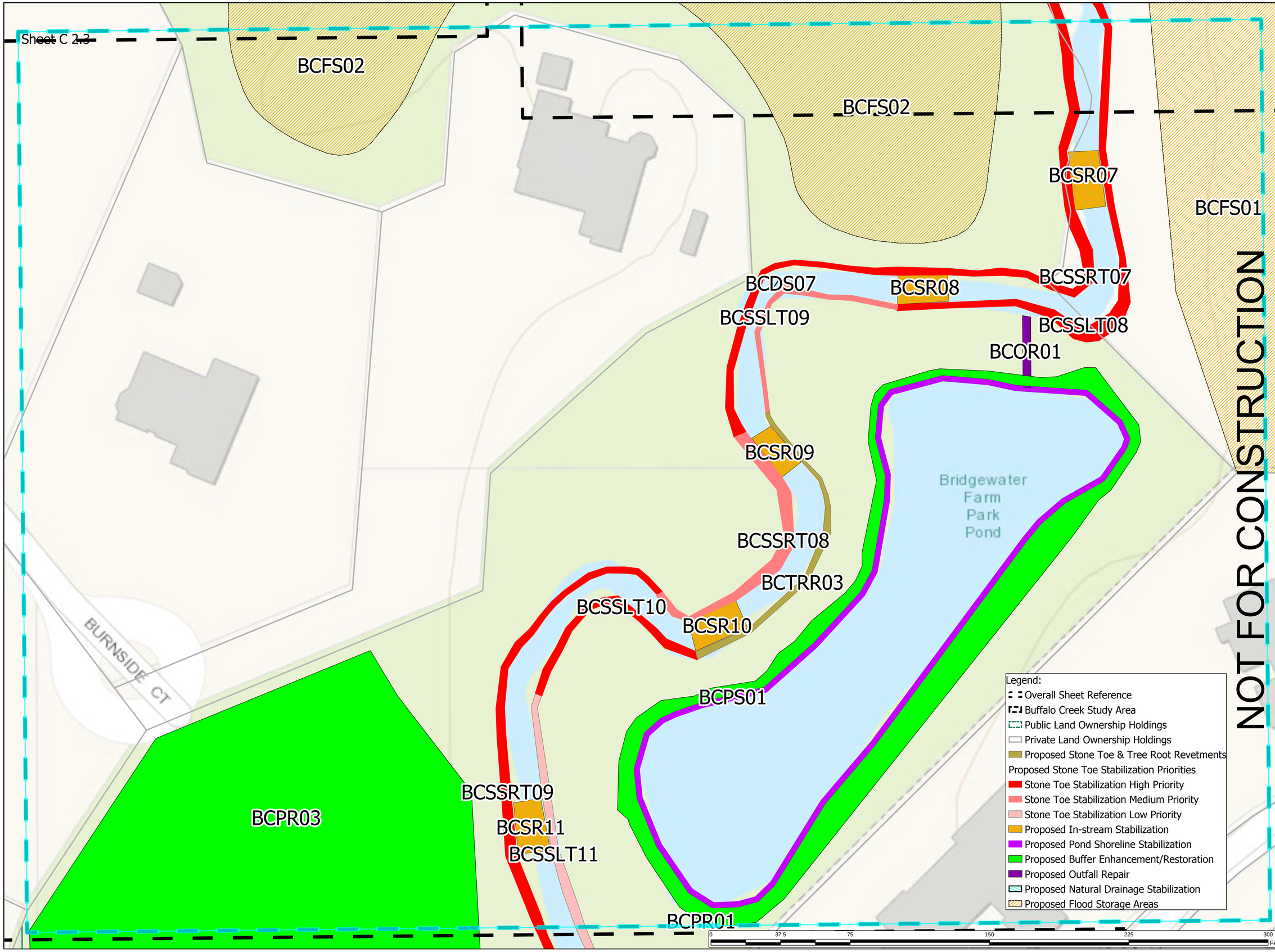
SHEET NO.

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:260

PROJECT NUMBER: 17.dpr.swapp

FILE:

LAKE COUNTY STORMWATER COMMISSION



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK
IDENTIFIED STUDY AREA

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

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BUFFALO CREEK
PROPOSED PROJECTS

SHEET NO.	DESIGNED	EH
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PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
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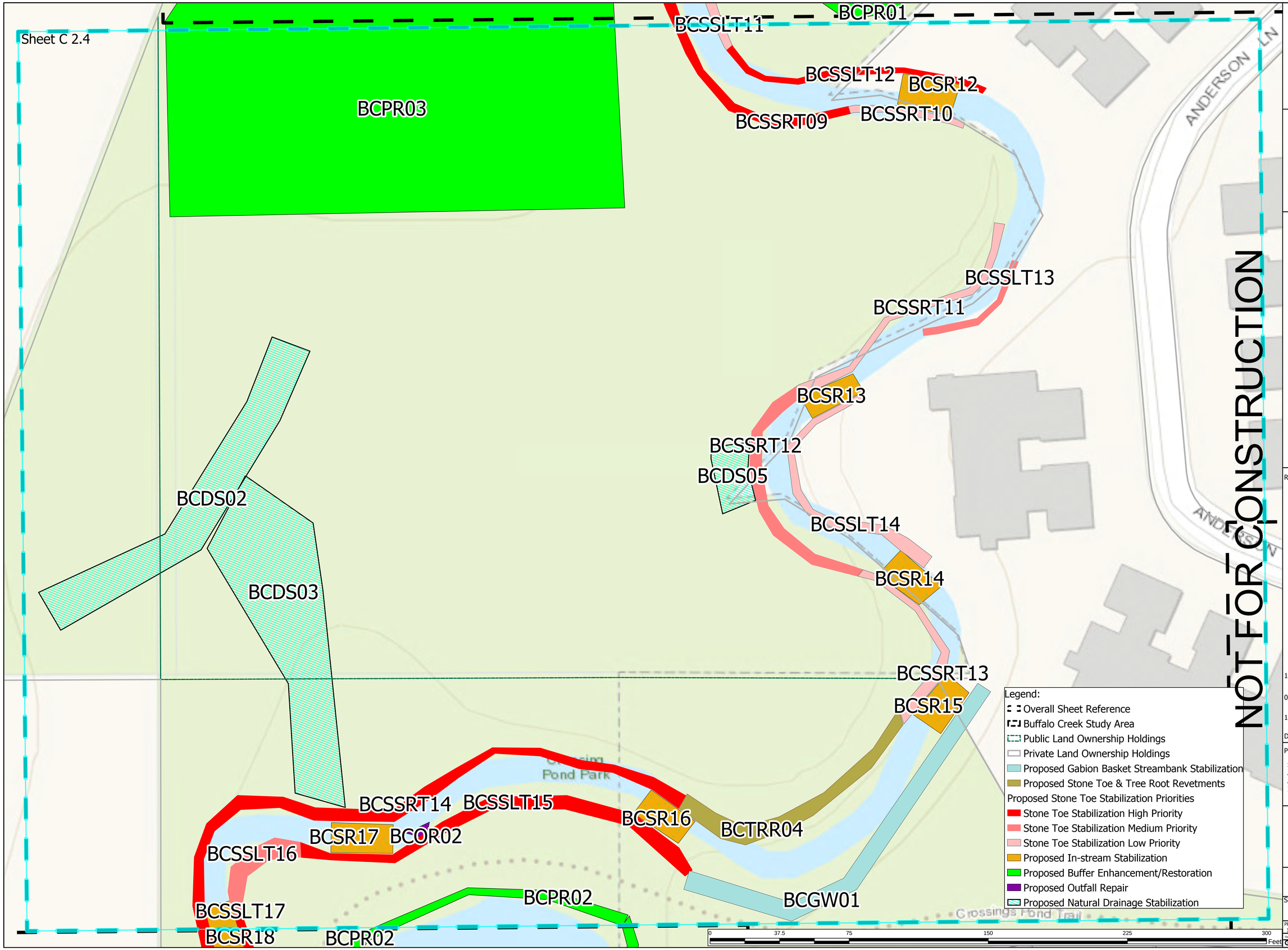
FILE: LAKE COUNTY STORMWATER COMMISSION	SCALE	1:260



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.4
BUFFALO CREEK
PROPOSED PROJECTS

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	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
	DATE	10/30/2017
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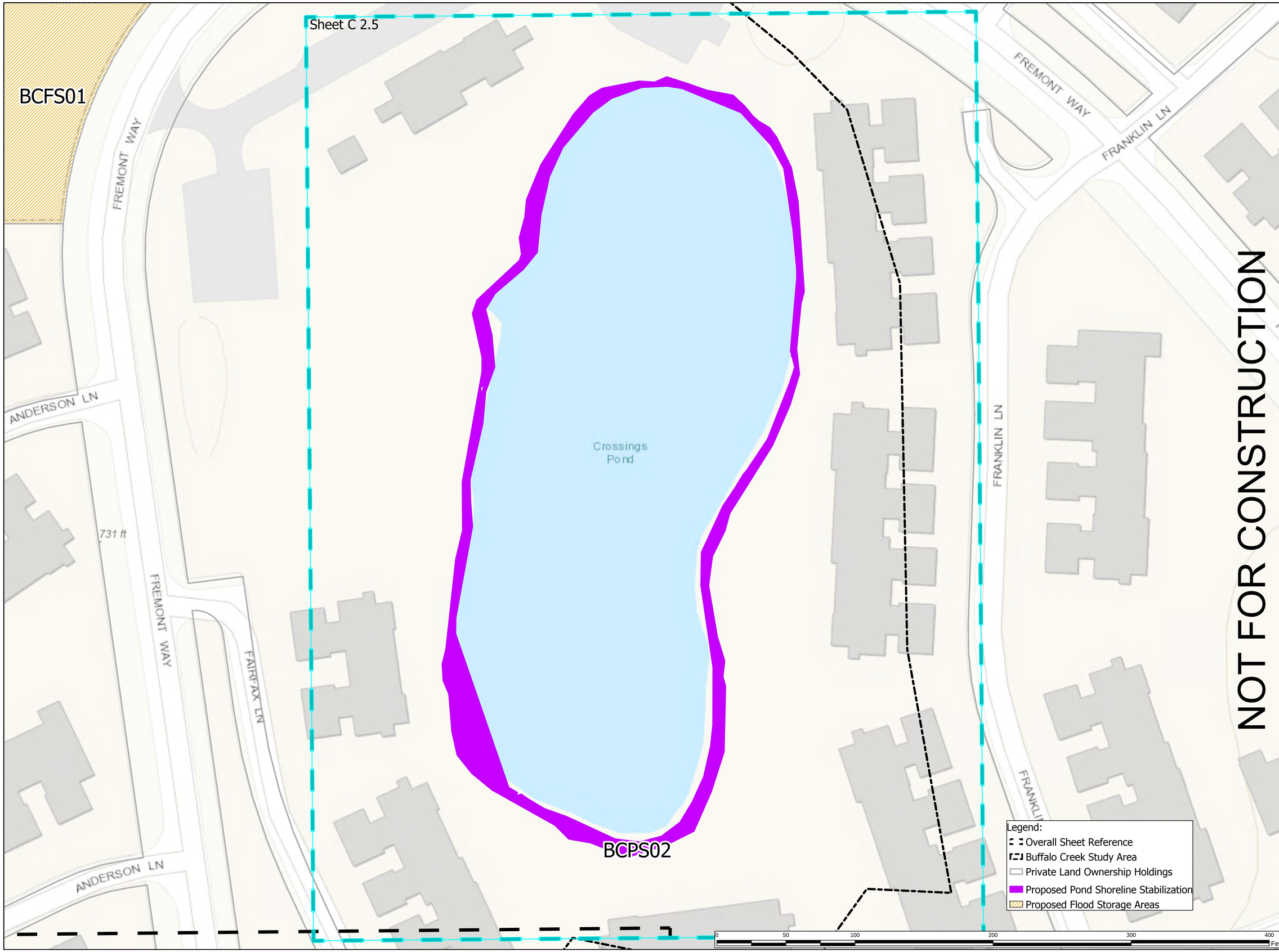


NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK
IDENTIFIED STUDY AREA

N

REVISIONS:

DATE:	DESCRIPTION OF REVISION
10/30/2017	DRAFT CONCEPTUAL DESIGN
02/01/2018	CONCEPTUAL DESIGN REVISIONS
10/30/2017	DRAFT CONCEPTUAL DESIGN

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

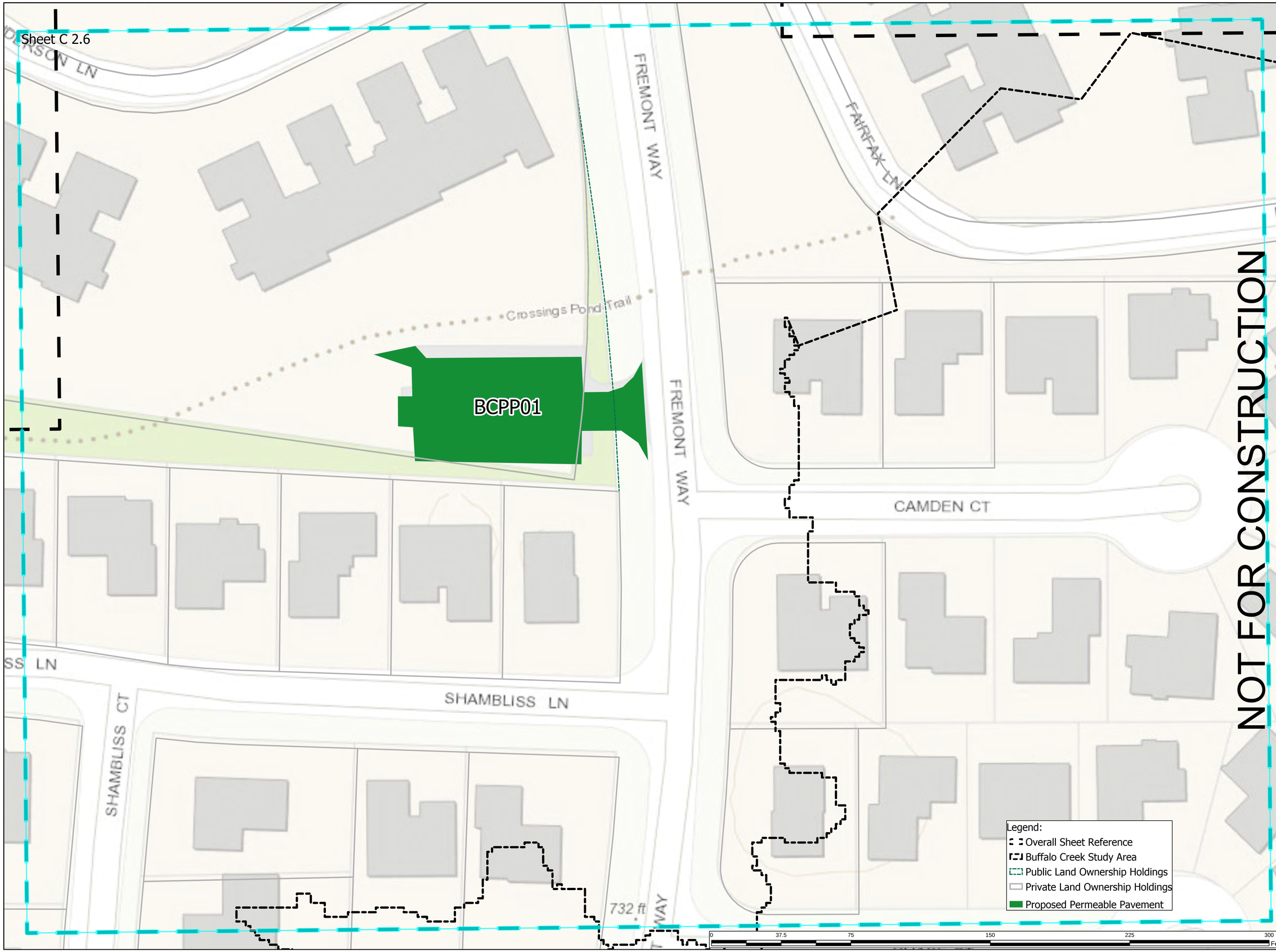
SHEET C 2.5
BUFFALO CREEK
PROPOSED PROJECTS

SHEET NO.

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
DATE	10/30/2017
SCALE	1:350

PROJECT NUMBER: 17.dpr.swapp

REV. LAKE COUNTY STORMWATER COMMISSION



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

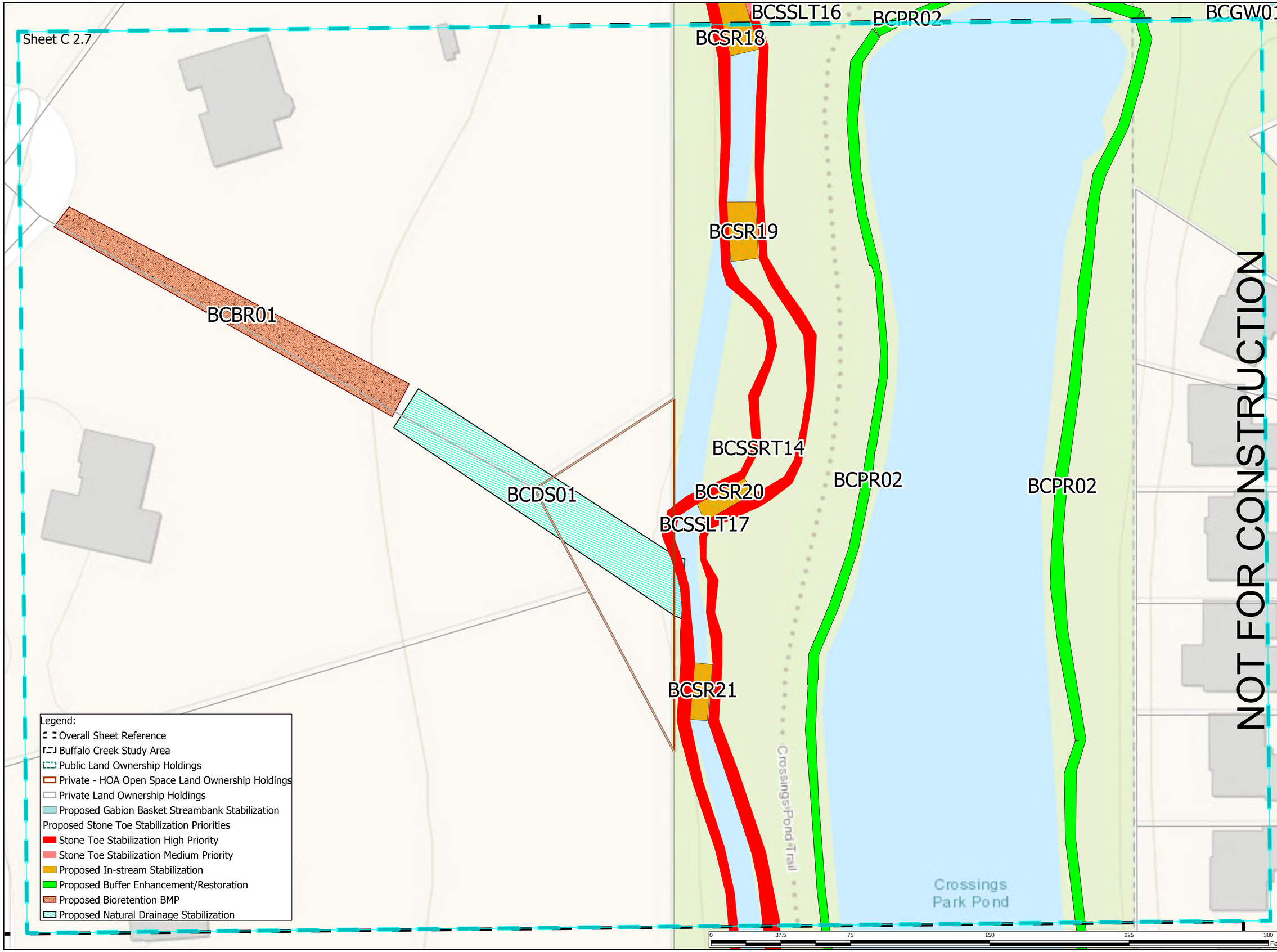
DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.6
BUFFALO CREEK
PROPOSED PROJECTS

SHEET NO.	DESIGNED	EH
	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
	DATE	10/30/2017
	SCALE	1:260



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.7
BUFFALO CREEK
PROPOSED PROJECTS

SHEET NO.	DESIGNED	EH
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PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
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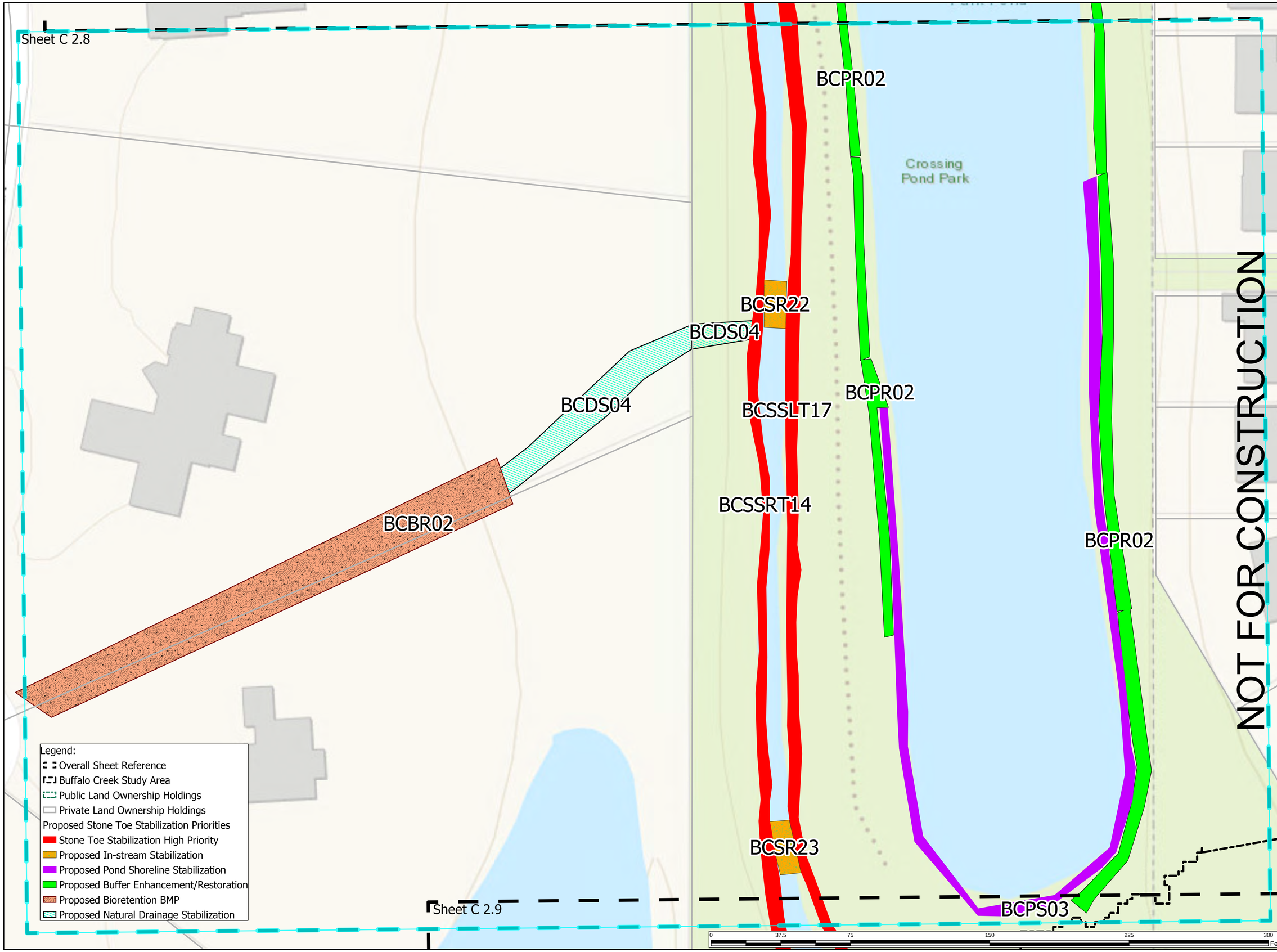
FILE: LAKE COUNTY STORMWATER COMMISSION	SCALE	1:260



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK
IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.8
BUFFALO CREEK
PROPOSED PROJECTS

SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

DESIGNED	EH
DRAWN	EH
APPROVED	N/A
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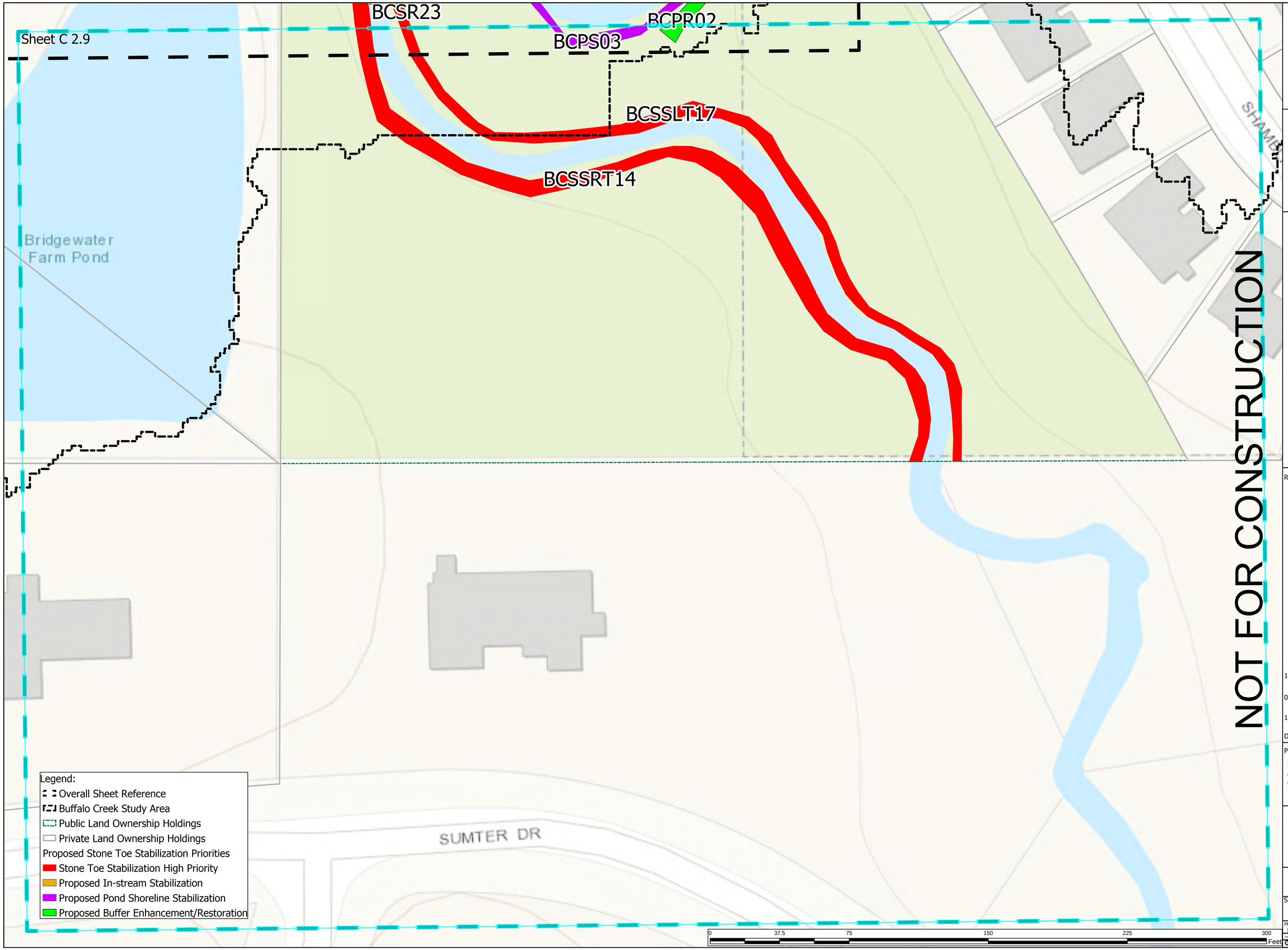

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK CROSSINGS PARK IDENTIFIED STUDY AREA

N

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 2.9
BUFFALO CREEK
PROPOSED PROJECTS

SHEET NO.

PROJECT NUMBER: 17.dpr.swapp

FILE: LAKE COUNTY STORMWATER COMMISSION

DESIGNED	EH
DRAWN	EH
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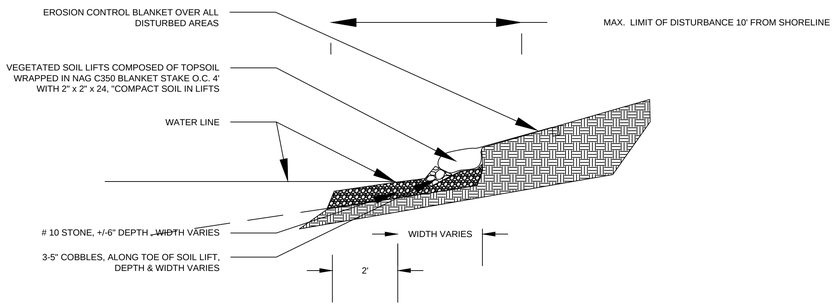

SHORELINE STABILIZATION HARDSCAPE SECTION

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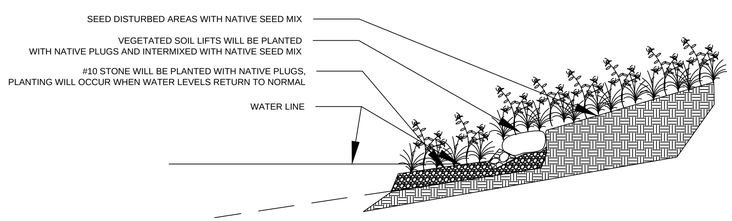

SHORELINE STABILIZATION PLANTING SECTION

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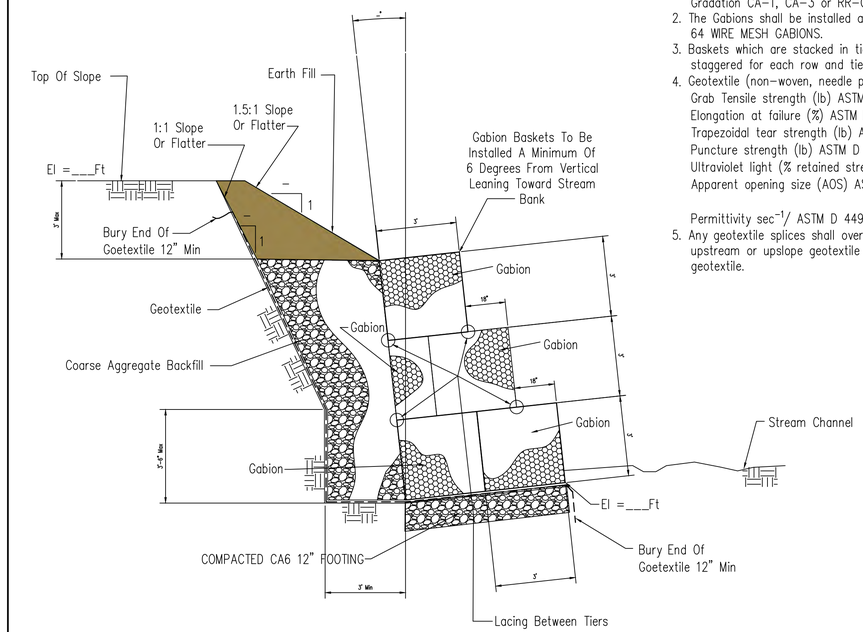


SECTION

NOTES:

1. The coarse aggregate backfill shall meet the IDOT requirement for Gradation CA–1, CA–3 or RR–Gradation 1 Riprap.
2. The Gabions shall be installed according to construction specification 64 WIRE MESH GABIONS.
3. Baskets which are stacked in tiers shall have vertical seams staggered for each row and tier.
4. Geotextile (non–woven, needle punched) min. criteria:
   Grab Tensile strength (lb) ASTM D 4632_____202
   Elongation at failure (%) ASTM D 4632_____≥50
   Trapezoidal tear strength (lb) ASTM D 4533_____79
   Puncture strength (lb) ASTM D 6241 _____433
   Ultraviolet light (% retained strength) ASTM 4355_____min 50
   Apparent opening size (AOS) ASTM D 4751____
   max 0.22 mm (US sieve size 70)
   Permittivity sec^{-1}/ ASTM D 4491_____min 0.70
5. Any geotextile splices shall overlap a minimum of 18 inches, with upstream or upslope geotextile overlapping the abutting downslope geotextile.

STRUCTURAL STREAMBANK STABILIZATION
GABION & BASKET CONSTRUCTION DETAIL

Designed — Drawn M. QUINONES — Checked — Date 10/1/13

USDA United States Department of Agriculture
Natural Resources Conservation Service

File No. IL–ENG–54
Drawing No.
Page 1 of 1
Sheet of

NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK IDENTIFIED STUDY AREA

REVISIONS:

10/30/2017 DRAFT CONCEPTUAL DESIGN

02/01/2018 CONCEPTUAL DESIGN REVISIONS

10/30/2017 DRAFT CONCEPTUAL DESIGN

DATE: DESCRIPTION OF REVISION

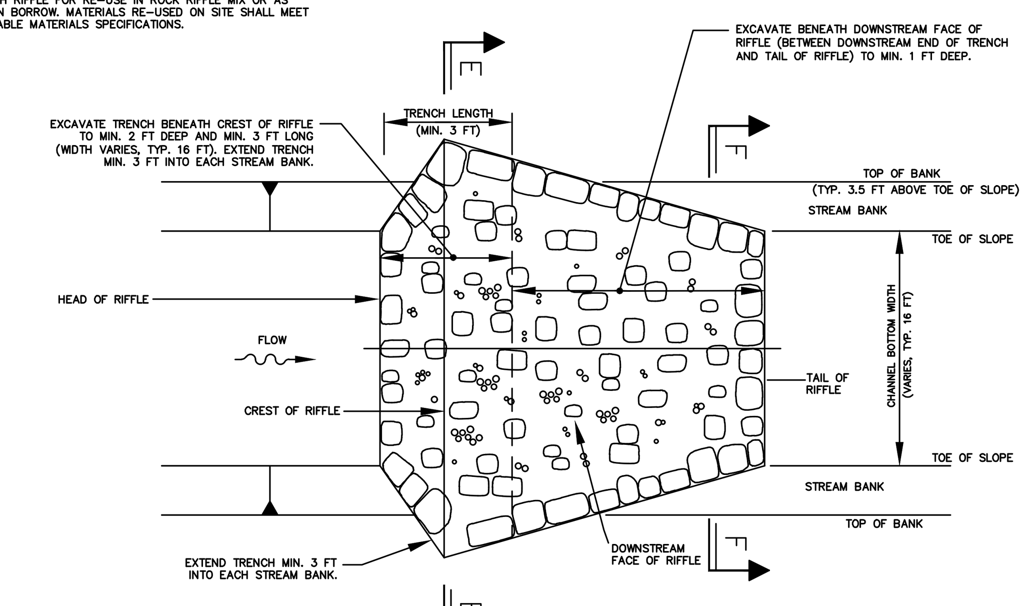
PROJECT:

SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

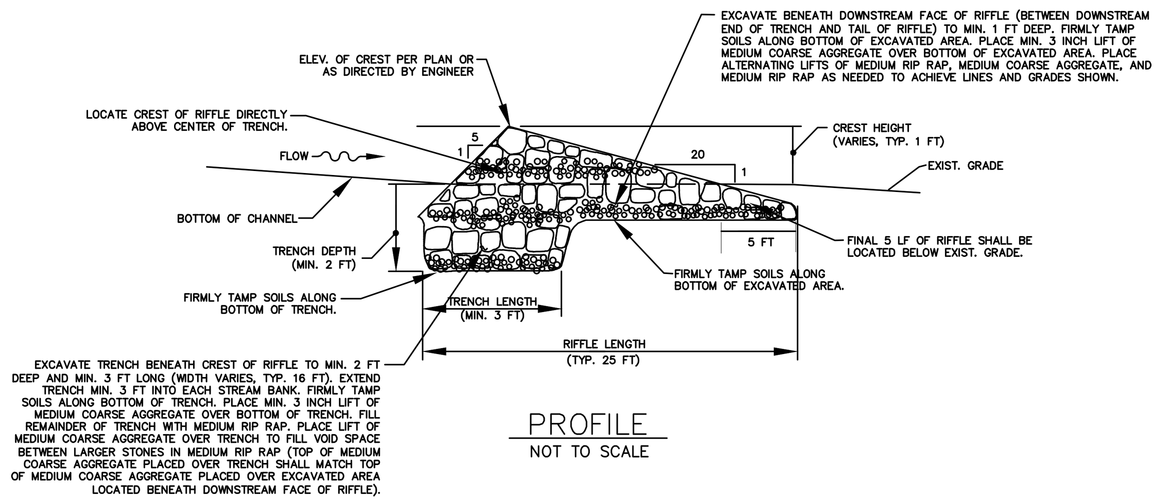
SHEET C 3.0
BUFFALO CREEK
SHEET REFERENCE

SHEET N0.	DESIGNED	EH
	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
	DATE	10/30/2017
FILE: LAKE COUNTY STORMWATER COMMISSION	SCALE	

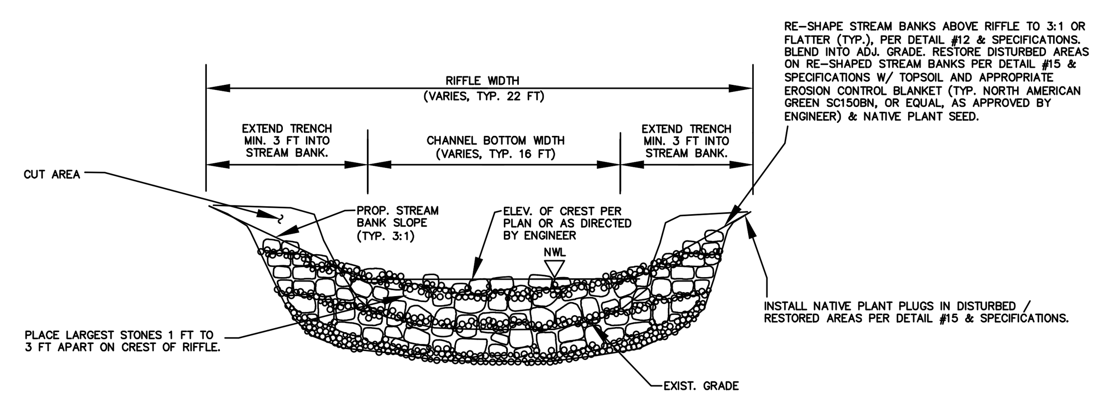
NOTE:
REMOVE LOOSE BOULDERS AND COBBLE IN STREAM BED BENEATH RIFFLE FOR RE-USE IN ROCK RIFFLE MIX OR AS COMMON BORROW. MATERIALS RE-USED ON SITE SHALL MEET APPLICABLE MATERIALS SPECIFICATIONS.



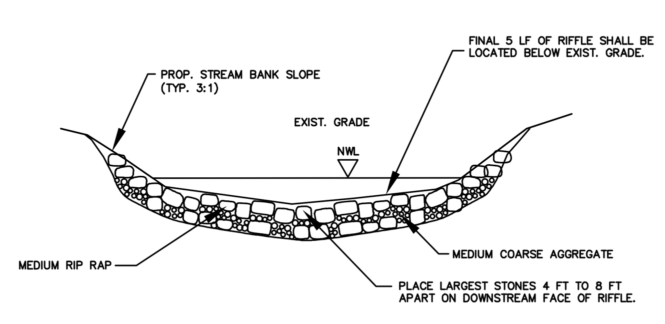
PLAN VIEW
NOT TO SCALE



PROFILE
NOT TO SCALE



ELEVATION AT CREST (E SECTION)
NOT TO SCALE



ELEVATION ON DOWNSTREAM FACE (F SECTION)
NOT TO SCALE

INSTALLATION

1. REMOVE LOOSE BOULDERS AND COBBLE IN STREAM BED BENEATH RIFFLE FOR RE-USE IN ROCK RIFFLE MIX OR AS COMMON BORROW. MATERIALS RE-USED ON SITE SHALL MEET APPLICABLE MATERIALS SPECIFICATIONS.
2. EXCAVATE TRENCH BENEATH CREST OF RIFFLE TO MIN. 2 FT DEEP AND MIN. 3 FT LONG (WIDTH VARIES, TYP. 16 FT). EXTEND TRENCH MIN. 3 FT INTO EACH STREAM BANK.
3. EXCAVATE BENEATH DOWNSTREAM FACE OF RIFFLE, BETWEEN DOWNSTREAM END OF TRENCH AND TAIL OF RIFFLE, TO MIN. 1 FT DEEP.
4. FIRMLY TAMP SOILS ALONG BOTTOM OF TRENCH AND ALONG BOTTOM OF EXCAVATED AREA LOCATED BENEATH DOWNSTREAM FACE OF RIFFLE.
5. PLACE MIN. 3 INCH LIFT OF MEDIUM COARSE AGGREGATE OVER BOTTOM OF TRENCH AND OVER BOTTOM OF EXCAVATED AREA LOCATED BENEATH DOWNSTREAM FACE OF RIFFLE.
6. FILL REMAINDER OF TRENCH WITH MEDIUM RIP RAP.
7. PLACE LIFT OF MEDIUM COARSE AGGREGATE OVER TRENCH TO FILL VOID SPACE BETWEEN LARGER STONES IN MEDIUM RIP RAP (TOP OF MEDIUM COARSE AGGREGATE PLACED OVER TRENCH SHALL MATCH TOP OF MEDIUM COARSE AGGREGATE PLACED OVER BOTTOM OF EXCAVATED AREA LOCATED BENEATH DOWNSTREAM FACE OF RIFFLE).
8. PLACE ALTERNATING LIFTS OF MEDIUM RIP RAP, MEDIUM COARSE AGGREGATE, AND MEDIUM RIP RAP AS NEEDED TO ACHIEVE LINES AND GRADES SHOWN. MEDIUM COARSE AGGREGATE SHALL FILL VOID SPACE BETWEEN LARGER STONES IN MEDIUM RIP RAP.
9. ON CREST OF RIFFLE, LARGEST STONES SHALL BE PLACED 1 FT TO 3 FT APART.
10. ON DOWNSTREAM FACE OF RIFFLE, LARGEST STONES SHALL BE PLACED 4 FT TO 8 FT APART.
11. PLACE FINAL LIFT OF MEDIUM COARSE AGGREGATE OVER RIFFLE. SURFACE OF RIFFLE SHALL BE ROUGH AND NATURAL IN APPEARANCE AND SHALL NOT BE SMOOTHED.
12. RE-SHAPE STREAM BANKS ABOVE RIFFLE TO 3:1 OR FLATTER (TYP.), PER DETAIL #12 & SPECIFICATIONS. BLEND INTO ADJ. GRADE.
13. RESTORE DISTURBED AREAS ON RE-SHAPED STREAM BANKS PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
14. RESTORE DISTURBED AREAS ABOVE RE-SHAPED STREAM BANKS PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
15. INSTALL NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

ROCK RIFFLE MIX

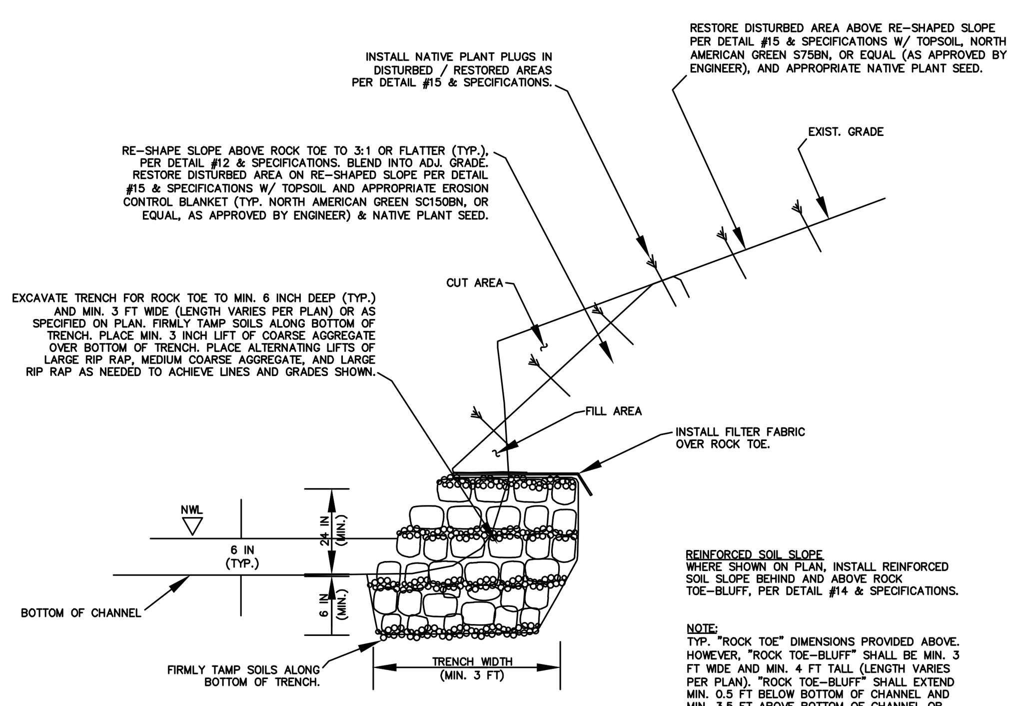
67% OF ROCK RIFFLE MIX = MEDIUM RIP RAP:
D100 = 18 INCH (~ 300 LB)
D75 = 12 INCH (~ 90 LB)
D50 = 9 INCH (~ 40 LB)
D10 = 3 INCH (~ 1 LB)

33% OF ROCK RIFFLE MIX = MEDIUM COARSE AGGREGATE:
D100 = 1 INCH
D50 = 0.50 INCH
D10 = 0.1875 INCH

ROCK TYPE:
RIP RAP SHALL BE STONE, QUARRIED FROM UNDISTURBED, CONSOLIDATED DEPOSITS (LEDGES) OF ROCK REASONABLY FREE OF SHALE AND SHALY STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

COARSE AGGREGATE SHALL BE GRAVEL, CRUSHED GRAVEL, OR CRUSHED STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

ROCK RIFFLE
NOT TO SCALE



PROFILE
NOT TO SCALE

REINFORCED SOIL SLOPE
WHERE SHOWN ON PLAN, INSTALL REINFORCED SOIL SLOPE BEHIND AND ABOVE ROCK TOE-BLUFF, PER DETAIL #14 & SPECIFICATIONS.

NOTE:
TYP. "ROCK TOE" DIMENSIONS PROVIDED ABOVE. HOWEVER, "ROCK TOE-BLUFF" SHALL BE MIN. 3 FT WIDE AND MIN. 4 FT TALL (LENGTH VARIES PER PLAN). "ROCK TOE-BLUFF" SHALL EXTEND MIN. 0.5 FT BELOW BOTTOM OF CHANNEL AND MIN. 3.5 FT ABOVE BOTTOM OF CHANNEL OR AS SPECIFIED ON PLAN.

INSTALLATION

1. EXCAVATE TRENCH FOR ROCK TOE TO MIN. 6 INCH DEEP (TYP.) AND MIN. 3 FT WIDE (LENGTH VARIES PER PLAN) OR AS SPECIFIED ON PLAN.
2. FIRMLY TAMP SOILS ALONG BOTTOM OF TRENCH.
3. PLACE MIN. 3 INCH LIFT OF MEDIUM COARSE AGGREGATE OVER BOTTOM OF TRENCH.
4. PLACE ALTERNATING LIFTS OF LARGE RIP RAP, MEDIUM COARSE AGGREGATE, AND LARGE RIP RAP AS NEEDED TO ACHIEVE LINES AND GRADES SHOWN. MEDIUM COARSE AGGREGATE SHALL FILL VOID SPACE BETWEEN LARGER STONES IN LARGE RIP RAP. ROCK TOE SHALL EXTEND MIN. 6 INCH BELOW BOTTOM OF CHANNEL AND MIN. 2 FT ABOVE BOTTOM OF CHANNEL OR AS SPECIFIED ON PLAN.
5. INSTALL FILTER FABRIC OVER ROCK TOE, AS SHOWN AND PER SPECIFICATIONS.
6. RE-SHAPE SLOPE ABOVE ROCK TOE TO 3:1 OR FLATTER (TYP.), PER DETAIL #12 & SPECIFICATIONS. BLEND INTO ADJ. GRADE.
7. TRIM FILTER FABRIC EXTENDING BEYOND TOE OF RE-SHAPED SLOPE. FILTER FABRIC SHALL NOT EXTEND MORE THAN 3 INCH BEYOND TOE OF RE-SHAPED SLOPE.
8. RESTORE DISTURBED AREA ON RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
9. RESTORE DISTURBED AREA ABOVE RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
10. INSTALL NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

ROCK TOE / ROCK POINT MIX

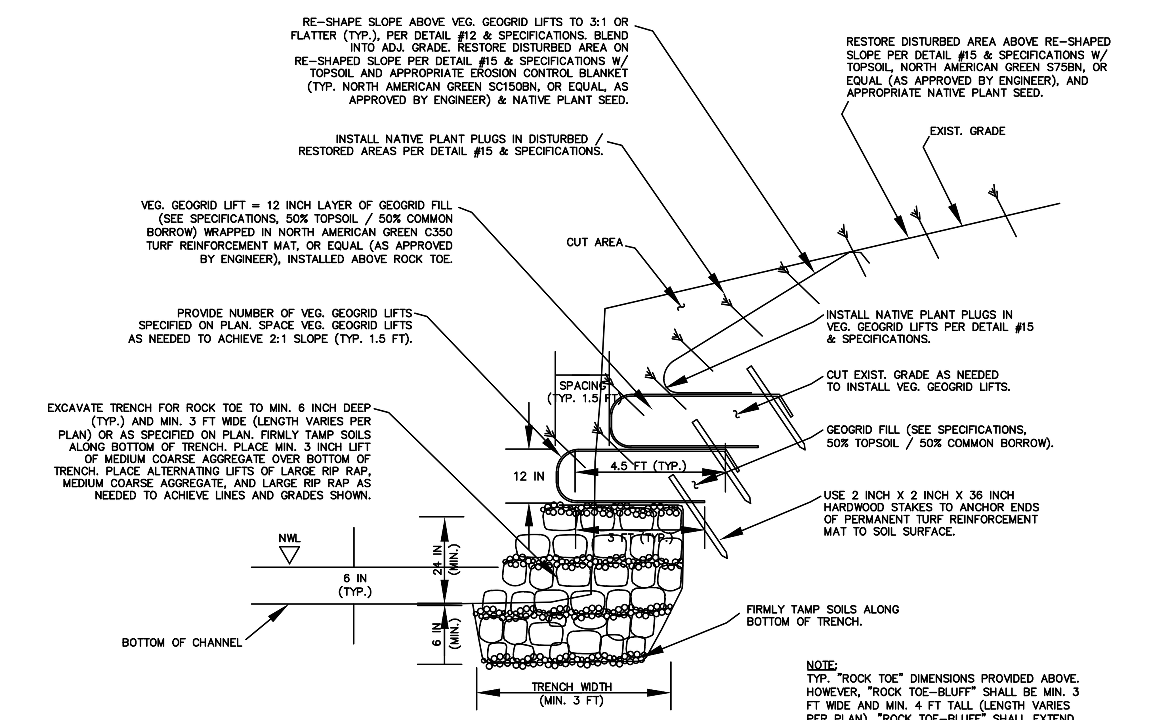
67% OF ROCK TOE / ROCK POINT MIX = LARGE RIP RAP:
D100 = 21 INCH (~ 400 LB)
D75 = 15 INCH (~ 170 LB)
D50 = 12 INCH (~ 90 LB)
D10 = 4 INCH (~ 3 LB)

33% OF ROCK TOE / ROCK POINT MIX = MEDIUM COARSE AGGREGATE:
D100 = 1 INCH
D50 = 0.50 INCH
D10 = 0.1875 INCH

ROCK TYPE:
RIP RAP SHALL BE STONE, QUARRIED FROM UNDISTURBED, CONSOLIDATED DEPOSITS (LEDGES) OF ROCK REASONABLY FREE OF SHALE AND SHALY STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

COARSE AGGREGATE SHALL BE GRAVEL, CRUSHED GRAVEL, OR CRUSHED STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

ROCK TOE / RE-SHAPE SLOPE
NOT TO SCALE



PROFILE
NOT TO SCALE

NOTE:
TYP. "ROCK TOE" DIMENSIONS PROVIDED ABOVE. HOWEVER, "ROCK TOE-BLUFF" SHALL BE MIN. 3 FT WIDE AND MIN. 4 FT TALL (LENGTH VARIES PER PLAN). "ROCK TOE-BLUFF" SHALL EXTEND MIN. 0.5 FT BELOW BOTTOM OF CHANNEL AND MIN. 3.5 FT ABOVE BOTTOM OF CHANNEL OR AS SPECIFIED ON PLAN.

INSTALLATION

1. EXCAVATE TRENCH FOR ROCK TOE TO MIN. 6 INCH DEEP (TYP.) AND MIN. 3 FT WIDE (LENGTH VARIES PER PLAN), OR AS SPECIFIED ON PLAN.
2. FIRMLY TAMP SOILS ALONG BOTTOM OF TRENCH.
3. PLACE MIN. 3 INCH LIFT OF MEDIUM COARSE AGGREGATE OVER BOTTOM OF TRENCH.
4. PLACE ALTERNATING LIFTS OF LARGE RIP RAP, MEDIUM COARSE AGGREGATE, AND LARGE RIP RAP AS NEEDED TO ACHIEVE LINES AND GRADES SHOWN. MEDIUM COARSE AGGREGATE SHALL FILL VOID SPACE BETWEEN LARGER STONES IN LARGE RIP RAP. ROCK TOE SHALL EXTEND MIN. 6 INCH BELOW BOTTOM OF CHANNEL AND MIN. 2 FT ABOVE BOTTOM OF CHANNEL OR AS SPECIFIED ON PLAN.
5. CUT EXIST. GRADE ABOVE ROCK TOE AS NEEDED TO INSTALL VEG. GEOGRID LIFTS.
6. INSTALL VEG. GEOGRID LIFTS ABOVE ROCK TOE. ROLL OUT TURF REINFORCEMENT MAT (NORTH AMERICAN GREEN C350, OR EQUAL, AS APPROVED BY ENGINEER) TO MIN. WIDTH OF 3 FT (TYP.), AS MEASURED FROM FACE OF SLOPE. ANCHOR END OF TURF REINFORCEMENT MAT TO SOIL SURFACE W/ 2 INCH X 2 INCH X 36 INCH HARDWOOD STAKES INSTALLED AT MAX. 4 FT O.C.
7. PLACE AND COMPACT MAX. 6 INCH LIFTS OF GEOGRID FILL (SEE SPECIFICATIONS, 50% TOPSOIL / 50% COMMON BORROW) OVER TURF REINFORCEMENT MAT AS NEEDED TO ACHIEVE 12 INCH LAYER OF COMPACTED GEOGRID FILL OVER TURF REINFORCEMENT MAT. FOLLOWING COMPACTION, THE DRY DENSITY OF THE COMPACTED GEOGRID FILL SHALL BE AT LEAST 85% OF THE LABORATORY STANDARD (STANDARD PROCTOR) DRY DENSITY.
8. INSTALL APPROPRIATE NATIVE PLANT SEED INTO GEOGRID FILL, PER DETAIL #15 & SPECIFICATIONS.
9. WRAP TURF REINFORCEMENT MAT AROUND AND OVER GEOGRID FILL AND ROLL OUT TO MIN. WIDTH OF 4.5 FT (TYP.) ON TOP OF GEOGRID FILL, AS MEASURED FROM FACE OF SLOPE. FASTEN TURF REINFORCEMENT MAT TO UNDERLYING GEOGRID FILL, PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDED STAPLE PATTERN, W/ MIN. 12 INCH STAPLES AND ANCHOR END OF TURF REINFORCEMENT MAT TO SOIL SURFACE W/ 2 INCH X 2 INCH X 36 INCH HARDWOOD STAKES INSTALLED AT MAX. 4 FT O.C.
10. PROVIDE NUMBER OF VEG. GEOGRID LIFTS SPECIFIED ON PLAN. SPACE VEG. GEOGRID LIFTS AS NEEDED TO ACHIEVE 2:1 SLOPE (TYP. 1.5 FT).
11. RE-SHAPE SLOPE ABOVE VEG. GEOGRID LIFTS TO 3:1 OR FLATTER (TYP.), PER DETAIL #12 & SPECIFICATIONS. BLEND INTO ADJ. GRADE.
12. RESTORE DISTURBED AREA ON RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
13. RESTORE DISTURBED AREA ABOVE RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
14. INSTALL NATIVE PLANT PLUGS IN VEG. GEOGRID LIFTS AND DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

ROCK TOE / ROCK POINT MIX

67% OF ROCK TOE / ROCK POINT MIX = LARGE RIP RAP:
D100 = 21 INCH (~ 400 LB)
D75 = 15 INCH (~ 170 LB)
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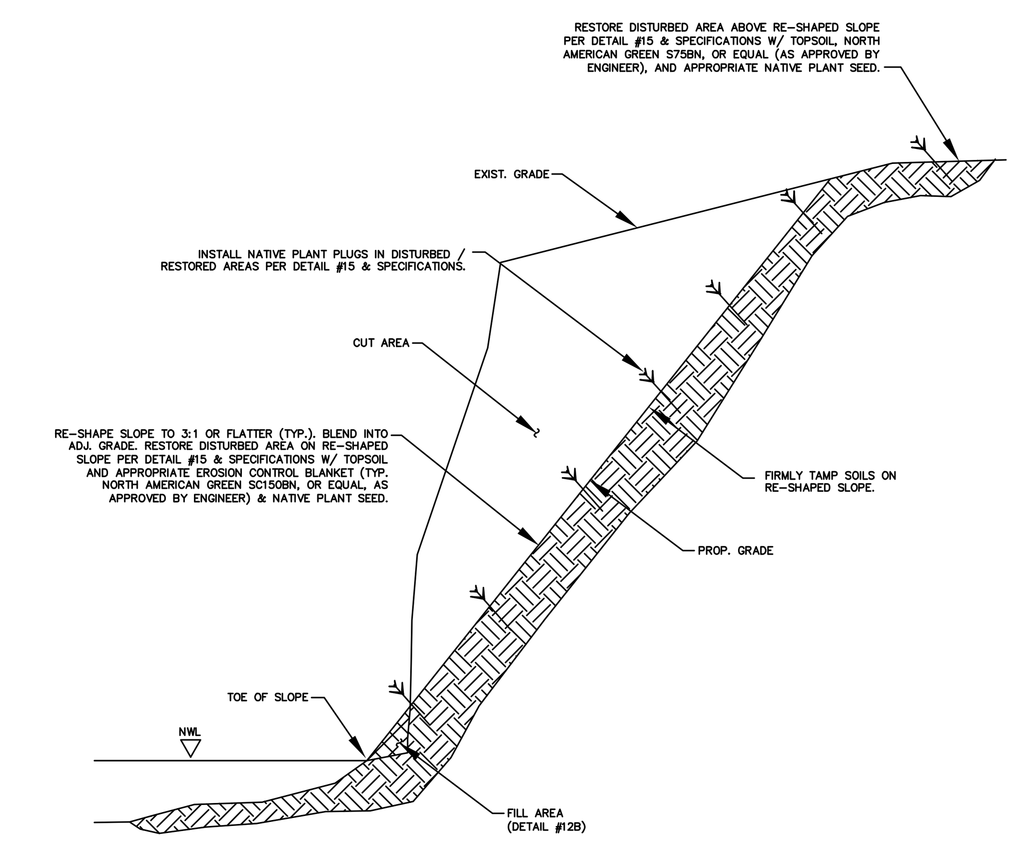
33% OF ROCK TOE / ROCK POINT MIX = MEDIUM COARSE AGGREGATE:
D100 = 1 INCH
D50 = 0.50 INCH
D10 = 0.1875 INCH

ROCK TYPE:
RIP RAP SHALL BE STONE, QUARRIED FROM UNDISTURBED, CONSOLIDATED DEPOSITS (LEDGES) OF ROCK REASONABLY FREE OF SHALE AND SHALY STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

COARSE AGGREGATE SHALL BE GRAVEL, CRUSHED GRAVEL, OR CRUSHED STONE, ANGULAR TO SUB-ROUNDED IN SHAPE, DENSE, SOUND, AND REASONABLY FREE OF LAMINATIONS, CRACKS, SEAMS, AND OTHER STRUCTURAL DEFECTS OR IMPERFECTIONS TENDING TO DESTROY ITS RESISTANCE TO WEATHER. RE-USE OF ON-SITE MATERIALS WITHIN THE SPECIFIED GRADATIONS IS ACCEPTABLE.

ROCK TOE / VEG. GEOGRID LIFTS / RE-SHAPE SLOPE
NOT TO SCALE

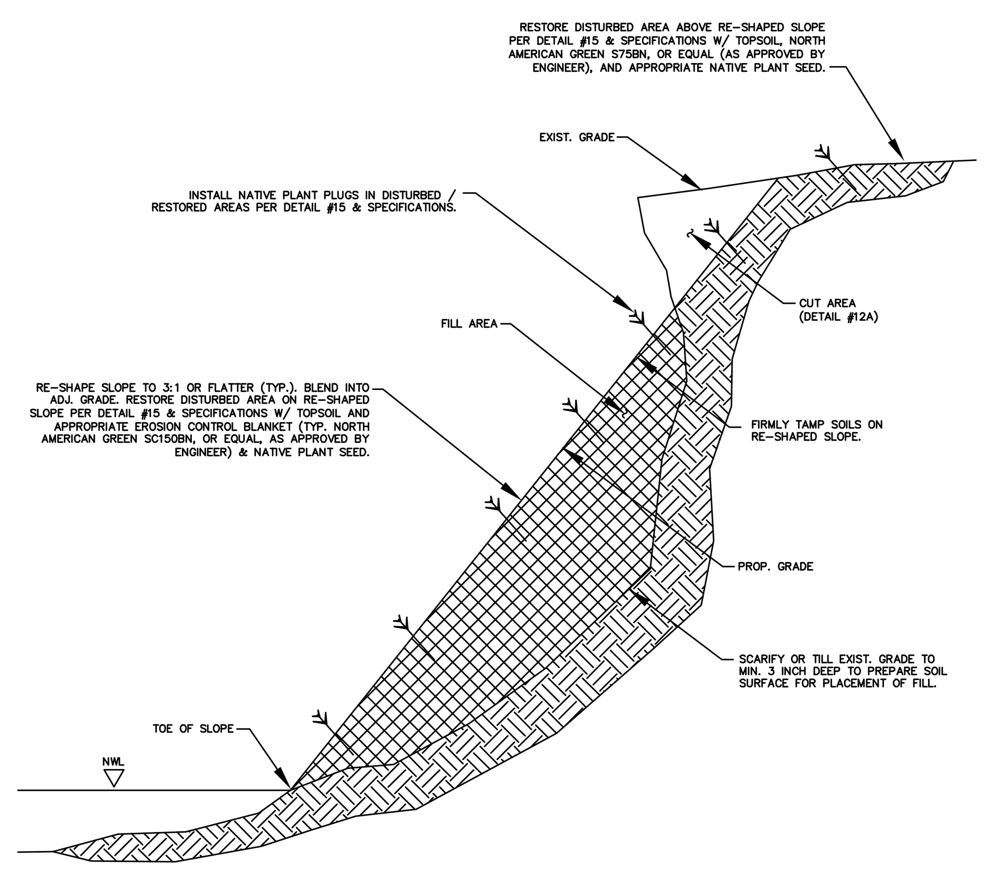


PROFILE
NOT TO SCALE

INSTALLATION

1. CUT EXIST. GRADE AS NEEDED TO RE-SHAPE SLOPE TO 3:1 OR FLATTER (TYP.). SHAPE, TRIM, & FINISH RE-SHAPED SLOPE AND BLEND INTO ADJ. GRADE. FIRMLY TAMP SOILS ON RE-SHAPED SLOPE.
2. RESTORE DISTURBED AREA ON RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
3. RESTORE DISTURBED AREA ABOVE RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
4. INSTALL NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

RE-SHAPE SLOPE (CUT)
NOT TO SCALE

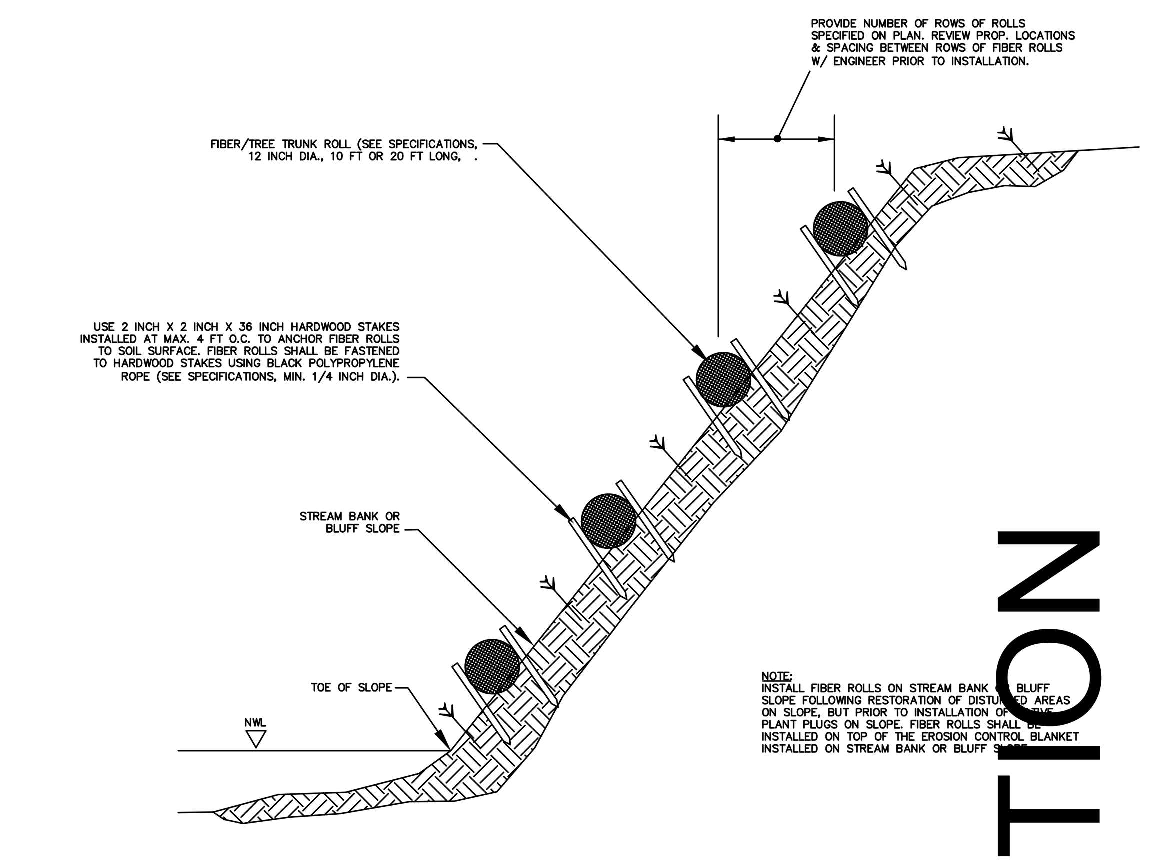


PROFILE
NOT TO SCALE

INSTALLATION

1. SCARIFY OR TILL EXIST. GRADE TO MIN. 3 INCH DEEP TO PREPARE SOIL SURFACE FOR PLACEMENT OF FILL.
2. FILL (USING COMMON BORROW) ABOVE TOE OF SLOPE AS NEEDED TO RE-SHAPE SLOPE TO 3:1 OR FLATTER (TYP.). SHAPE, TRIM, & FINISH RE-SHAPED SLOPE AND BLEND INTO ADJ. GRADE. FIRMLY TAMP SOILS ON RE-SHAPED SLOPE.
3. RESTORE DISTURBED AREA ON RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL AND APPROPRIATE EROSION CONTROL BLANKET (TYP. NORTH AMERICAN GREEN SC150BN, OR EQUAL, AS APPROVED BY ENGINEER) & NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
4. RESTORE DISTURBED AREA ABOVE RE-SHAPED SLOPE PER DETAIL #15 & SPECIFICATIONS W/ TOPSOIL, NORTH AMERICAN GREEN S75BN, OR EQUAL (AS APPROVED BY ENGINEER), AND APPROPRIATE NATIVE PLANT SEED. INSTALL EROSION CONTROL BLANKET PER MANUFACTURER'S INSTRUCTIONS & RECOMMENDED STAPLE PATTERN. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS.
5. INSTALL NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS PER DETAIL #15 & SPECIFICATIONS.

RE-SHAPE SLOPE (FILL)
NOT TO SCALE



NOTE:
INSTALL FIBER ROLLS ON STREAM BANK OR BLUFF SLOPE FOLLOWING RESTORATION OF DISTURBED AREAS ON SLOPE, BUT PRIOR TO INSTALLATION OF NATIVE PLANT PLUGS ON SLOPE. FIBER ROLLS SHALL BE INSTALLED ON TOP OF THE EROSION CONTROL BLANKET INSTALLED ON STREAM BANK OR BLUFF SLOPE.

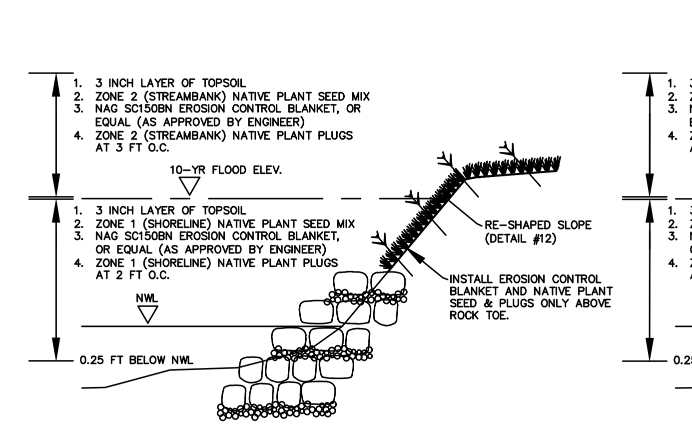
PROFILE
NOT TO SCALE

INSTALLATION

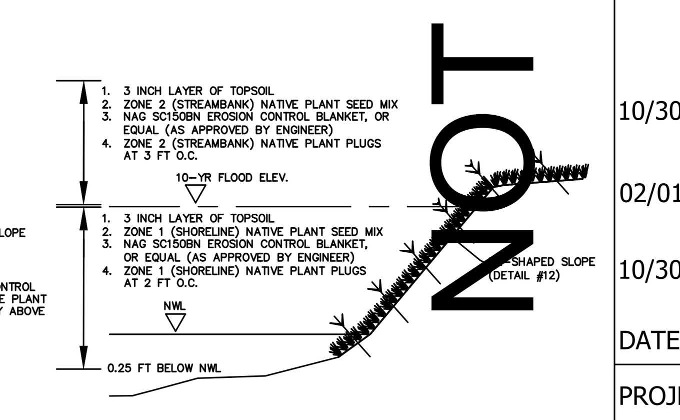
1. INSTALL FIBER ROLLS ON STREAM BANK OR BLUFF SLOPE FOLLOWING RESTORATION OF DISTURBED AREAS ON SLOPE, BUT PRIOR TO INSTALLATION OF NATIVE PLANT PLUGS ON SLOPE. FIBER ROLLS SHALL BE INSTALLED ON TOP OF THE EROSION CONTROL BLANKET INSTALLED ON STREAM BANK OR BLUFF SLOPE. PROVIDE NUMBER OF ROWS OF FIBER ROLLS SPECIFIED ON PLAN. REVIEW PROP. LOCATIONS & SPACING BETWEEN ROWS OF FIBER ROLLS W/ ENGINEER PRIOR TO INSTALLATION.
2. USE 2 INCH X 2 INCH X 36 INCH HARDWOOD STAKES INSTALLED AT MAX. 4 FT O.C. TO ANCHOR FIBER ROLLS TO SOIL SURFACE.
3. FASTEN FIBER ROLLS TO WOOD STAKES USING BLACK POLYPROPYLENE ROPE (SEE SPECIFICATIONS, MIN. 1/4 INCH DIA.).

TERRACE ROLL
NOT TO SCALE

NOTE:
INSTALL TOPSOIL, NATIVE PLANT SEED, EROSION CONTROL BLANKET, & NATIVE PLANT PLUGS IN DISTURBED / RESTORED AREAS AS SHOWN AND PER SPECIFICATIONS.



ROCK TOE / RE-SHAPE SLOPE



RE-SHAPE SLOPE

RE-SHAPE SLOPE
NOT TO SCALE

NOT FOR CONSTRUCTION

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

STORMWATER MANAGEMENT COMMISSION

LAKE COUNTY STORMWATER MANAGEMENT COMMISSION
500 W. WINCHESTER RD., STE. 201
LIBERTYVILLE, IL 60048

PROJECT LOCATION:
BUFFALO CREEK IDENTIFIED STUDY AREA

REVISIONS:

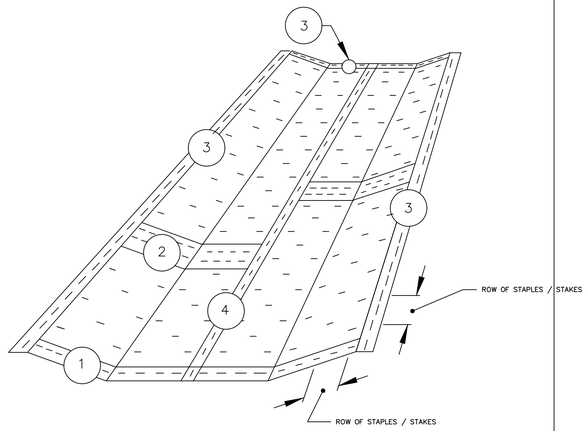
10/30/2017 DRAFT CONCEPTUAL DESIGN
02/01/2018 CONCEPTUAL DESIGN REVISIONS
10/30/2017 DRAFT CONCEPTUAL DESIGN
DATE: DESCRIPTION OF REVISION

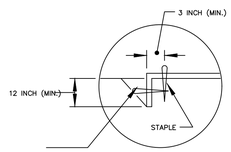
PROJECT:
SMALL WATERSHED ASSESSMENT AND ACTION PLAN IMPROVEMENT PROJECTS

SHEET C 3.1
BUFFALO CREEK
SHEET REFERENCE

SHEET N0.	DESIGNED	EH
	DRAWN	EH
PROJECT NUMBER: 17.dpr.swapp	APPROVED	N/A
FILE :	DATE	10/30/2017
© LAKE COUNTY STORMWATER COMMISSION	SCALE	

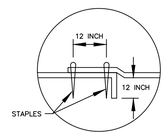
SEE ALSO IL URBAN MANUAL IL-530A / IL-530B





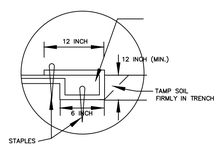
TERMINAL FOLD

DETAIL 1



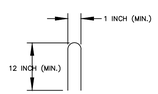
JUNCTION SLOT

DETAIL 2



ANCHOR SLOT

DETAIL 3



STAPLE DETAIL

DETAIL 4

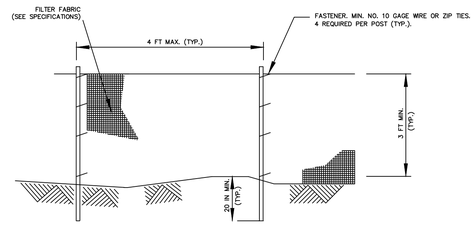
NOTES:

1. IF HEIGHT OF SLOPE TO BE RESTORED IS GREATER THAN 4 FT, EROSION CONTROL BLANKET SHALL BE INSTALLED VERTICALLY UP THE SLOPE, PERPENDICULAR TO THE STREAM BANK. IF HEIGHT OF SLOPE TO BE RESTORED IS 4 FT OR LESS, EROSION CONTROL BLANKET SHALL BE INSTALLED HORIZONTALLY ALONG THE SLOPE; PARALLEL TO THE STREAM BANK.
2. EROSION CONTROL BLANKET SHALL BE PLACED FIRMLY IN CONTACT WITH SOIL SURFACE. FASTEN EROSION CONTROL BLANKET TO SOIL SURFACE W/ MIN. 12 INCH LONG STAPLES, PER MANUFACTURER'S RECOMMENDED STAPLE PATTERN.
3. ANCHOR EACH END OF EROSION CONTROL BLANKET IN MIN. 12 INCH DEEP BY MIN. 6 INCH WIDE TRENCH, PER MANUFACTURER'S INSTRUCTIONS. EACH EDGE OF BLANKET SHALL BE SECURED USING ANCHOR SLOT OR TERMINAL FOLD, PER MANUFACTURER'S INSTRUCTIONS. DO NOT USE LAP JOINTS BETWEEN SECTIONS OF EROSION CONTROL BLANKET.
4. PER MANUFACTURER'S RECOMMENDED STAPLE PATTERN, APPROXIMATELY 1.15 STAPLES REQUIRED PER SQ. YD. OF EROSION CONTROL BLANKET INSTALLED IN AREAS RE-SHAPED TO A SLOPE OF 3:1 OR FLATTER, APPROXIMATELY 1.7 STAPLES REQUIRED PER SQ. YD OF EROSION CONTROL BLANKET INSTALLED IN AREAS RE-SHAPED TO A SLOPE OF 2:1 OR FLATTER, AND APPROXIMATELY 3.4 STAPLES REQUIRED PER SQ. YD OF EROSION CONTROL BLANKET INSTALLED IN AREAS RE-SHAPED TO 1:1 OR FLATTER.

EROSION CONTROL BLANKET

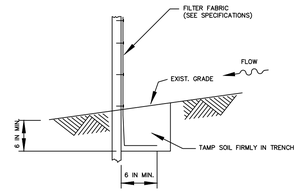
NOT TO SCALE

SEE ALSO IL URBAN MANUAL IL-620A



ELEVATION

NOT TO SCALE



ANCHOR DETAIL

NOT TO SCALE

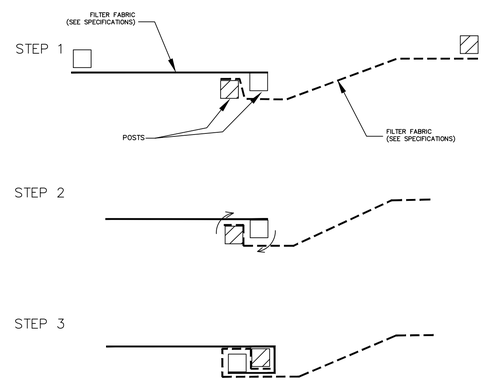
NOTES:

1. SEE SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL PLAN. IF INCLUDED AS PART OF SOIL EROSION AND SEDIMENT CONTROL PLAN, SILT FENCE SHALL BE INSTALLED PRIOR TO THE START OF LAND DISTURBING ACTIVITIES, AS INDICATED ON PLAN. SILT FENCE SHALL BE MAINTAINED THROUGHOUT CONSTRUCTION AND REMOVED IN CONJUNCTION WITH FINAL SITE AND SITE STABILIZATION.
2. SILT FENCE SHALL MEET THE PROVISIONS OF AASHTO M288 AND IL URBAN MANUAL IL-620. WHICHEVER STANDARD IS MORE RESTRICTIVE SHALL PREVAIL.
3. FILTER FABRIC USED ON SILT FENCES SHALL BE CLASSIFIED AS SUPPORTED (WITH A WIRE OR POLYMERIC MESH BACKING) OR UNSUPPORTED (NO BACKING).
4. FILTER FABRIC SHALL MEET THE REQUIREMENTS OF AASHTO M288 WITH MIN. AVG. ROLL VALUES (MARV) OF AT LEAST 90-LB FORCE (BEFORE THE FABRIC TEARS) FOR SUPPORTED SILT FENCE, OR 124-LB FORCE PARALLEL TO THE MACHINE DIRECTION & 100-LB FORCE PERPENDICULAR TO THE MACHINE DIRECTION FOR UNSUPPORTED SILT FENCE. PERMITTIVITY SHALL BE TESTED IN ACCORDANCE WITH ASTM D4491 AND MARV PERMITTIVITY SHALL BE 0.05 / SEC OR GREATER. APPARENT OPENING SIZE SHALL BE TESTED IN ACCORDANCE WITH ASTM D4751 AND MARV APPARENT OPENING SIZE SHALL BE 0.024 INCHES OR LESS. UV STABILITY SHALL BE TESTED IN ACCORDANCE WITH ASTM D4355 AND MARV UV STABILITY SHALL BE 70% RETAINED STRENGTH AFTER 500 HOURS OF EXPOSURE OR GREATER.
5. POST SPACING SHALL BE MAX. 4 FT O.C. FOR SUPPORTED FILTER FABRIC OR UNSUPPORTED FILTER FABRIC ELONGATED TO $\geq$ 50% AS MEASURED IN ACCORDANCE WITH ASTM D4632. POST SPACING SHALL BE MAX 6 FT O.C. FOR UNSUPPORTED FILTER FABRIC ELONGATED < 50% AS MEASURED IN ACCORDANCE WITH ASTM D4632.
6. POSTS SHALL BE COMPOSED OF HARDWOOD, STEEL, OR SYNTHETIC MATERIAL. POSTS SHALL BE A MIN. OF 56 IN LONG (3 FT ABOVE GRADE, 20 IN BELOW GRADE). HARDWOOD POSTS SHALL BE A MIN. OF 1.2 INCH X 1.2 INCH. STEEL POSTS MAY BE U, T, L, OR C SHAPE, WEIGHING 1.3 LBS PER FT (MIN.).

18 SILT FENCE

NOT TO SCALE

SEE ALSO IL URBAN MANUAL IL-620B



ATTACHING TWO SILT FENCES

NOTES:

1. PLACE THE END POST OF THE SECOND FENCE INSIDE THE END POST OF THE FIRST FENCE.
2. ROTATE BOTH POSTS AT LEAST 180 DEGREES IN A CLOCKWISE DIRECTION TO CREATE A TIGHT SEAL WITH THE FABRIC MATERIAL.
3. DRIVE BOTH POSTS A MINIMUM OF 20 INCHES INTO THE GROUND AND BURY THE FLAP.

SILT FENCE FASTENING

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SHEET C 3.2
BUFFALO CREEK
SHEET REFERENCE

SHEET N0.	DESIGNED	EH
	DRAWN	EH
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