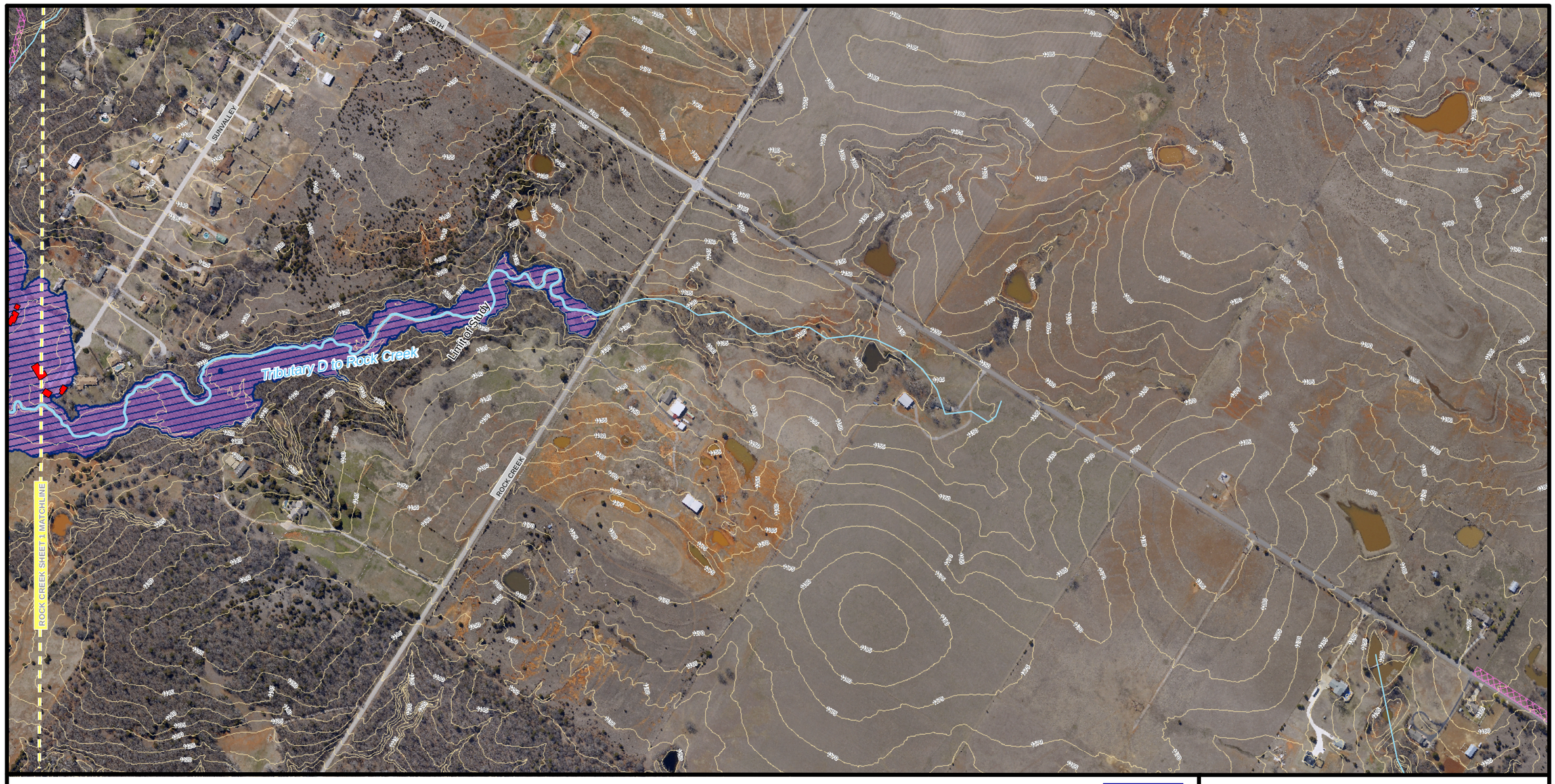


0 250 500 1,000 Feet

Aerial Photography: 2007
Coordinate System: Oklahoma State Plane, South Zone
Horizontal Datum: NAD 1983
Vertical Datum: NAVD 1988

Legend

City Boundary
Existing Drainage Easement

Stream Centerlines
Level 1 and 2 (Detailed)
Level 3 and 4 (General)

Floodplains
100-year Baseline
100-year Solution

Buildings in Floodplain
100-year Baseline
100-year Solution

Recommended Solutions
Road Crossing Upgrade
Property Buyouts
Floodwall
Channel Stabilization
Channel Improvements
Storm Sewer Improvements
Storm Water Detention

Storm Water Master Plan

Exhibit 6-17c

Baseline Floodplain and Recommended Solutions Overview Rock Creek - Tributary D

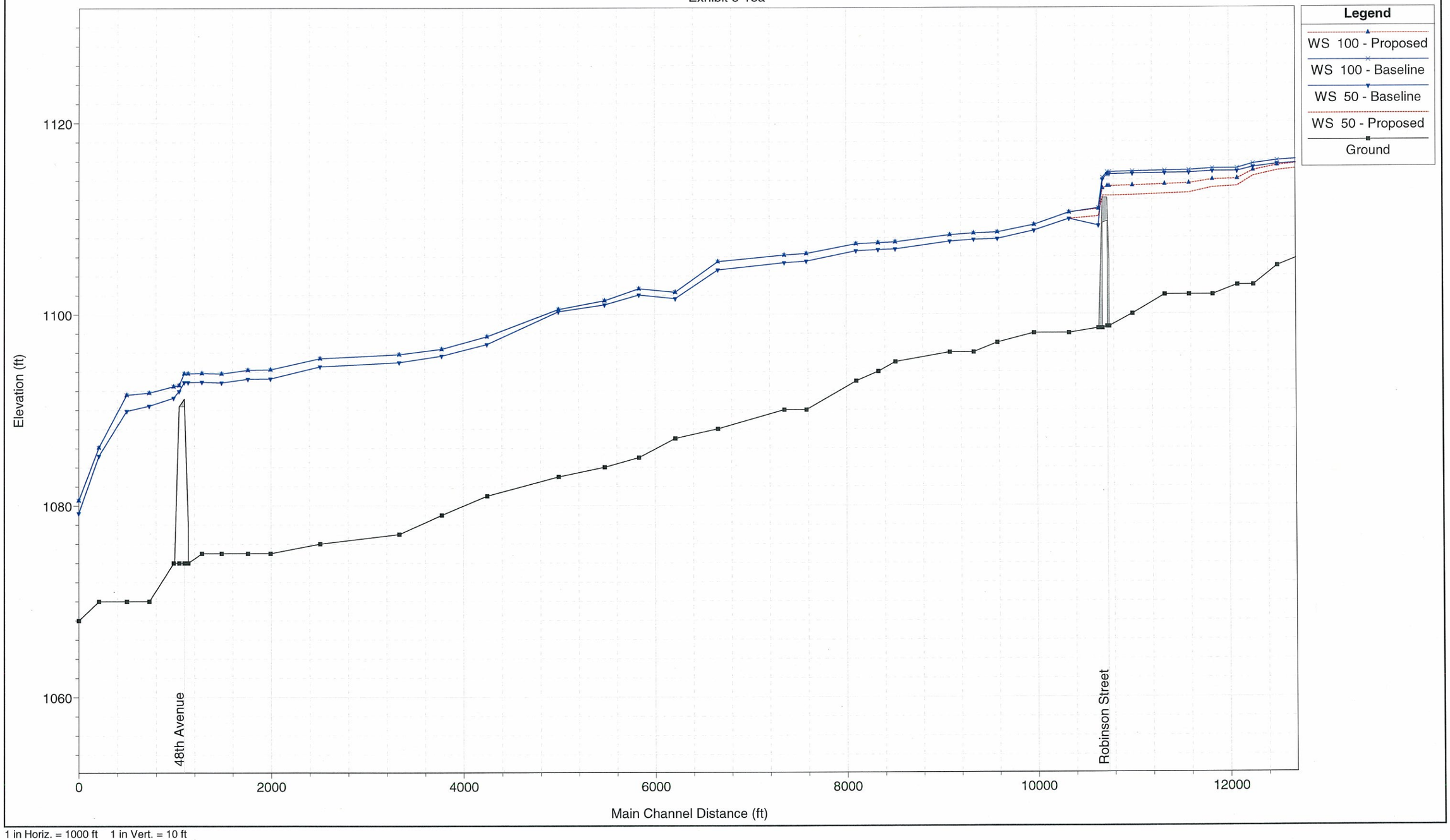
Sheet 1 of 1

Job No.: 044194100	Date: 12-11-08	Scale: 1 inch = 500 Feet

File: W:/WR/proj/441941_Norman/Report/Figures/TribDToRockCreek.mxd

Rock Creek Mainstem

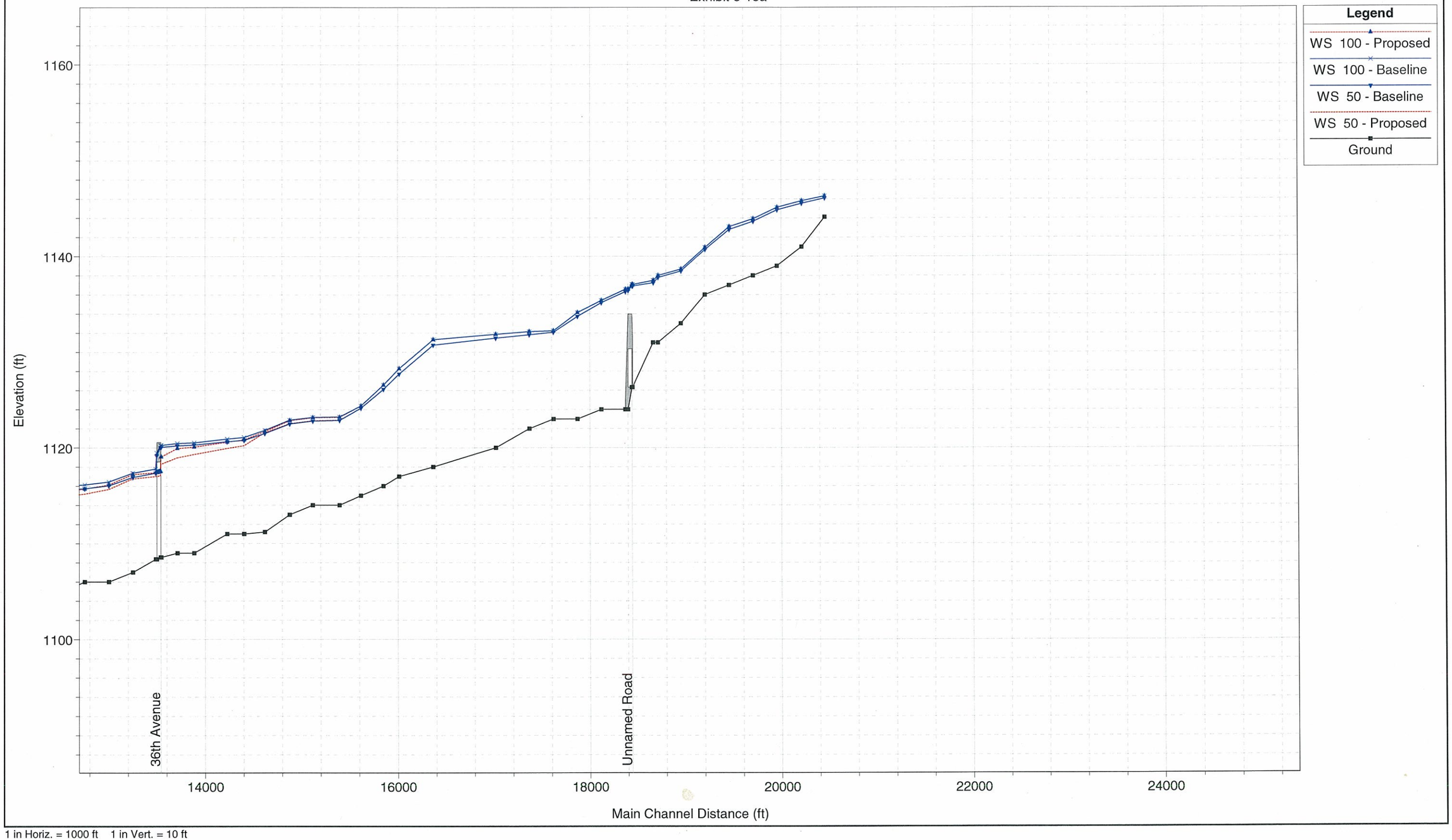
Exhibit 6-18a



1 in Horiz. = 1000 ft 1 in Vert. = 10 ft

Rock Creek Mainstem

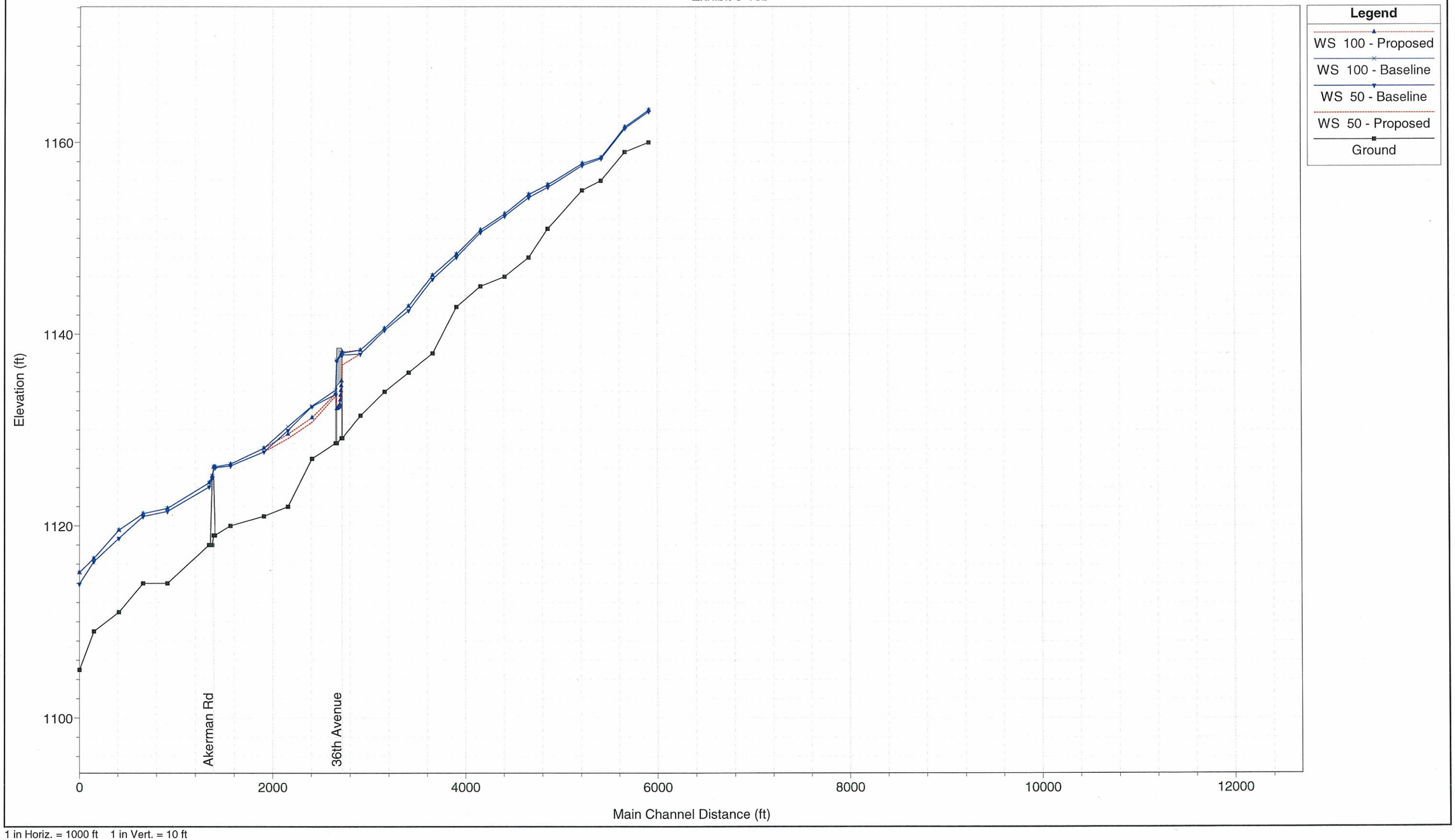
Exhibit 6-18a



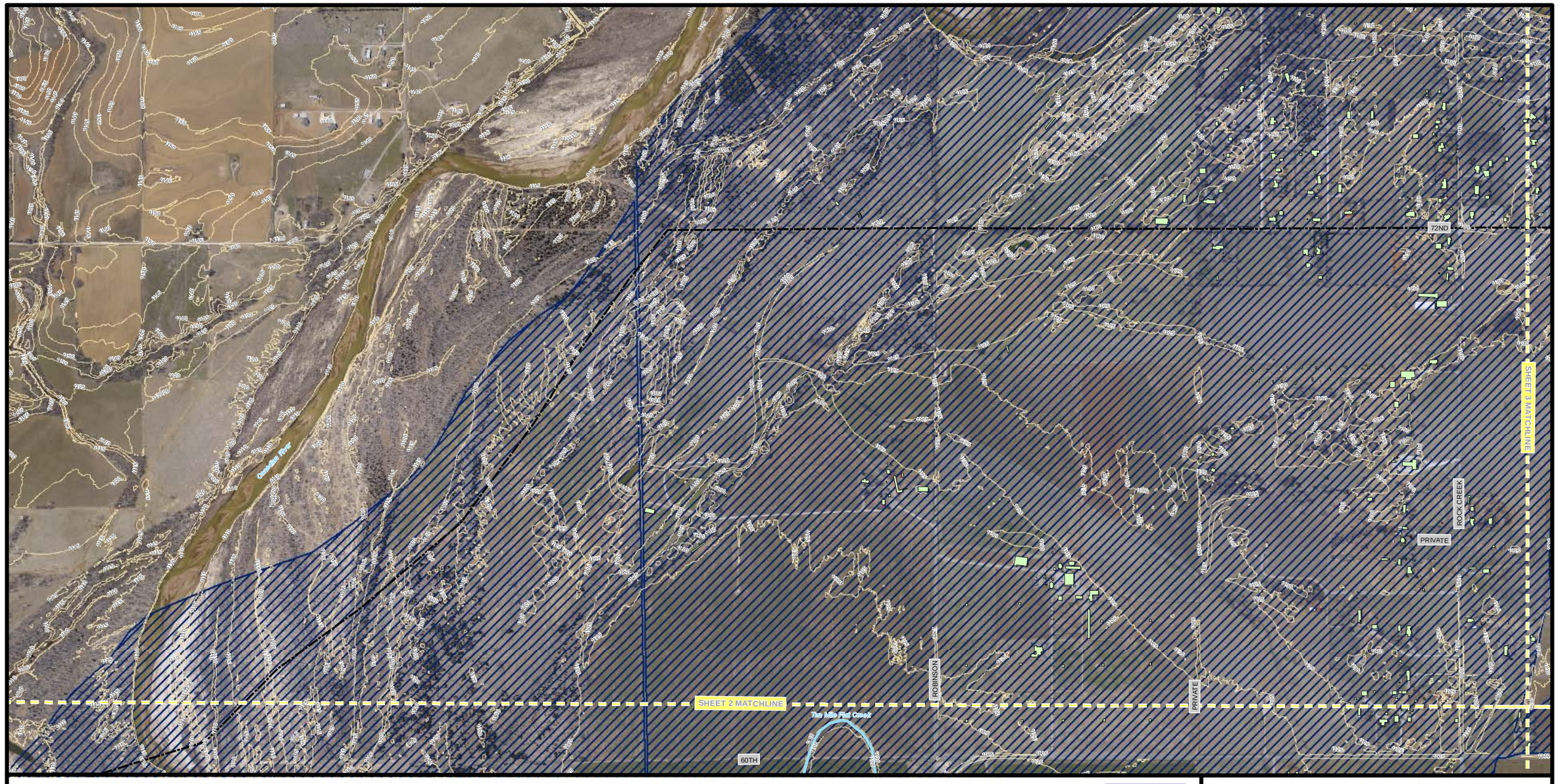
1 in Horiz. = 1000 ft 1 in Vert. = 10 ft

Rock Creek - Tributary C

Exhibit 6-18b



1 in Horiz. = 1000 ft 1 in Vert. = 10 ft



0 500 1,000 2,000 Feet

Aerial Photography: 2007
Coordinate System: Oklahoma State Plane, South Zone
Horizontal Datum: NAD 1983
Vertical Datum: NAVD 1988

Legend

City Boundary

Existing Drainage Easement

Stream Centerlines

Level 1 and 2 (Detailed)

Level 3 and 4 (General)

Floodplains

100-year (2007 CLOMR and Canadian River)

Zone X (100-year Floodplain depths less than 1 foot - Ten Mile Flat Creek)

Buildings in Floodplain

100-year (2007 CLOMR and Canadian River)

Recommended Solutions

Road Crossing Upgrade

Property Buyouts

Floodwall

Channel Stabilization

Channel Improvements

Storm Sewer Improvements

Storm Water Detention

Storm Water Master Plan

Exhibit 6-19

100-Year Floodplain (2007 CLOMR) and Recommended Solutions Overview Ten Mile Flat Creek

Sheet 1 of 4

Job No.: 044194100	Date: 10-06-09	Scale: 1 inch = 1000 Feet

File: W:/WR/proj/441941_Norman/Report/Figures/Ten_Mile_Flat_1_New.mxd

Legend

City Boundary

Existing Drainage Easement

Stream Centerlines

Level 1 and 2 (Detailed)

Level 3 and 4 (General)

Floodplains

100-year (2007 CLOMR and Canadian River)

Zone X (100-year Floodplain depths less than 1 foot - Ten Mile Flat Creek)

Buildings in Floodplain

100-year (2007 CLOMR and Canadian River)

Recommended Solutions

Road Crossing Upgrade

Property Buyouts

Floodwall

Channel Stabilization

Channel Improvements

Storm Sewer Improvements

Storm Water Detention

0 500 1,000 2,000 Feet

Aerial Photography: 2007
Coordinate System: Oklahoma State Plane, South Zone
Horizontal Datum: NAD 1983
Vertical Datum: NAVD 1988

Storm Water Master Plan

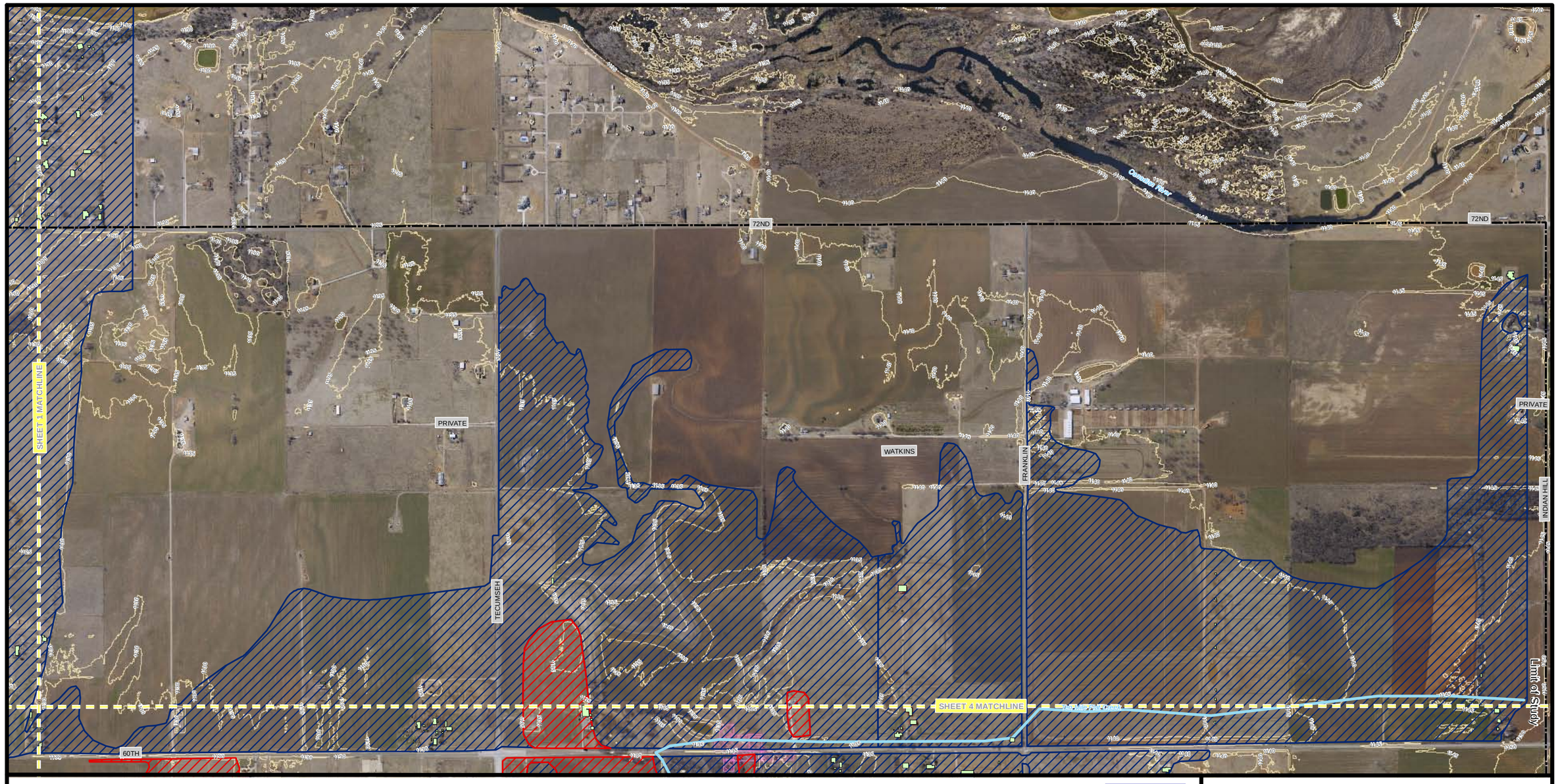
Exhibit 6-19

100-Year Floodplain (2007 CLOMR) and Recommended Solutions Overview Ten Mile Flat Creek

Sheet 2 of 4

Job No.: 044194100	Date: 12-11-08	Scale: 1 inch = 1000 Feet

File: W:/WR/proj/441941_Norman/Report/Figures/Ten_Mile_Flat_2_New.mxd



0 500 1,000 2,000 Feet

Aerial Photography: 2007
Coordinate System: Oklahoma State Plane, South Zone
Horizontal Datum: NAD 1983
Vertical Datum: NAVD 1988

Legend

City Boundary

Existing Drainage Easement

Stream Centerlines

Level 1 and 2 (Detailed)

Level 3 and 4 (General)

Floodplains

100-year (2007 CLOMR and Canadian River)

Zone X (100-year Floodplain depths less than 1 foot - Ten Mile Flat Creek)

Buildings in Floodplain

100-year (2007 CLOMR and Canadian River)

Recommended Solutions

Road Crossing Upgrade

Property Buyouts

Floodwall

Channel Stabilization

Channel Improvements

Storm Sewer Improvements

Storm Water Detention

Storm Water Master Plan

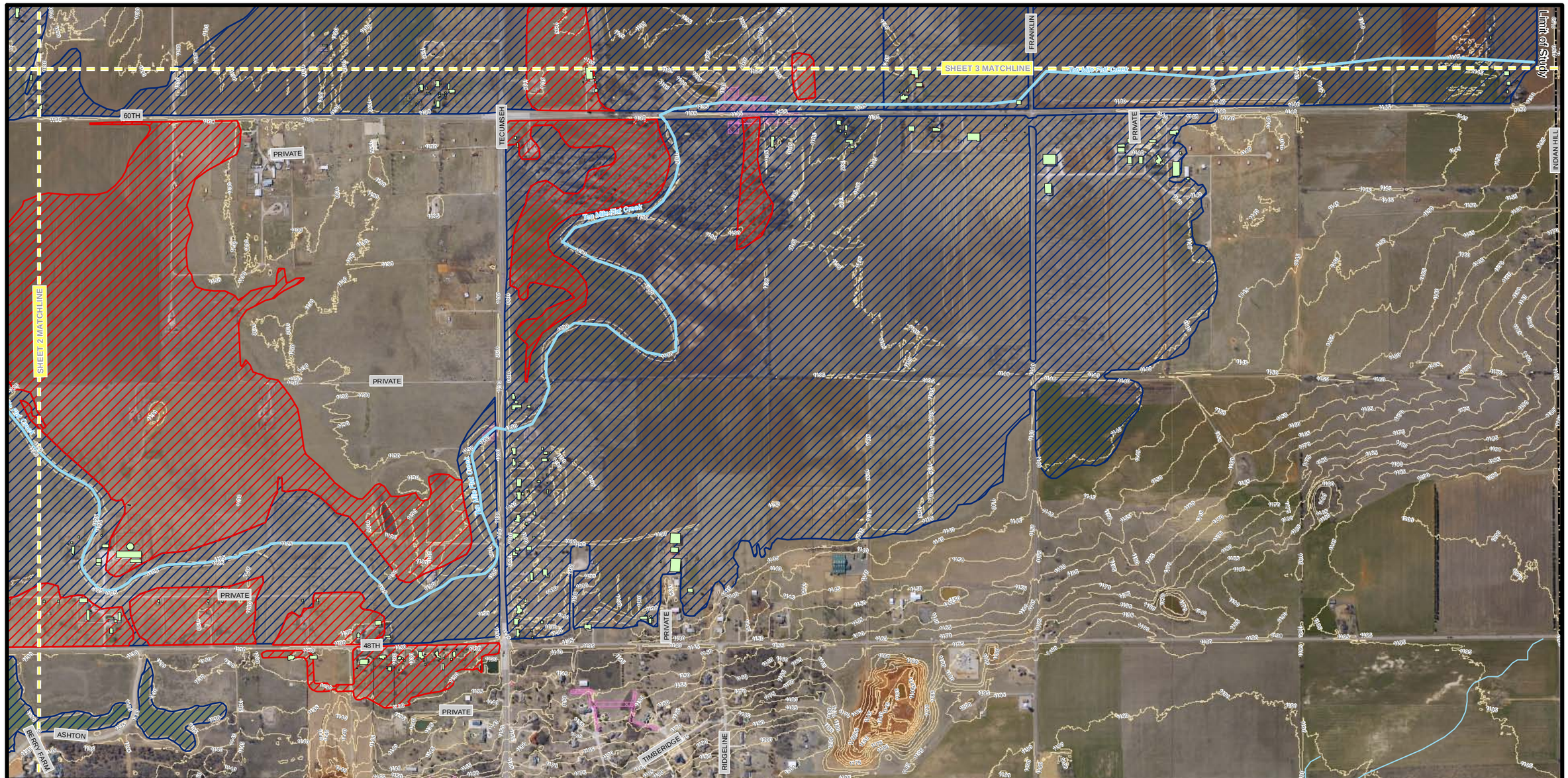
Exhibit 6-19

100-Year Floodplain (2007 CLOMR) and Recommended Solutions Overview Ten Mile Flat Creek

Sheet 3 of 4

Job No.: 044194100	Date: 10-06-09	Scale: 1 inch = 1000 Feet

File: W:/WR/proj/441941_Norman/Report/Figures/Ten_Mile_Flat_3_New.mxd



Legend

City Boundary

Existing Drainage Easement

Stream Centerlines

Level 1 and 2 (Detailed)

Level 3 and 4 (General)

Floodplains

100-year (2007 CLOMR and Canadian River)

Zone X (100-year Floodplain depths less than 1 foot - Ten Mile Flat Creek)

Buildings in Floodplain

100-year (2007 CLOMR and Canadian River)

Recommended Solutions

Road Crossing Upgrade

Property Buyouts

Floodwall

Channel Stabilization

Channel Improvements

Storm Sewer Improvements

Storm Water Detention

0 500 1,000 2,000 Feet

Aerial Photography: 2007
Coordinate System: Oklahoma State Plane, South Zone
Horizontal Datum: NAD 1983
Vertical Datum: NAVD 1988

Storm Water Master Plan

Exhibit 6-19

100-Year Floodplain (2007 CLOMR) and Recommended Solutions Overview Ten Mile Flat Creek

Sheet 4 of 4

Job No.: 044194100	Date: 10-06-09	Scale: 1 inch = 1000 Feet

File: W:/WR/proj/441941_Norman/Report/Figures/Ten_Mile_Flat_4_New.mxd

6.2.1 Stream Flooding, Stream Erosion, and Local Drainage

Beginning with the problem areas identified in Section 5, a screening process was developed for those stream flooding problems for which a solution was not obvious. For situations where there was not an obvious solution, alternative solutions were conceptualized and then "screened" based on their applicability and practicality with the goal of selecting the best solution for each respective problem. Solutions for some problems were straight-forward and did not require consideration of alternatives. For the problem areas for which more than one viable solution held promise, possible alternatives were generally evaluated in terms of their applicability. This process led to the ultimate selection of the most preferred solution or option to solve the problem.

Once preferred solution alternatives were identified, hydrologic and hydraulic modeling/analyses (see Section 4) and/or stream stability considerations based primarily on field reconnaissance were used to design and size the respective improvements such that the structures, roadways, and stream environment were protected to the targeted level. The solutions ranged from complex solutions that covered reaches extending for thousands of feet to small conveyance improvements for identified localized problem areas. Although HEC-1 or HEC-HMS models were used to identify and solve stream flooding problems in the larger storm water systems, general hydrologic (Rational Method) and hydraulic (Manning Equation) methods were used for localized drainage analyses. For each respective stream flooding project or solution, the design conditions (locations, sizes, improvement types, characteristics, etc.) were converted to hydrologic and/or hydraulic modeling input and evaluated with the models to develop the project's performance. The solutions developed include property acquisitions, creek modifications (natural, bio-engineered, historic WPA-type, grass lined, and concrete lined), bridge/culvert upsizing, creek bed and bank stabilization, storm water detention ponds, flow diversions, storm sewer size increases, street storm inlet additions, property buyouts, drainage easement and/or rights-of-way acquisition, and others.

The level of protection for most stream flooding solutions varied somewhat although improvements associated with channel capacity and roadway bridge openings used projected 100-year baseline (future) peak discharges while roadway culvert openings used 50-year peak flows. Exceptions occurred in special cases where 10-year protection was judged to be preferred due to limited space and the costs associated with larger improvements. Such cases included channel improvements and certain roadway crossings along Imhoff Creek, the west-central Imhoff Creek watershed area (Lindsey Street – McGee Drive intersection flooding problem), and a few others. **An important consideration is pointed out here involving the planning and engineering needed to ensure that problems in one area are not created or made worse while solving a problem in another area. This is often a concern and consideration when creek conveyance is improved to lower flood levels by improving creek channels and/or opening up constricted culvert/bridge openings. Proper design considerations must be addressed and related hydrologic and hydraulic analysis must be performed during project design phases to prevent increased flooding in any areas as a result of project "improvements."**

The natural and/or bio-engineered design solutions used for certain stream flooding situations and all stream stabilization projects utilize a combination of techniques including channel grade (slope) control, streambank armoring, slope flattening, and bank toe protection. Stable channel designs to stop and/or prevent existing and future stream erosion/instability need to incorporate sediment discharge principals in concert with hydrologic and hydraulic considerations. The design of stable streams requires sediment transport analyses. These analyses include the determinations of design stream longitudinal slopes and cross-section configurations to handle the channel-forming flows (often less than a 2-year event), sediment discharges, and flood discharges.

The materials used to achieve these techniques include rock riprap, erosion protection fabric, "geogrids" to hold the structure together, and select vegetation. As shown in Figure 6-2, one stabilization type involves "laying back" the streambank slope to achieve stabilization. As presented in Figure 6-3, another method used is commonly referred to as a mechanically stabilized earth (MSE) structure in which the layered geogrids and construction methods allow the structure to function as a single stable mass rather than an area that can erode away in pieces. Finally, stream grade control structures as illustrated in Figure 6-4 were used where needed to flatten slope and control flow velocities to non-erosive levels. Photos of these types of solutions that use natural materials and a more environmentally sensitive footprint are also shown here to better indicate these types of improvements.

Typical cross sections for improvements along key locations, including Bishop Creek between State Highway 9 and Constitution, Brookhaven Creek downstream of Main Street, and Imhoff Creek upstream of Boyd Street, are provided in figures 6-5, 6-6, and 6-7, respectively.

As provided in Table 6-2, general cost estimates for each selected or recommended project solution were developed using unit costs and estimated quantities for the construction bid items required to construct the respective projects. Appendix H contains a detailed cost estimate breakdown of each project's cost estimate including the applicable bid items, estimated quantities, units of measurement, unit costs, and bid item costs. These bid item costs are summed then a 20% contingency was added to obtain a total costs for each project. The unit costs were developed from bid tabulations obtained from ODOT, the City of Norman, and contractors. Quantities were obtained using a variety of means such as obtaining channel cut and fill as well as culvert/bridge sizing from HEC-RAS modeling, measuring heights and distances of improvements from the local GIS maps, estimating stream erosion stabilization needs based on field measurements and design water levels (2-year event), and estimating general contractor costs and other project costs from standard relationships. These standard relationships used were based on the following percentages of the total bid item costs not including any of the costs from these items themselves and before including the 20% contingency.

- Mobilization – 15%
- Preparation of ROW – 4%
- Utility relocation – 5%
- Barricades/signs/traffic handling – varies 3%–6%
- Site stabilization – 7%
- City project management – 10%
- Design engineering – 15%
- Significant permitting (U.S. Army Corps of Engineers [USACE] CWA Section 404, etc.), where required – 5%

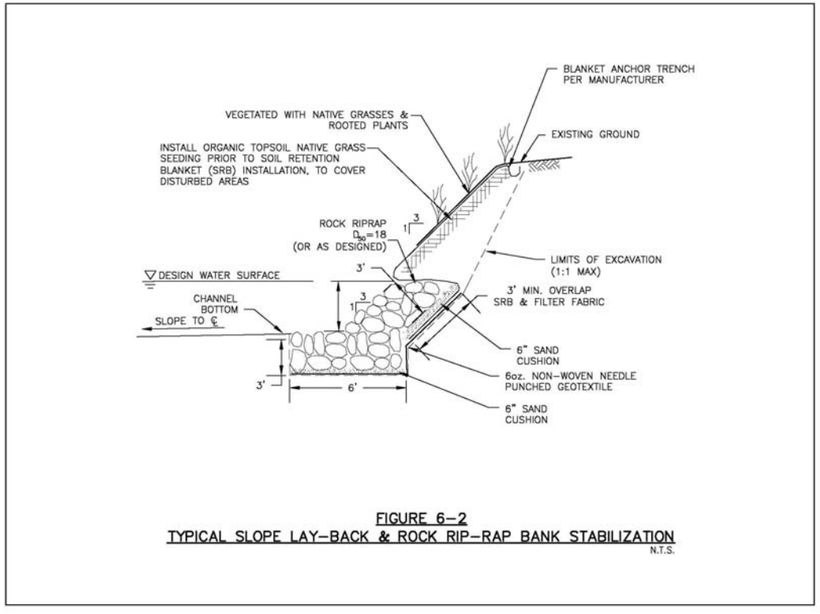


FIGURE 6-2
TYPICAL SLOPE LAY-BACK & ROCK RIP-RAP BANK STABILIZATION
N.T.S.

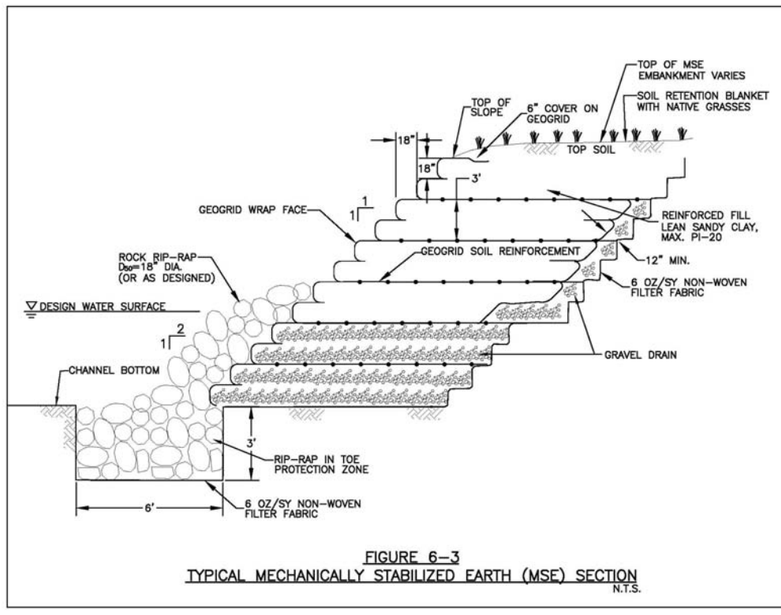


FIGURE 6-3
TYPICAL MECHANICALLY STABILIZED EARTH (MSE) SECTION
N.T.S.

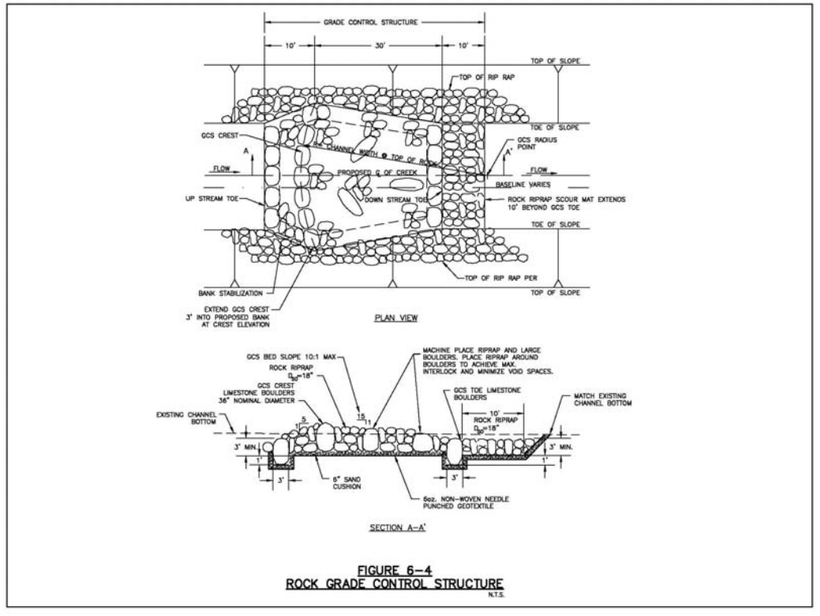


FIGURE 6-4
ROCK GRADE CONTROL STRUCTURE
N.T.S.

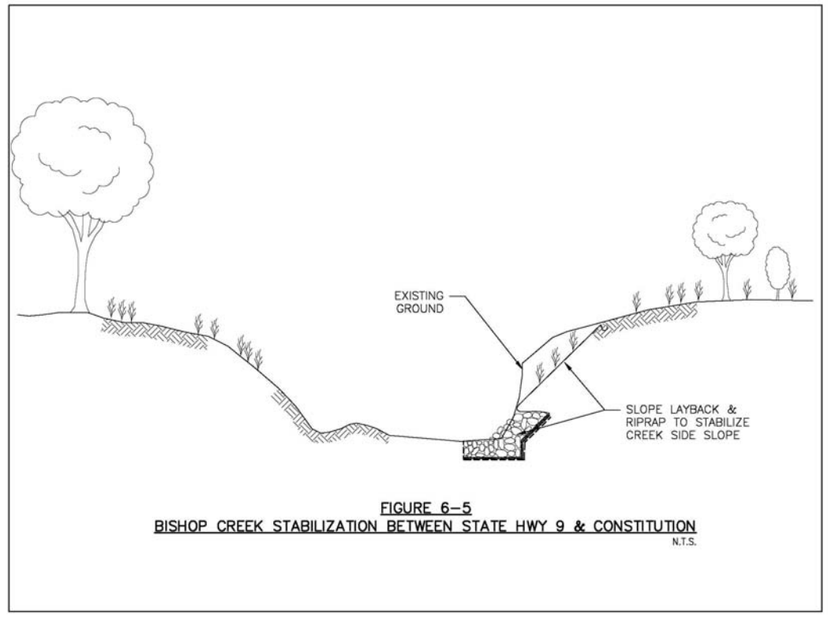


FIGURE 6-5
BISHOP CREEK STABILIZATION BETWEEN STATE HWY 9 & CONSTITUTION
N.T.S.

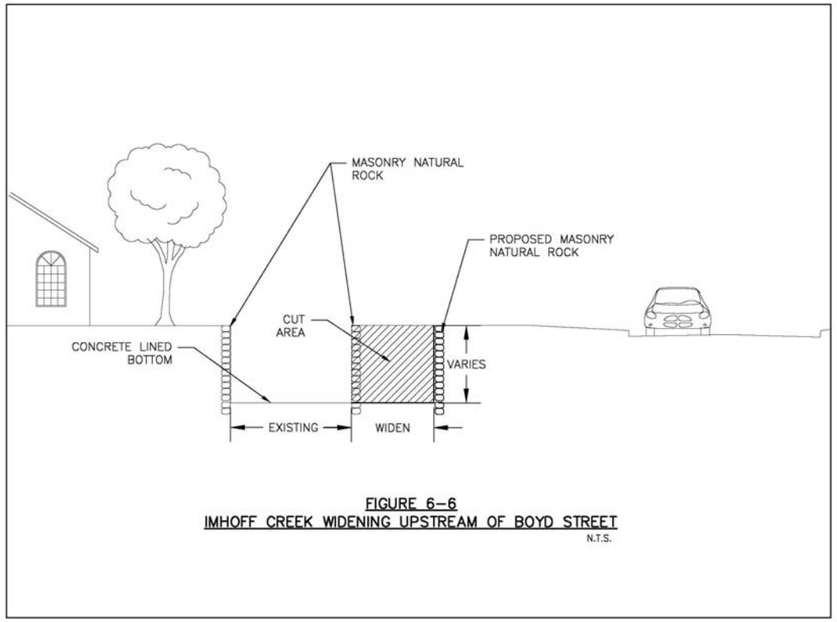


FIGURE 6–6
IMHOFF CREEK WIDENING UPSTREAM OF BOYD STREET
N.T.S.

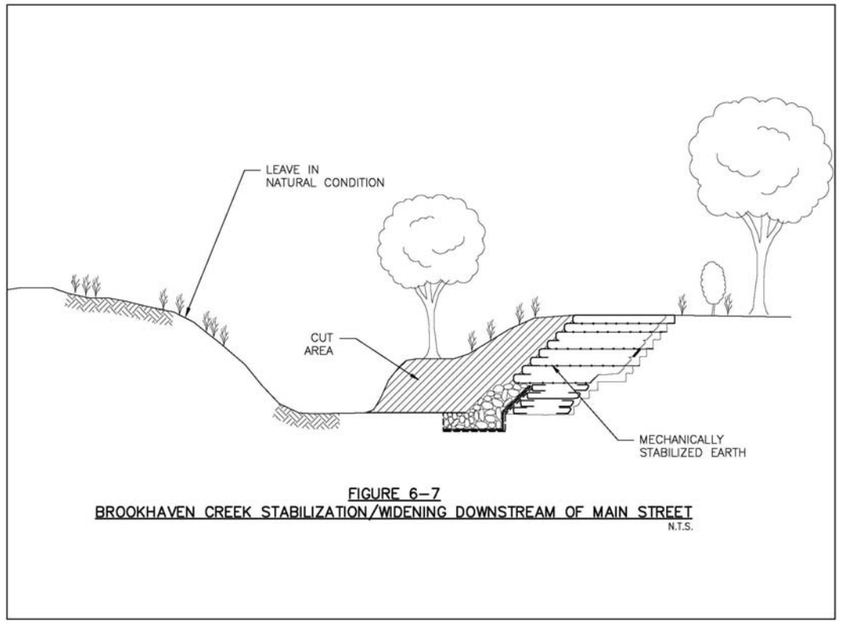


FIGURE 6–7
BROOKHAVEN CREEK STABILIZATION/WIDENING DOWNSTREAM OF MAIN STREET
N.T.S.

Stabilization using rock riprap

MSE stabilization with rock riprap

MSE stabilization with gabions and ledge rock in dense urban setting

Another key issue and cost item involved developing project costs for new drainage easements and/or rights-of-way needed in order to assure construction of project improvements on property either owned by the City or made available through City easements. These easements will be needed for a variety of purposes including gaining access for construction, the construction footprint needed to make the improvements, inspections, and maintenance. Costs were obtained from the City staff based on historical costs and were based on the location of the problems and the adjacent local land use. In a few locations with special circumstances, easement costs were increased somewhat to cover possible difficulties. The types of easement needed to be purchased and the cost per square foot is given below:

- Agricultural – $0.35/SF
- Residential – $2.00/SF
- Commercial – $3.50/SF

Citywide, there was one project requiring an agricultural easement, 14 projects that required residential easements, and 12 projects requiring commercial easements. The size of the respective project easements were determined based on the area needed for future construction, maintenance, and inspections. In many instances, existing drainage or storm water easements and/or rights-of-way were available to satisfy part or all of project needs. The cost estimates in Appendix H outline the type, quantity, and costs for drainage easements for each individual project.

Although an effort was made to minimize property buyouts, 12 of the projects include entire property buyouts since additional area was needed to build the improvements or it was impractical to make the improvements large enough to protect the property's structures. As shown in the cost estimates in Appendix H, a total of 62 properties located throughout the City were identified for buyout in the proposed solutions. Since the solution designs are conceptual, the exact properties are not specified to avoid controversy and can be better defined in subsequent more detailed engineering and design efforts if the City wants to pursue such acquisitions.

Another important aspect of developing solutions for the many problems identified involved a prioritization of the solutions. This prioritization allows identification of the most critical projects for addressing the storm water needs in Norman and is an important tool for the City to use along with other information, such as individual project costs, in determining the order that solutions might be implemented or how they might be financed. The prioritization system developed and used evaluates each solution or project in terms of its ability to solve the problem being considered, provide for public safety, provide sustainability, utilize funding advantages, impart positive impacts on affected neighborhoods and the environment, assist in other important issues like transportation, and determine its economic costs versus benefits relationship. Each prioritization factor was given a weight based on its importance. Factors were grouped and classified in four categories. The factors in the most important category were given a weighting of four, the factors in the second category were given a weighting of three, the factors in the third category were given a weighting of two, and the factors in the fourth category were given a weighting of one. The various factors are shown in Table 6-3 along with scoring examples for hypothetical projects.

When evaluating a project using this prioritization "matrix," each factor was evaluated by providing its respective rating with the highest rating being three, a moderate rating being two, a low rating being one, and a rating of zero given if there was no relevance for the factor whatsoever. Once each factor was rated for a project, the factor weighting was multiplied by the rating to give a factor score. The individual factor scores were then totaled to give a total prioritization score for the project. The higher the score, the greater the importance of the subject project. This process was followed for each identified project in the City. Once project prioritization scores were obtained, the project rankings were then compared on a watershed, ward, and city-wide basis as shown in Table 6-2. The individual project rankings are organized by watershed and are provided in Appendix I.

The integration of the proposed storm water solutions with proposed greenbelt routes was another key element of the SWMP. As part of the SWMP consultant team, Halff Associates, is presently in the process of finalizing development of the greenbelt trails plan for Norman. Coordination throughout the project has occurred to ensure that storm water projects could be integrated with greenbelts whenever possible. Table 6-2 provides a column indicating whether there is a reasonable integration opportunity for any particular storm water project. If there is a possible opportunity to integrate the two project types, a "Y" is included in the table. In such instances, the greenbelts plan can be consulted for the trail alignment which should coincide with the storm water project either partially or totally. During the design effort for any particular project, its integration with greenbelts can be considered further and incorporated into the project if the City desires.

6.2.1.1 Capital Improvements Program

In order to perform the City duties associated with managing a CIP program and the projects undertaken in the program, provisions to supply the needed design and construction oversight need to be accommodated. The two best

Table 6-3
Project Prioritization Scoring Sheet

Prioritization Ranking Factors	Ranking Factor Weight	A Road Drainage Ditch		Wet Creek Buyouts		Maximum Possible Score	
		Project Specific Score	Project Specific Weighted Score	Project Specific Score	Project Specific Weighted Score	Project Specific Score	Project Specific Weighted Score
Public safety	4	3	12	3	12	3	12
Flood, erosion, and water quality significance	4	1	4	2	8	3	12
Engineering economy (good benefit/cost relationship)	4	2	8	3	12	3	12
Potential for recreation/open space/connectivity for linear parks	4	2	8	3	12	3	12
Sustainability or low operations & maintenance cost	3	1	3	3	9	3	9
Environmental enhancement	3	1	3	3	9	3	9
Funding sources (leverage of participants available funds)	2	2	4	2	4	3	6
Beneficial neighborhood impacts	2	1	2	1	2	3	6
Degree of economic impact on local businesses	2	2	4	3	6	3	6
Dependency on other projects	1	0	0	1	1	3	3
Improve economic development/redevelopment potential	1	3	3	2	2	3	3
Mobility or effects on transportation system	1	3	3	0	0	3	3
Time to implement or construct	1	2	2	1	1	3	3
Ease of permitting	1	1	1	3	3	3	3
Project Total Specific Score			57		81		99

Note: Project Specific Scores can be 0, 1, 2, or 3.

options for the City appear to be either: 1) hiring or reassigning City staff or 2) retaining a consultant or consulting firm to perform or assist with the work. Both have merits and the City could even use a combination of the two approaches. It may also be advantageous for the City to begin with one method, such as hiring a consultant, and then ramping up with staff over time to take over the program.

The basic driving factor is the amount of program management work to be done and the budget to perform that work. For estimating purposes, the general obligation (GO) bonding and annual CIP project funding needs provided in Table 8-4 in Section 8 were used to estimate the amount of work budget required for storm water improvements in Norman over the first 5 years of such a program. Additionally, it was assumed that the GO bonds would be used in the first five years of the program. It was decided to use Option 1 in Table 8-4 in order to not overestimate the amount of work and funds needed.

Utilizing information provided in Table 8-4, the following calculations were made to generally estimate the amount of program work needed and, therefore, the staffing required.

1) GO Bonding = $30,000,000 assumed to be spent over the first 5 years of the program
2) CIP funding through a storm water utility = $2,650,000 annually over the first 5 years of the program
3) Total funding over the first 5 years of the program = $30,000,000 + 5($2,650,000) = $43,250,00
4) Average annual funding = $43,250,000/5 = $8,650,000
5) Consistent with the project cost estimates assumption in this Section of the report, assume 10% for City program and project management = $865,000/year
6) After the first 5 years, the GO bonding funds would no longer be available. The annual needs would be reduced to $2,650,000 which would yield a program and project management budget of $265,000 at the 10% management rate used.

Therefore, the City would have $865,000 per year to manage the program and the projects being constructed during the first 5 years of the program. That amount would drop to $265,000 after that time period to only include the CIP funding amount.

As mentioned above, the City could approach this work in a number of different ways. A “middle ground” approach was used here to assist the City in making possible program/project staffing decisions if this amount of funding becomes available. A solid approach that the City could follow would be to only hire enough staff to perform about $265,000 annually and hire consultants to perform the remaining program/project work. In that manner, the City would not be overstaffed at the end of the 5 year period when the GO bonding funds begin to decrease as projects are designed and constructed. The very approximate annual costs are estimated to be:

1) One senior engineering manager = $100,000
2) One engineer/engineer-in-training or technician/inspector = $75,000
3) Part time administration assistance = $25,000
4) Non-labor expenses and fees = $50,000
5) Total annual costs = $250,000

These staffing costs are very approximate and could vary, but this provides a general basis for beginning a program and project management group at the City to fulfill the duties of such an endeavor.

6.2.2 Water Quality

Programmatic water quality solutions are presently being implemented in Norman’s “urbanized areas” as part of the City’s compliance with ODEQ’s Oklahoma Pollutant Discharge Elimination System (OPDES) “MS4” program. Additional future water quality compliance will also be required as part of the previously mentioned TMDL requirements for Bishop Creek and ODEQ’s future watershed management plan development for the Lake Thunderbird watershed. As part of this SWMP, a “Storm Water Management Program for MS4 Compliance – 2011 to 2015” (PBS&J, 2008) was developed and submitted to the City of Norman in February 2008 and is made part of this SWMP by reference. This document outlines an MS4 program that the City has begun undertaking to address the need to protect and improve water quality in the City. The TMDL study for the Canadian River involves the City of Norman and the University of Oklahoma as contributors to fecal coliform problems in Bishop Creek which will

require compliance activities by the City and University. The City will also be required to comply with ODEQ's upcoming watershed management plan to protect Lake Thunderbird's water quality.

With its ongoing MS4 program, the City is presently complying with OPDES MS4 permitting requirements. In summary, the state permit requires the City to comply with a number of administrative and legal requirements and to develop, implement, and enforce a storm water management program designed to reduce the storm water discharge pollutants from its MS4 area to the maximum extent practicable for water quality protection purposes. The SWMP must address six areas, called Minimum Control Measures (MCMs), as follows:

- Public Education and Outreach Program
- Public Participation and Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-Construction Management in New Development and Redevelopment
- Pollution Prevention/Good Housekeeping for MS4 Operations

General Permit OKR04 for small MS4s, dated February 2005, authorizes discharges of storm water and certain non-storm water discharges from small MS4s. The submittal date of the NOI for storm water discharges from small MS4s as required by General permit OKR04 was May 9, 2005. The permit number assigned by ODEQ for the NOI is OKR040015.

For each MCM the City must:

- Select appropriate BMPs, which are various methods of reducing pollutants in storm water runoff.
- Define measurable goals for each BMP.
- Establish an implementation schedule.
- Assign a responsible person or persons for implementing all activities.

Additionally, the City of Norman is in the process of developing a program to assess the condition and repair needs of the City's underground storm sewer system as well as to locate any illicit (illegal) connections/discharges of the system. This program will utilize a video camera system operated by trained City maintenance personnel. Equipment costs for the camera and a truck total approximately $170,000 with operation and maintenance costs for the truck amounting to approximately $5,000 per year. Annual costs for the maintenance personnel including uniforms will amount to almost $100,000. Therefore, first-year costs would total approximately $275,000 while costs in subsequent years would run about $103,000.

Under the TMDL process for the Canadian River, ODEQ has also identified Norman and the University of Oklahoma as contributors to non-attainment for fecal coliform in Bishop Creek, a local tributary to the Canadian River. Bishop Creek failed to support the designated water use due to fecal coliform concentrations, and thus actions must be taken to meet the water quality standard. Where the TMDL has been developed, additional sampling becomes part of the implementation requirements for regulated MS4 discharges such as those from the City of Norman. Significant monitoring and reporting of water quality and implementation of BMPs are expected to result.

The watershed management plan being established by ODEQ discussed above and in Section 5 will identify implementation of management practices in the Lake Thunderbird watershed to help achieve beneficial uses of water in the lake. This watershed management plan could require that the City of Norman develop a program and/or modifications to its land development policies and ordinances to reduce pollutant loadings commonly associated with urban development.

These ongoing and upcoming programs assist in addressing water quality solutions for the City of Norman as they encompass the entire city, examine water quality conditions in Lake Thunderbird, and even consider the storm water quality entering the City of Norman from areas outside of Norman's city limits as is being done with ODEQ's watershed management plan development. As these programs progress and mature, additional compliance requirements and actions will be defined and become part of the City's normal operations. However, additional actions are warranted by the City to protect Lake Thunderbird's water quality.

The use of structural and non-structural storm water quality controls as discussed in Section 7.2 of this report are needed to provide significant water quality protection throughout Norman and especially for the City's drinking water supply, Lake Thunderbird. The need for such controls is evident in the State of Oklahoma's action to designate Lake Thunderbird as a sensitive water supply lake (ODEQ, 2002). Lake Thunderbird has been added to the State of Oklahoma's 303(d) list of impaired waterbodies due to high levels of chlorophyll-a, an accepted measure of algal content, which has caused non-attainment of designated uses in the lake. A major component of this SWMP is to provide further understanding and awareness of the critically important need to protect Lake Thunderbird's water quality and to recommend measures that will assist in accomplishing the needed protection. As land development progresses in the Lake Thunderbird Watershed, further degradation of the lake's water quality can be expected as reported in a recent report developed by Vieux, Inc., entitled "Lake Thunderbird Watershed Analysis and Water Quality Evaluation" for the Oklahoma Conservation Commission (Vieux, 2007). This 2007 study assessed and quantified the impact of future land development on storm water non-point nutrient and sediment loadings to the lake as well as analyzed the potential effectiveness of management practices (i.e., structural and non-structural controls) in preserving and protecting the lake's water quality.

Modeling reported in the Vieux report (Vieux, 2007) generated results of water quality conditions associated with baseline (2000) and build-out (2030) conditions which clearly point out that watershed nutrient loadings to the lake are high and will increase (phosphorus more than doubling) with future urbanization. As explained in some detail in this 2007 report, these nutrient loadings and especially those from phosphorus have already contributed significantly to algal growth in the lake. Additionally in 2000, the Central Oklahoma Master Conservancy District (COMCD) and the Oklahoma Water Resources Board (OWRB) in cooperation with the cities of Norman, Del City, and Midwest City, set an upper limit goal of 20 µg/L of chlorophyll-a, a pigment or molecule commonly used to indicate algal

content, for open water sites during the growing season (OWRB, 2001). The 20 µg/L concentration goal for chlorophyll-a is regarded as the boundary between eutrophic (high) and hypereutrophic (excessive) algal growth. Using projected phosphorus loadings and an in-lake relationship between phosphorus and chlorophyll-a, estimates of potential algal growth (i.e., in-lake chlorophyll-a concentrations) in the lake were made for baseline and build-out watershed conditions. As the projected nutrient loading and associated chlorophyll-a results clearly show, the increased nutrient loadings projected to occur with future urbanization without sufficient mitigating measures will further exacerbate the algal growth in the lake significantly above the in-lake level set as the goal (i.e., the 20 µg/L chlorophyll-a concentration). Modeling in the Vieux report reveals that chlorophyll-a concentrations currently exceed the existing water quality goal of 20 µg/L for the lake, averaging 30.8 µg/L for baseline conditions. For the build-out conditions, the average chlorophyll-a concentration is projected to be as high as 44 µg/L, which is an increase of 43% above existing conditions and well above the water quality goal set for the lake. This increase in potential algal growth greatly increases the threat of toxins being produced in the lake from the algal masses, exacerbates taste and odor problems, as well as decreases recreational potential. It is clear that the City of Norman is confronted with the significant potential for an ever worsening unclean, unhealthy, and unsafe water supply.

The 2007 Vieux analyses further present that implementation of multiple management practices (structural and non-structural water quality controls) for both existing and build-out conditions such as statutory fertilizer reductions, existing wetlands protection, and structural controls (e.g., detention basins, retention or sedimentation basins, constructed wetlands, and bioretention filter basins) can result in significant reductions of phosphorus loading and chlorophyll-a concentrations within the lake. Combinations of several management practices throughout the entire Lake Thunderbird Watershed were shown to reduce the lake's total phosphorus load to a level where the chlorophyll-a concentration in the lake would remain close to the set water quality goals. However, limiting the application of management practices within the limits of the City of Norman alone would not meet the water quality goals set for the lake. If statutory fertilizer reduction, wetlands, and structural controls are applied only to the area within the City of Norman under baseline conditions, the modeled chlorophyll-a concentration in the lake was estimated to be 24 µg/L which is still above the goal of 20 µg/L. For the build-out condition and management practices applied only in Norman, the chlorophyll-a concentration in the lake equated to 36 µg/L principally due to watershed loadings from outside of Norman's city limits. This indicates significant hyper-eutrophic water quality conditions and still well above the 20 µg/L water quality goal.

While implementing non-structural and structural controls for previously developed areas would be difficult, the implementation of such controls including stream buffers or related floodplain dedications (e.g., Stream Planning Corridors) as well as water quality facilities (e.g., extended detention) in future developments will greatly assist Norman in improving the water quality in Lake Thunderbird. According to the Environmental Protection Agency (EPA), the use of stream buffers has the potential to control nutrient loadings by reducing loadings to streams by 30–40% (EPA, 1993). Fisher and Fischenich (2000) reported literature values for phosphorus removal due to "buffer zones and corridors for water quality considerations" as high as approximately 80%. Extended detention, an often used structural water quality control, has been reported to reduce phosphorus loadings by approximately 50% (Vieux, 2007).

Along with several other studies, reports, and programs (e.g., requirements of the City's MS4 Program), results of the Vieux (2007) analyses and report were strongly considered when selecting and recommending structural and non-structural controls for areas that could potentially undergo future development within the City of Norman. These results were also considered when making our recommendation to coordinate storm water protection initiatives with the cities of Moore and Oklahoma City which also have areas that drain to Lake Thunderbird and contribute to the water quality problems therein. It is also recognized that in certain circumstances these water quality controls may also be implemented in previously developed areas depending on the conditions and applicability.

The Vieux report clearly reveals that a combination of controls will be needed to protect Lake Thunderbird's water quality. The SWMP recommendations and implementation plan presented in this report serve to provide an outline of recommended storm water management practices or controls for the Lake Thunderbird Watershed that, among other items, include Stream Planning Corridors (SPCs), structural controls (dry extended detention basins), fertilizer use education, fertilizer use controls, a continuation of present development density controls, and the encouraged use of effective low impact development measures. Recommendations of these particular controls are being made since they have demonstrated in numerous locations that they have the ability to significantly assist in protecting water quality and are recognized by EPA as viable management practices or controls. If implemented properly, these management practices will significantly assist in preserving and protecting Lake Thunderbird's water quality and the City's primary water source which, in turn, will protect the health, safety, and welfare of Norman's citizenry.

As the largest municipal area draining into Lake Thunderbird, the City of Norman should take affirmative steps to address water quality issues. In order to assure the continued viability of the City's primary water source, it is recommended that the City implement the key non-structural and structural water quality controls selected herein in areas of future development and work to ameliorate conditions in existing developments that are reported to be contributing to the degradation of water quality.

Construction erosion protection with silt fence

7.0 KEY ISSUES

During development of the SWMP, several key issues emerged that warranted a considerable amount of time due to their complexity and the need to have various stakeholder groups offer their guidance on how best to resolve the issues. Numerous discussions with City Council members, the SWMP Task Force, City staff, and other stakeholders produced a variety of good ideas about the various issues. Although recommendations are included in this report (this section and Section 9), consideration will be needed to resolve details on moving forward with several of these recommendations. Therefore, this section provides pertinent background on the issues, discussion topics considered in the stakeholder meetings, and recommendations on how the City should move forward in the future on each of the issues. Several of these issues came up as the consultant team brought suggestions forward specifically targeting certain City goals established for the SWMP. A breakdown of the major issues into "considerations" is presented below along with options, respective discussions, and recommended actions. It is anticipated that the recommended actions will allow the City to ultimately reach a consensus or understanding on the best approach to follow in the future on each respective issue.

Several possible concepts were considered in an effort to meet certain City's SWMP goals of providing public safety from flooding, protecting water quality including Lake Thunderbird, meeting OPDES permitting requirements, protecting stream corridor environments, capitalizing on greenway and open space expanding opportunities, and generally improving the "quality of life" in Norman. These concepts included:

- incorporating floodplain dedications and/or "Stream Planning Corridors" in new developments,
- utilizing structural (e.g., sediment trapping basins, wet ponds, porous pavement, grass swales) and non-structural (e.g., stream buffers or floodplain dedications, fertilizer application controls, development density limitations, street sweeping) water quality controls in new developments, including low impact development,
- providing enhanced maintenance of creeks and storm water detention facilities in existing and new developments,
- ensuring that existing and any new policies are followed in obtaining drainage easements and rights-of-way in new developments,
- acquiring drainage easements and rights-of-way, as needed, in existing developments, and
- providing dam safety throughout the City.

The City Council and SWMP Task Force assisted the consultant team and City staff in the consideration and discussion of these storm water-related elements.

7.1 STREAM PLANNING CORRIDORS

One particular element considered to help meet the City's SWMP goals involved the dedication of floodplain areas and/or stream corridors in new developments. Numerous municipalities (e.g., City of Austin, Texas; City of Stow, Ohio; Burke County, North Carolina; and Cobb County, Georgia) throughout the country presently utilize this environmentally sensitive approach to:

- protect water quality by removing sediments, nutrients, and other contaminants from runoff,
- infiltrate runoff and store floodwaters, thereby providing for public safety and reducing property damage,
- reduce channel bottom degradation and stream bank erosion,
- maintain habitat for fish and other aquatic organisms,
- provide terrestrial habitat,
- improve aesthetics, possibly improving property values,
- maintain base flow in streams, and
- offer opportunities for greenway development.

The appropriateness of dedicating floodplain areas or "Stream Planning Corridors" received considerable discussion during development of the SWMP. A great many discussions were held with the City Council in work session, the SWMP Task Force, City staff, and other stakeholders (including City Council presentations) in an effort to obtain input as well as reach a consensus about using such a method to meet some of the City's water quality, environmental, flood control, and recreational goals. A very wide range of opinions was received with some stakeholders enthusiastically favoring the corridors and others totally against them.

Stream Planning Corridors and Greenways

It is proposed that Stream Planning Corridors (SPCs) be defined as the area of land along both sides of a stream or natural drainage corridor that encompasses the area projected to be inundated by the 1% chance flood event (i.e., the 100-year floodplain) in any given year assuming full buildout watershed conditions plus possibly including an

additional buffer width or strip. This additional buffer strip, if added, would aid in further filtering runoff as well as expanding opportunities for incorporating greenbelts/recreational trails within land areas being developed. SPCs without any added buffer strip have been developed for those areas with 40 or more acres of drainage area for Level 3 and 4 streams as shown in Exhibit 4-4. Projected ultimate buildout development conditions consistent with the Norman 2025 Plan, as well as future projected growth for areas that drain into Norman, were used to develop the peak flow rates used to delineate the 1% or 100-year floodplains and SPCs. FEMA floodplains were considered but not used since they were not available when the analysis was performed, were not developed assuming ultimate development conditions, and in many locations were not based on the recent 2007 LIDAR-based topography at the time of the analysis. The SPCs reflect full buildout development flow rates in order to respect conditions expected in the future rather than the present or past.

The use of floodplains or SPC dedications in the headwaters areas of watersheds (up to the 40-acre drainage area size) is important as SPCs have the greatest potential to provide water quality protection in these areas. In these headwater areas, the flows are relatively small and dispersed (shallow flow) in any one location and therefore offer the best opportunity to filter runoff and infiltrate it into the ground surface. SPCs or buffer strips adjacent to larger streams with large drainage areas also help filter runoff and provide many other environmental functions and recreational opportunities but once the runoff is into these larger stream reaches, the chance for filtration through vegetation, absorption, and infiltration decreases as a factor due to the larger flows and resulting velocities in downstream reaches. These processes relate to streams left in their natural state as such benefits are significantly reduced in most rectified channels, especially in concrete-lined or piped systems.

Establishing SPCs provide a means of approximating the floodplain areas along unstudied streams for possible dedication and/or other storm water planning purposes. The floodplains for Level 1 and 2 streams can, and should, be used in the same manner when considering floodplain dedications. The main difference is that the Level 1 and 2 floodplains were developed with more comprehensive and detailed methods. Revisions to these Level 1 and 2 stream floodplains for future land development conditions could be allowed if a delineation problem was discovered during the land development process. In Level 3 and 4 streams, revisions to the SPCs should be allowed if superior floodplain information is presented but the SPCs as provided in the SWMP should provide a reasonable approximation of the floodplain for the 1% flood in most locations. It is anticipated and expected that refined floodplain delineations will be developed by engineers as parcels are developed and compliance with subdivision regulations is achieved. Land developers can, at a minimum, use these SPCs as a planning tool when laying out their respective developments and City staff can use them in their review of development plans and other planning activities.

7.1.1 Key Questions, Options, and Recommended Actions

Question 1: Does the City want future land developments to dedicate the ultimate development condition 1% chance (100-year) floodplain extending well upstream of a 1-square-mile area as an SPC to provide water quality protection, capitalize on greenbelt and open space expansion opportunities, protect stream corridor environments, and generally increase the “quality of life” in Norman?

Discussion: In general, requiring the dedications would be a positive step toward meeting the City’s goals for the SWMP. Floodplain dedications can provide for significant water quality protection, more stream base flow, improved neighborhood recreational opportunities, as well as a more sound and viable environment for wildlife and native vegetation. This will be a change from the way developments are presently planned in Norman so some will not want to make any significant change in the status quo. Some developers may feel that such a program is unfair and not needed. They may also believe that they can develop solutions that would be equivalent to the natural system in terms of flood control, water quality, and recreation. Some may embrace such dedications as long as exceptions or variances could be considered. To the degree that variances are allowed, the City must develop criteria to judge the adequacy of alternative approaches in lieu of the SPC dedications. One approach to consider would be to allow alternative approaches, including low-impact development techniques, but require studies to show that at least flood control and water quality are equivalent to that obtained through using the floodplain dedications. Alternative approaches should include requirements for developers to provide the City with documentation that the U.S. Army Corps of Engineers (USACE) was notified and a Section 404 permit was obtained when natural waterways are altered as part of the development.

Requiring these dedications could also potentially add a significant amount of additional area that the City might have to maintain to some degree, regardless of whether such dedications were in some sort of drainage, utility, or conservation easement. While these areas would require funding to maintain, if they were left natural, maintenance could be minimized.

The City must ultimately decide to require these dedications in a uniform manner throughout the City or apply them differently for areas draining directly to the Canadian River versus areas that drain into Lake Thunderbird. The City could also chose to vary the application of the dedications depending on whether the development was located in the current urban service area, the future urban service area, suburban residential area, and country residential area according to the Norman 2025 Plan.

Options:

1) Require such dedications up to the 40-acre drainage area limit for all new developments.

2) Require such dedications but only up to some other drainage area cut-off limit such as 80 acres, 160 acres, etc.

3) Select 1 or 2 above but apply the dedications differently depending on the development location within the City such as whether or not the area drains to Lake Thunderbird or directly to the Canadian River. Another process that could be used would be to vary the requirements or ability to obtain a variance based on whether a stream being considered has mapped flood prone soils by the Natural Resources Conservation Service. If such soils exist, the stream would be viewed as having an increased need for floodplain/SPC dedications.

4) Make no changes to the present land development regulations, requirements, and processes.

Recommended Actions: In order to meet the goals of protecting the water quality of Lake Thunderbird and its contributing waterways, Option 3 is recommended, which requires that floodplain and/or Stream Planning Corridor dedications extend into the headwater (upstream areas) of Lake Thunderbird watersheds. Option 4 is certainly not recommended given the worsening water quality conditions in Lake Thunderbird. For purposes of this Option 3 recommendation, the City should extend such dedications requirements to the 40-acre drainage area limit for all watershed areas that drain to Lake Thunderbird. Such dedications are not recommended for other portions of the city outside of the Lake Thunderbird watershed since, with the exception of the Ten Mile Flat Creek watershed, these watersheds have relatively small amounts of undeveloped area. Extending the requirement to the 40-acre drainage area size maximizes the water quality benefits afforded by the overland flow, increased infiltration, and vegetative filtering of runoff in these headwater areas. A review of Exhibit 4-4 provides visual observation of the relative areal coverage of the SPC areas versus those areas outside of the SPCs in these headwater areas. It is recognized that further discussions will be held on this subject and the City may eventually decide to select a larger (greater than 40 acres) drainage area limit.

In making this recommendation, it is realized that certain legal and political considerations may require discussion and resolution in the future. The resolution of any legal and political considerations will need to be made in conjunction with the public safety and environmental concerns that are facing the City presently and in the future. The SPC recommendation made here focuses on the actions needed to provide water quality, flood, and environmental corridor protection as well as increasing recreational opportunities. Lake Thunderbird's water quality constitutes the overriding concern since there is considerable evidence that the lake is already degraded (as discussed in Section 5) even though many areas and streams in the lake's watershed are presently in a natural or undeveloped condition. When development occurs in these areas and along the many local streams, it will be very hard to "hold the line" on water quality conditions and prevent further degradation of water quality in the lake as well as in the Canadian River. The challenge to protect water quality in all of the City's steams and especially those contributing to the lake is enormous and will not be met unless significant controls are put in place to counter the impacts of future urbanization.

In an effort to better understand what other local governments throughout the country have done in similar situations, numerous floodplain and/or riparian buffer ordinances across the country were reviewed. While these ordinances have similarities and differences, they provided supportive approaches and information. In Austin, Texas there are requirements to provide "Critical Water Quality Zones" that extend out to the full buildout 100-year floodplain along streams with drainage areas greater than 64 acres in water supply watersheds. These water supply watersheds are similar to those that contribute to Lake Thunderbird in Norman, such as the Little River, Rock Creek, and Dave Blue Creek watersheds. There is also a further requirement in Austin to provide a "Water Quality Transition Zone" that extends from 100 to 300 ft beyond the Critical Water Quality Zone depending on the size of a stream's drainage area at any particular point. Development is all but eliminated in the Critical Water Quality Zone and severely limited in the Water Quality Transition Zone (City of Austin Code, 2009). In Stow, Ohio riparian setbacks from the banks of streams are 50 ft for areas as small as 32 acres and 30 ft for streams smaller than 32 acres (Chagrin River Watershed Partners, Inc., 2006). Douglas County, Georgia requires stream buffers in their water supply basins that extend 100 ft from the stream bank plus an additional 250-foot setback on "small tributaries" in which housing density is limited to one house per acre (Wenger and Fowler, 2000). Lastly, Platte County, Missouri (1992) (part of the Kansas City Metropolitan Area) designates "stream corridor buffer zones" of various total widths depending on drainage area sizes, including 100 ft for areas between 25 and 40 acres; 150 ft for areas between 40 and 160 acres; 250 ft for areas between 160 and 5,000 acres; and 300 ft for areas greater than 5,000 acres.

For those watershed areas that do not drain to Lake Thunderbird but drain more directly to the Canadian River, the recommendation is for the City to forego these dedications altogether instead of extending floodplain/SPC dedications to a larger drainage area limit such as 80 acres. A cursory review of developable land in areas that drain directly to the Canadian River reveals that these dedications would not impact a significant amount of area or stream length and would provide limited water quality benefit due to the existing disturbed nature of the area overall and stream corridors. However, as recommended later in this section, water quality structural and nonstructural water quality controls should be used in this area for future development activities. In terms of flooding in this more urban portion of the city, existing and herein proposed drainage/storm water regulations should provide adequate protection. It is further felt that variance requests could be difficult to judge in these areas creating administrative problems. The Ten Mile Flat Watershed may be an exception to the above discussions since it does have a significant amount of undeveloped area, but existing housing density regulations and other drainage/storm water regulations should provide ample protection for this area.

It is also recommended that the City consider allowing justifiable variances to this requirement that would allow alternative approaches that could be shown to achieve similar water quality, flood control, and recreational opportunity. In situations where a clearly defined riparian corridor of environmental significance and/or flood prone soils exist, it should be relatively more difficult to obtain such a variance. However, obtaining such variances should be less difficult in situations where a riparian corridor does not exist and the subject waterway flows through an area that has experienced significant past disturbance or change from natural conditions (such as past agricultural activities and/or activities associated with residential, commercial, transportation, or industrial uses).

Question 2: Does the City want to add an extra buffer width or strip to the 1% chance floodplain? If yes, how much extra width?

Discussion: Adding an extra buffer width basically has the same type of considerations that were presented above for the first issue. The benefit primarily relates to adding a "safety factor" to help protect the stability, water quality, and environmental integrity of the City's streams. Adding an extra buffer strip would also provide more opportunity for greenbelts and trails although most trails could be included within an SPC. From a water quality standpoint, adding buffer width is important in areas where water quality degradation is occurring or is expected to occur such as is happening to Lake Thunderbird. Adding buffer width might make more sense in the City areas that are to subject to relatively less dense urban development such as the suburban residential areas and the country residential areas, especially those areas draining into Lake Thunderbird. In the current urban service area and the future urban service area, the Norman 2025 Plan discusses the need to provide for more dense development. In these more densely developing areas, it may be impractical and inconsistent to add buffer width.

Options:

1) Add an extra buffer width of 15 ft or some other amount to increase water quality protection.
2) Vary the buffer width with drainage area size, such as:
   a. 40 acres – 640 acres: none
   b. 640 acres – 5 square miles: 20 ft on each side of the creek
   c. >5 square miles: 30 ft on each side of the creek
3) Vary the width based on the development location within the City (see discussion above).
4) Do not add any buffer width.

Recommended Actions: It is recommended that additional buffers of 15 ft be added to each side of all waterways with 40 acres or greater drainage area in addition to, or beyond, all Stream Planning Corridors and/or ultimate buildout 100-year (1%) floodplains areas in those areas that are included in the Norman 2025 Plan as Suburban Residential Areas and Country Residential Areas. No additional buffer is recommended in other City areas. Variance provisions should be considered and allowed if similar water quality protection can be conclusively demonstrated, including provisions for future operations and maintenance.

When the City moves forward with changes to their ordinances and regulations related to floodplain/Stream Planning Corridor dedications and structural/nonstructural water quality controls (discussed subsequently below), the following ordinance considerations have been developed to initiate thoughts about the regulatory changes that might apply.

7.2 STRUCTURAL AND NONSTRUCTURAL STORM WATER QUALITY CONTROLS

As discussed in Section 6.2, programmatic water quality solutions are presently being implemented in Norman's "urbanized areas" as part of the City's compliance with ODEQ's Oklahoma Pollutant Discharge Elimination System (OPDES) "MS4" program. Additional future water quality compliance will also be required as part of the previously mentioned TMDL requirements for Bishop Creek and ODEQ's future watershed management plan development for Lake Thunderbird. As a supplement to the MS4 program, the upcoming ODEQ watershed management plan, and/or the Bishop Creek TMDL as well as to meet certain SWMP water quality goals, the City will need to require new developments to incorporate certain structural and/or nonstructural water quality controls. Structural and non-structural storm water quality controls have the ability to help protect the water quality in Norman's streams and Lake Thunderbird. Typical structural controls include extended detention (sediment trapping) basins, wet ponds or retention basins, filtration basins, porous pavement, and grassed swales. Nonstructural controls include stream buffers, floodplain dedications, fertilizer application controls, street sweeping, and development density limitations. These types of structural and nonstructural controls (BMPs, or best management practices) are an integral part of the City's MS4 program. Discussions on this topic during the SWMP development have been much less involved compared to other issues such as stream planning corridor dedications and drainage easement/ROW needs.

Combination water quality and flood control facility

7.2.1 Key Questions, Options, and Recommended Actions

Question: Should the City of Norman adopt structural and nonstructural storm water quality controls in its development standards and require new developments to provide these controls?

Discussion: First, a discussion of local conditions and ongoing programs underway or in various development stages is provided. This discussion is then followed by an overview of structural and nonstructural water quality controls, or BMPs, that could be used in Norman. In many instances the City will lead the efforts to provide nonstructural controls while developers will provide the structural controls as part of their development drainage infrastructure.

Storm water runoff quality is affected by human activities, land use changes, and the alteration of natural drainage patterns. These urban conditions and activities add pollutants to rivers, lakes, and streams. Urban runoff has been shown to be a significant source of water pollution in locations throughout the country, causing declines in water quality and impairment of waterbodies as is the case for Lake Thunderbird. Examination of national storm water quality data and local studies reveals that nutrients and total suspended solids (as well as other water quality parameters), runoff volumes, and flow rates increase with urbanization and impervious surfaces, thusly impacting Lake Thunderbird inflows and discharges to local streams and the Canadian River.

Though a limited dataset, a local study entitled "Rock Creek Watershed Analysis and Water Quality Evaluation" (COMCD, 2006), in the Rock Creek tributary to Lake Thunderbird showed that total phosphorus, total nitrogen and total suspended solids concentrations were several times higher than National Storm Water Quality Database values. This modeling and analysis study for the Central Oklahoma Water Conservancy District (COMCD, 2006) focused on estimating the impact of urban storm water on nutrient and sediment loading into Lake Thunderbird, the water supply

reservoir for the cities of Norman, Midwest City, and Del City. For the majority of events, the most highly developed areas in Rock Creek had the highest modeled constituent concentration of suspended solids, nitrogen and phosphorus. As urban development results in conversion of land use from open areas to residential or commercial classifications, the impervious area and urban activities will increase and result in higher nutrient and total suspended solids concentrations of nutrients and annual loading in storm water to the lake. Increased nutrient loading has the potential to increase algal growth in the lake which, in turn, can cause significant taste and odor problems in the lake's finished drinking water as well as cause the waterbody to be in non-compliance with the set water quality goal for chlorophyll *a* (an indication of lake eutrophication).

In a subsequent study for the Oklahoma Conservation Commission (OCC) entitled "Lake Thunderbird Watershed Analysis and Water Quality Evaluation" (OCC, 2007), an evaluation of structural and nonstructural storm water controls were evaluated in terms of their ability to reduce nutrient and sediment loadings to the lake. Nonstructural controls included voluntary and statutory urban nutrient management while structural controls included grassed swales, constructed wetlands, extended detention – enhanced, retention basins, and bio-retention filters. Modeling indicated that use of all of these controls throughout the lake's watershed reduced total phosphorus loadings to the lake by more than 80% for full buildout development conditions. Although it may be impractical to assume that all of these controls would be implemented as part of any plan, it does show that it is possible to reduce loadings substantially.

ODEQ is concerned that urban development, without appropriate mitigation of its environmental impact, will exacerbate the water quality problems currently experienced by the lake. The watershed management plan being established by ODEQ will identify implementation of management practices in the Lake Thunderbird watershed to help achieve beneficial uses of water in the lake. This watershed management plan could require that the City of Norman develop a program and/or modifications to its land development policies and ordinances to reduce pollutant loadings commonly associated with urban development. Other cities, agencies, and entities that make land use changes within the lake's basin area will also have to follow requirements of the watershed management plan. Norman should increase its efforts to work cooperatively with the cities of Moore and Oklahoma City to improve water quality and protect Lake Thunderbird.

Under the TMDL process for the Canadian River, ODEQ has also identified Norman and the University of Oklahoma as contributors to non-attainment for fecal coliform in Bishop Creek, a local tributary to the Canadian River. Bishop Creek failed to support the designated water use due to fecal coliform concentrations, and thus actions must be taken to meet the water quality standard. Where the TMDL has been developed, additional sampling becomes part of the implementation requirements for regulated MS4 discharges such as those from the City of Norman. Significant monitoring and reporting of water quality and implementation of BMPs are expected to result.

Structural and Nonstructural Storm Water Quality Controls. Both structural and nonstructural solutions have been implemented in areas across the United States, ranging from site-specific engineering solutions to watershed solutions. **Structural controls** constitute engineering solutions designed to reduce pollution in surface water runoff primarily through three basic mechanisms: infiltration, filtration, and detention (EPA, 1993). In effect, these systems attempt to counteract the opposite tendencies of decreased infiltration, filtration, and detention which urbanization imposes upon the land. This section discusses the advantages and disadvantages of the major options available, detailing both design and general cost constraints.

The many BMP options offer varying capabilities in terms of type and extent of pollutant removal, size of upland basin appropriate to the structure and general comparisons. These BMPs have been developed for use across the United States and are generally suitable for the Norman area. This section presents comparative information for several structural BMP options. Tables 7-1 through 7-3 provide a considerable amount of information on (1) pollutant removal efficiencies, (2) siting restrictions, and (3) general cost information, where available.

Nonstructural controls include a wide variety of pollution prevention measures. Whereas structural BMPs require the design, installation and maintenance of actual control facilities/infrastructure, nonstructural BMPs rely on the proper management of existing resources and adherence to common-sense materials management practices to maintain water quality. As such, nonstructural controls are generally less expensive to implement and maintain than structural controls. By anticipating potential problems and by acting to limit contaminants at the source, a substantial savings can be realized compared with a program which solely reacts to pollution once it has occurred. The latter approach involves relatively costly containment, mitigation, cleanup and treatment methods while the former involves techniques such as public education, pollutant source reduction, improved development site design, and protection of environmentally critical areas. Ultimately both strategies are necessary as some entry of pollutants into waterways must be anticipated. However, inexpensive preventative methods can enable end-of-the-pipe structural solutions to be both less expensive and more effective.

Buffer Zones/Protection of Existing Vegetation. Vegetation inherently addresses the hydrologic goals of many structural BMPs with minimal cost and maintenance: tree canopies intercept and diminish the erosive force of rainfall; ground cover by plants and organic matter slows runoff velocities, increases infiltration rates, and inhibits contaminants from entering waterways; and root growth holds and protects the soil from channel and gully erosion. Wetlands serve many of the same functions, effectively acting as natural pollution control systems as well as critical habitat areas. When considered on the large scale of the Lake Thunderbird watershed, proper maintenance of existing vegetative resources becomes an imperative from both cost-effective and pollutant removal standpoints. Through advanced planning, important woodland and wetland areas can be identified and protected. Such strategies have been used nationwide as a highly practical and achievable pollution control measure; significant habitat protection benefits can also be achieved. Table 7-4 presents very general information on the relative costs and benefits of forest and wetland protection.

Buffer zones are nonstructural BMPs that maintain existing or establish new vegetation in critical areas to, among other things, assist in controlling storm water pollution. They are widely accepted as a means of protecting streambanks, wetlands, and other environmentally important areas. Table 7-4 shows the relative costs and benefits of stream, wetland, and expanded buffers. These zones are often employed in areas which are already unsuitable for development, such as within floodplains or federally protected wetlands. These steeper gradients are more susceptible to erosion, especially with increases in impervious cover in nearby areas following development. Buffer zones in

Table 7-1
Structural BMPs: Description, Advantages, and Disadvantages

Management Practice	Advantages	Disadvantages
Extended Detention (ED) Dry Pond Designed to trap a specific percentage of total runoff from upstream drainage basin. Upper chamber traps sediment for easy disposal; lower chamber detains the water for controlled, extended detention. Increased holding time allows suspended particulates and other associated pollutants to drop out prior to release. Performance depends upon the size of the structure (e.g. the percentage of the "first flush" contained) and the length of detention time. Particulate pollutants (e.g. sediments) more effectively removed than soluble forms (e.g. nutrients) (see Table 7-2). Detention design of 24 hours minimum "to achieve maximum removal of most pollutants" (Schueler, 1987). Rates vary with site-specific conditions (e.g. soil types). Fine-grained clays/silts require longer detention times than heavier, coarser sand particles.	• Can provide peak flow control, reducing runoff flows, erosion and flooding downstream • Possible to provide good particulate removal • Can serve large development or area • Requires less capital cost and land area when compared to wet pond • Does not generally release warm or anoxic water downstream • Provides excellent protection for downstream channel erosion • Can create valuable wetland and meadow habitat when properly landscaped • Lowest cost alternative in size range	• Removal rates for soluble pollutants are quite low • Generally not economical for drainage area less than 10 acres • If not adequately maintained, can be an eyesore, breed mosquitoes, and create undesirable odors
Extended Detention (ED) Wet Pond Same as ED dry pond except designed to maintain a permanent pool. Pool vegetation enhances nutrient uptake.	• Can provide peak flow control, reducing runoff floors, erosion and flooding downstream • Can serve large developments or area; most cost-effective for larger, more intensively developed sites • Enhances aesthetics and provides recreational benefits • Permanent pool in wet ponds helps to prevent scour and resuspension of sediments • Provides better nutrient removal when compared to wet pond • Significant soluble nutrient capability added with marginal additional cost over dry ED pond • Can create valuable wetland and meadow habitat when properly landscaped	• Generally not economical for drainage area less than 10 acres • Potential safety hazards if not properly maintained • If not adequately maintained, can be an eyesore, breed mosquitoes, and create undesirable odors • Requires considerable space, which limits use in densely urbanized areas with expensive land and property values • Not suitable for hydrologic soil groups "A" and "B" (SCS classification) • ·With possible oxygen depletion, may severely impact downstream aquatic life
Wet Pond Pond design features pollutant removal through sedimentation (via holding times) and biological uptake (via established plants). Similar to ED ponds, while wetland plant growth captures soluble nutrients, etc. Often have two chambers like ED ponds; upper bay traps sediments for easy maintenance, limiting their entry into pool. Use of native wetland plant species enhances BMP performance, reduces maintenance.	• Can provide peak flow control, reducing runoff flows, erosion and flooding downstream • Can serve large developments; most cost-effective for larger, more intensively developed sites • Enhances aesthetics with proper design • Little groundwater discharge • Permanent pool in wet ponds helps to prevent scour and resuspension of sediments • Provides moderate to high removal of both particulate and soluble urban stormwater pollutants • Can create valuable aquatic habitat when properly maintained	• Generally not economical for drainage area less than 10 acres • Potential safety hazards if not properly maintained • If not adequately maintained, can be an eyesore, breed mosquitoes, and create undesirable odors • Requires considerable space, which limits use in densely urbanized areas with expensive land and property values • Not suitable for hydrologic soil groups "A" and "B" (SCS classification) • With possible oxygen depletion, may severely impact downstream aquatic life
Constructed Stormwater Wetland Constructed to simulate their natural wetland counterparts. Offer a high degree of nutrient uptake and sediment removal, and provide habitat and aesthetic benefits. Often designed with an upper chamber to trap sediments. Careful designs must judge adequate flow rates, microtopography, species diversity, and sediment volume; material excavation must be anticipated for long-term maintenance.	• Can serve large developments or areas; most cost-effective for larger, more intensively developed sites • Provides peak flow control, reducing runoff flows, erosion and flooding downstream • Enhances aesthetics and provides recreational benefits • The marsh fringe also protects shoreline from erosion • Permanent pool in wet ponds helps to prevent scour and resuspension of sediments • Has high pollutant removal capability • Can create valuable aquatic habitat when properly maintained	• Generally not economical for drainage area less than 10 acres • Potential safety hazards if not properly maintained • If not adequately maintained can be an eyesore, breed mosquitoes, and create undesirable odors • Requires considerable space, which limits use in densely urbanized areas with expensive land and property values • With possible oxygen depletion, may severely impact downstream aquatic life • May contribute to nutrient loadings during die-down periods of vegetation
Filtration Basin First flush of rainfall diverted into a sand-filled impoundment. Sediments and associated pollutants strained by sand; water returned via perforated, subsurface pipes to receiving waters. Removal can be enhanced with an additional layer of peat, limestone, and/or topsoil. Soluble pollutants not reliably removed.	• Ability to accommodate medium-size development (3–80 acres) • Flexibility to provide or not provide groundwater recharge • Can provide peak volume control	• Requires pretreatment of storm water through sedimentation to prevent filter media from prematurely clogging • Minimal nutrient removal

Table 7-1, cont'd

Management Practice	Advantages	Disadvantages
Infiltration Basin Impoundments detain runoff, allowing it to recharge over a design period. Improved designs remove coarse sediments before they enter and clog the infiltration capacity of the basin. Full and partial exfiltration options available, depending upon the percentageof runoff desired to treat. Water quality versions treat only the first flush (Schueler, 1987).	• Provides groundwater recharge • Can serve large developments • High removal capability for particulate pollutants and moderate removal for soluble pollutants • When basin works, it can replicate predevelopment hydrology more closely than other BMP options • Basins provide more habitat value than other infiltration systems • Construction cost moderate	• Possible risk of contaminating ground water • Only feasible where soil is permeable and there is sufficient depth to rock and water table • Fairly high failure rate • If not adequately maintained, can be an eyesore, breed mosquitoes, and create undesirable odors • Regular maintenance activities cannot prevent rapid clogging of infiltration basins • Rehabilitation costs potentially high
Infiltration Trench Trench filled with rock to form easily recharged underground reservoirs for runoff. Improved designs incorporate mechanisms to remove sediment and oil before entry into trench. Generally serves drainage areas of less than 10 acres where ponds cannot be used. Full/partial exfiltration and water quality designs possible (Schueler, 1987).	• Provides groundwater recharge • Can serve small drainage areas • Can fit into medians, perimeters, and other unused areas of a development site • Helps replicate predevelopment hydrology, increases dry weather baseflow, and reduces bankful flooding frequency • Cost-effective for smaller sites	• Possible risk of contaminating ground water • Only feasible where soil is permeable and there is sufficient depth to rock and water table • Since not as visible as other BMPs, less likely to be maintained by residents • Requires significant maintenance • Rehabilitation costs potentially considerable
Porous Pavement Porous asphalt design infiltrates runoff into underground rock-filled reservoir for recharge. Often ineffective due to cloggage by fine, clayey soils; recommended only select circumstances. Full/partial exfiltration and water quality designs possible (Schueler, 1987).	• Provides groundwater recharge • Provides water quality control without additional consumption of land • Can provide peak flow control • High removal rates for sediment, nutrients, organic matter, and trace metals • When operating properly can replicate predevelopment hydrology • Eliminates the need for stormwater drainage, conveyance, and treatment systems off-site • Cost-effective compared to conventional asphalt when working properly	• Requires regular maintenance • Possible risk of contaminating ground water • Only feasible where soil is permeable, there is sufficient depth to rock and water table, and there are gentle slopes • Not suitable for areas with high traffic volume • Need extensive feasibility tests, inspections, and very high level of construction workmanship • High failure rate due to clogging • Not suitable to serve large off-site pervious areas
Concrete Grid Pavement Honeycomb grid of concrete blocks filled with pervious materials (e.g. gravel, sand, grass). Proper design bears vehicular traffic while still allowing infiltration.	• Can provide peak flow control • Provides groundwater recharge • Provides water quality control without additional consumption of land	• Requires regular maintenance • Not suitable for area with high traffic volume • Possible risk of contaminating ground water • Only feasible where soil is permeable, there is sufficient depth to rock and water table, and there are gentle slopes
Grassed Swales Check dams may be installed along swale to increase infiltration (Schueler, 1987). May be substituted for more expensive curb and gutter systems for storm water pollution reduction in certain areas.	• Requires minimal land area • Can be used as part of the runoff conveyance system to provide pretreatment • Can provide sufficient runoff control to replace curb and gutter in single-family residential subdivisions and on highway medians • Economical; low cost compared to curb and gutter	• Low pollutant removal rates • Leaching from culverts and fertilized lawns may actually increase the presence of trace metals and nutrients • Low cost compared to curb and gutter

Source: Modified and expanded from EPA, 1993.

Table 7-2
Structural BMPs: Effectiveness in Water Quality Control

Management Practice	Removal Efficiency (%) TSS	TP	TN	COD	Pb	Zn	Factors
Extended Detention (ED) Dry Pond							
Average:	45	25	30	20	50	20	– Storage volume
Reported Range:	5–90	10–55	20–60	0–40	25–65	(-40)–65	– Detention time
Probable Range:[d]	70–90	10–60	20–60	30–40	20–60	40–60	– Pond shape
No. Values Considered:	6	6	4	5	4	5	
Extended Detention (ED) Wet Pond							
Average:	80	65	55	NA	40	20	– Pool volume
Reported Range:	50–100	50–80	55	NA	40	20	– Pond shape
Probable Range:	50–95	50–90	10–90	10–90	10–95	20–95	– Detention time
No. Values Considered:	3	3	1	0	1	1	
Wet Pond							
Average:	60	45	35	40	75	60	– Pool volume
Reported Range:	(-30)–91	10–85	5–85	5–90	10–95	10–95	– Pond shape
Probable Range:	50–90	20–90	10–90	10–90	10–95	20–95	
No. Values Considered:	18	18	9	7	13	13	
Constructed Stormwater Wetland							
Average:	65	25	20	50	65	35	– Storage volume
Reported Range:	(-20)–100	(-120)–100	(-15)–40	20–80	30–95	(-30)–80	– Detention time
Probable Range[e]:	50–90	(-5)–80	0–40	---	30–95	---	– Pool shape
No. Values Considered:	23	24	8	2	10	8	– Wetland's biota
							– Seasonal variation
Filtration Basin							
Average:	80	50	35	55	60	65	– Treatment volume
Reported Range:	60–95	0–90	20–40	45–70	30–90	50–80	– Filtration media
Probable Range:	60–90	0–80	20–40	40–70	40–80	40–80	
Number of References:	10	6	7	3	5	5	
Infiltration Basin							
Average:	75	65	60	65	65	65	– Soil percolation rates
Reported Range:	45–100	45–100	45–100	45–100	45–100	45–100	– Basin surface area
Probable Range:[a]							– Storage volume
SCS Soil Group A	60–100	60–100	60–100	60–100	60–100	60–100	
SCS Soil Group B	50–80	50–80	50–80	50–80	50–80	50–80	
No. Values Considered:	7	7	7	4	4	4	
Infiltration Trench							
Average:	75	60	55	65	65	65	– Soil percolation rates
Reported Range:	45–100	40–100	(-10)–100	45–100	45–100	45–100	– Trench surface area
Probable Range:[b]							– Storage volume
SCS Soil Group A	60–100	60–100	60–100	60–100	60–100	60–100	
SCS Soil Group B	50–90	50–90	50–90	50–90	50–90	50–90	
No. Values Considered:	9	9	9	4	4	4	
Porous Pavement							
Average:	90	65	85	80	100	100	– Percolation rates
Reported Range:	80–95	65	80–85	80	100	100	– Storage volume
Probable Range:	60–90	60–90	60–90	60–90	60–90	60–90	
No. Values Considered:	2	2	2	2	2	2	

Table 7-2, concluded

Management Practice	Removal Efficiency (%) TSS	TP	TN	COD	Pb	Zn	Factors
Concrete Grid Pavement							
Average:	90	90	90	90	90	90	– Percolation rates
Reported Range:	65–100	65–100	65–100	65–100	65–100	65–100	
Probable Range:	60–90	60–90	60–90	60–90	60–90	60–90	
No. Values Considered:	2	2	2	2	2	2	
Grassed Swales							
Average:	60	20	10	25	70	60	– Runoff volume
Reported Range:	0–100	0–100	0–40	25	3–100[f]	50–60[f]	– Slope
Probable Range:[c]	20–40	20–40	10–30	---	10–20	10–20	– Soil infiltration rates
No. Values Considered:	10	8	4	1	10	7	– Vegetative cover
							– Swale length
							– Swale geometry

Source: EPA, 1993. All figures are for BMPs from newly developed areas.
NA – Not available.
a Design criteria: storage volume equals 90% avg runoff volume, which completely drains in 72 hours; maximum depth = 8 ft; minimum depth = 2 ft.
b Design criteria: storage volume equals 90% avg runoff volume, which completely drains in 72 hours; maximum depth = 8 ft; minimum depth = 3 ft; storage volume = 40% excavated trench volume.
c Design criteria: low slope and adequate length.
d Design criteria: min. ED time 12 hours.
e Design criteria: minimum area of wetland equal 1% of drainage area.
f Also reported as 90% TSS removed.

Table 7-3
Structural BMPs: Regional, Site-Specific, and Maintenance Considerations

BMP Option	Size of Drainage Area	Site Requirements	Maintenance Burdens	Longevity
Extended Detention Ponds (Dry and Wet)	Moderate to large	Deep soils	Dry ponds have relatively high burdens	High
Wet Ponds	Moderate to large	Deep soils	Low	High
Constructed Storm Water Wetlands	Moderate to large	Poorly drained soils, space may be limiting	Annual harvesting of vegetation	High
Filtration Basins and Sand Filters	Widely applicable	Widely applicable	Moderate	Low to moderate
Infiltration Basins	Moderate to large	Deep permeable soils	High	Low
Infiltration Trenches	Moderate	Deep permeable soils	High	Low
Porous Pavement	Small	Deep permeable soils, low slopes, and restricted traffic	High	Low
Concrete Grid Pavement	Small	Deep permeable soils, low slopes, and restricted traffic	Moderate to high	High
Grassed Swales	Small	Low-density areas with <15% slope	Low	Low if poorly maintained, high if well maintained

Source: Modified from EPA (1993).

Table 7-4
Nonstructural BMPs: Comparison of Relative Costs and Benefits

	Nutrient Control	Sedimentation	Sediment Toxics	Stormwater Control	Maintenance Burdens	Longevity	Cost to Developers	Cost to Local Governments	Difficulty in Local Implementation	Site Data Required
Buffer Zones/Protection of Existing Vegetation										
Forest Protection	○	⊙	○	○	●	●	○	●	⊙	⊙
Wetland Protection	●	●	○	⊙	●	●	⊙	●	●	○
Stream Buffers	⊙	⊙	○	○	●	●	⊙	●	⊙	●
Wetland Buffers	⊙	⊙	○	○	●	●	○	●	●	●
Expanded Buffers	●	●	○	○	●	●	⊙	●	○	○
Floodplain Limits	⊙	○	○	⊙	●	●	⊙	●	⊙	⊙
Steep Soils Limits	○	●	○	⊙	●	●	⊙	●	●	●
Site Planning BMPs										
Septic Limits	⊙	○	○	□	●	●	○	⊙	○	⊙
Minimize Imperviousness	○	○	○	⊙						
Time/Area Disturbance	⊙	⊙	□		●	●	●	⊙	●	⊙
Public Education Programs										
Urban Housekeeping	○	⊙	⊙	□	⊙	○		●	●	●
Fertilizer Control	⊙	□	□	□	○	○		⊙	⊙	⊙
Septic Maintenance	⊙	□	□	□	○	⊙		⊙	⊙	○
Household Hazardous Waste	○	□	●	□	○	○		⊙	⊙	○
	● 0–40% High Level of Control ⊙ 30–40% Mod. Level of Control ○ 0–20% Low Level of Control □ Ineffective	● 60+ High ⊙ 30–60% Moderate ○ 0–30% Low □ Ineffective	● Highly Effective ⊙ Moderately Effective ○ Low Effectiveness □ Ineffective	● Highly Effective ⊙ Moderately Effective ○ Low Effectiveness □ Ineffective	● Low Burden ⊙ Moderate Burden ○ High Burden □ Not Applicable	● Long Lived ⊙ Long Lived w/Maintenance ○ Short Lived □ Not Applicable	● Low ⊙ Moderate ○ High □ Very High	● Low ⊙ Moderate ○ High □ Very High	● Easy ⊙ Moderate ○ Tough □ Very Tough	● Simple ⊙ Moderate ○ Complex □ None

Source: Derived from EPA, 1993.

these areas would provide additional protection. Table 7-4 also gives information on limiting the development of steep slopes. Buffer zones may be incorporated into a development plan as an aesthetic amenity and wildlife habitat area as well as a pollution prevention measure. Excellent examples of buffer zone use can be seen in the Woodlands community near Houston, Texas, where pollution control and aesthetic design have been integrally combined.

Site Planning BMPs. A number of water quality benefits may be relatively easily achieved through the use of careful site planning and design in new developments. Table 7-4 presents general considerations for the nonstructural BMPs discussed in this section. Septic limits refer to guidelines on the proper location of onsite disposal systems (OSDS), including septic systems. If improperly sited and/or installed, OSDS are potentially a large source of pollution. Therefore, many municipalities across the U.S. advise against the placement of such systems near streams and other hydrologically problematic areas. Minimization of imperviousness is also a common strategy to avoid many of the negative effects of increases in paved surfaces. Buildings and associated parking areas may be clustered such that open spaces (pervious areas) are maximized and impervious areas are held to a minimum. Reduction of "effective" (hydraulically connected) impervious cover and structural BMPs such as grassed swales, as well as porous and concrete grid pavement, can be logically included in designs minimizing the extent and relative effects of impermeable surfaces (see Table 7-1). These innovative designs build in relatively low maintenance, or no maintenance, water quality features, reducing the need for costly future BMP retrofitting to offset developmental impacts. Time/area disturbance BMPs are those which intelligently sequence the timing of construction "to limit the amount of disturbed area at any given time" and to discourage the disturbance of areas to be used as buffer zones post-development (EPA, 1993).

Public Education Programs. A wide variety of innovative and effective public education campaigns have been developed throughout the United States to combat storm water pollution. The EPA has compiled several very useful summaries of such programs (EPA, 1993). Table 7-4 presents four basic programs: Urban Housekeeping; Fertilizer Control; Septic Maintenance; and Household Hazardous Waste. Urban housekeeping BMPs seek to educate the public about ways to limit storm water pollution (e.g., litter and pet waste control) and avoid introduction of harmful substances into waterways. Fertilizer control seeks to educate the public about sensible fertilizer selection and application techniques, minimizing nutrient pollution from more soluble forms of fertilizers. Septic maintenance includes a wide array of strategies on proper septic system upkeep ranging from education of homeowners about operation and maintenance procedures to systematically informing OSDS installers and waste haulers with up-to-date information.

Household hazardous waste programs seek to inform the public about the means of properly disposing of common household toxic substances commonly contributing to storm water pollution (e.g., waste motor oil, pesticides, paint thinner, etc.) and the availability and selection of non-toxic alternatives. Additional considerations/topics for storm water public education campaigns include the use of water tolerant, disease-resistant native plant species (e.g., xeriscape strategies, which minimize fertilizer and pesticide use), innovative turf management (e.g., proper use of treated wastewater for golf course irrigation), and education about the connection between storm water pollution and public infrastructure (e.g., keeping waste materials out of the storm sewer system; some cities have stenciled reminders of the destination of the sewer, such as "Rock Creek") (EPA, 1993).

Options:

1) Continue meetings between the City Council, SWMP Task Force, City staff, and other stakeholders and move forward with discussions to decide whether the City should investigate new structural and/or nonstructural storm water controls (BMPs) in new developments to improve existing water quality conditions and help prevent further degradation. The discussions should also include whether the requirement for such controls be different for areas draining into Lake Thunderbird versus those that drain directly to the Canadian River. Use of these controls would serve to comply with the City's OPDES permit with ODEQ for minimum control measure number five (discussed above) entitled "Post-Construction Management in New Development and Redevelopment."

2) Generally, implement structural storm water quality controls in the same manner and locations as storm water detention and consistent with the ordinance considerations provide below this section. Implement non-structural controls associated with the MS4 (minimum control measures), require SPCs and floodplain dedications, educate the public on limiting fertilizer application, develop a program to educate the public on fertilizer overuse, ensure proper septic system operation and maintenance, and maintain present development density limits in the Lake Thunderbird watershed.

3) Forego any changes to development regulations related to storm water structural and nonstructural controls and wait for any new requirements under ODEQ's Lake Thunderbird's watershed management plan and/or the OPDES MS4 program.

Recommendation Actions: Option 2 – It is recommended that structural storm water controls be, in general, required in the same manner and locations as required for storm water detention throughout the city. Further elaboration of how storm water quality controls could work is provided below in proposed ordinance enhancements. These structural controls can be built in conjunction with storm water detention facilities in most instances. In most, but not all, cases and due to maintenance costs, public safety, and nuisance (insects, etc.) considerations, the City should encourage the use of dry detention and water quality facilities rather than wet detention/water quality facilities. For nonstructural controls that should be concurrently implemented with structural controls, the City should continue to ensure that the minimum control measures, as part of the OPDES MS4 program, be met. Additionally, the City should require floodplain/SPC dedications, implement a program to educate the public on fertilizer use, develop a program to control the overuse of fertilizers, and ensure proper septic system installation and operation, as well as continue to limit development density (and impervious cover) in the Lake Thunderbird watershed.

Proposed Considerations, including Variances, for Incorporating Stream Planning Corridors (SPCs) and Structural as well as Nonstructural Water Quality Controls into Norman's Land Development Ordinances

The following generally outlines how SPCs and structural/nonstructural storm water controls could be incorporated into Norman's ordinances and subdivision regulations. These recommended ordinance additions are presented to illustrate how the dedications of SPCs and utilization of water quality controls can work in tandem to protect Norman's stream and lake water quality while allowing some flexibility in compliance for the City and developers. These ordinance items would be in addition to other existing or proposed ordinance requirements. Further, it

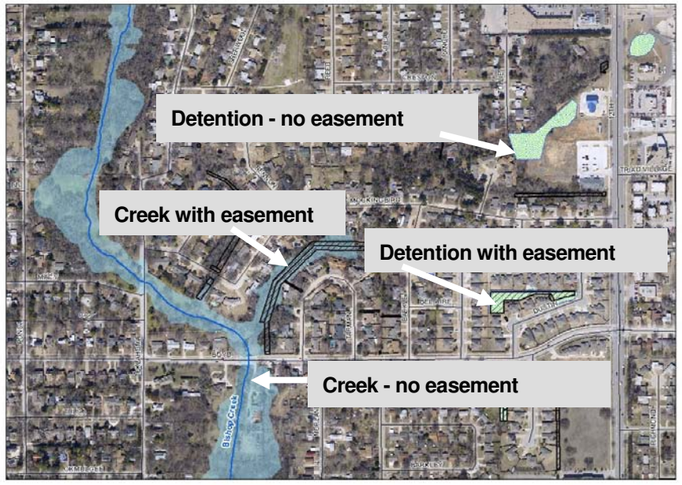
addresses the possible uses of variances for special or atypical circumstances including the compensatory requirements for those that obtain variances.

- Unless stipulated otherwise herein, these considerations would apply to all developments including, but not limited to, single-family residential, multi-family residential, commercial, industrial, and possible institutional developments.
- Dedicate SPCs and/or the 100-year full buildout floodplains to the City of Norman by easement or title for streams located in the Lake Thunderbird watershed that have a drainage area greater than 40 acres.
  - Prohibit development or significant land disturbance in the SPCs and/or 100-year full buildout floodplain. Exemptions should include items such as, but not limited to, maintenance activities, greenway trails, road crossings, utilities, and stream stabilization measures.
  - Additional stream-side buffers of 15 ft to be added to each side of waterways for streams with greater than 40 acres that are located in the Lake Thunderbird watershed and also in Suburban Residential and Country Residential areas as defined in the Norman 2025 Plan.
  - If development per lot storm water fees are ultimately required to help pay for storm water management costs in the City, these fees will not be charged to developments that dedicate SPCs and/or full buildout 100-year floodplains to the City by easement or title for streams that drain more than 40 acres and are located in the Lake Thunderbird watershed.
- Require that water quality facilities be constructed to capture and treat runoff from all proposed developments in the City of Norman that exceed one acre (or some other size selected by the City) in size. The runoff "capture and treatment volume" should be set to 0.5 inch of runoff from the development area unless specified otherwise for a special condition.
  - The City should consider allowing very small developments, say less than one acre or some other limit, to pay into a regional detention/water quality program in lieu of building very small water quality structures. The City's present regional detention program should be broadened to include this water quality fee in lieu process.
  - The City should allow and encourage low impact development techniques such as rain gardens and biofilters to provide a portion or all of their storm water quality control requirements subject to the developer providing sufficient technical justification for the techniques.
  - For developments that do not dedicate the SPC or full buildout 100-year floodplain by virtue of obtaining a variance, the runoff capture and treatment volume for their development area should be increased to 0.7 inch of runoff.
- Require storm water detention facilities to control post-development peak discharges to pre-development peak discharges for the 2-, 5-, 10-, 25-, 50-, and 100-year events assuming full buildout watershed development.
  - Inlet and outlet structures to provide erosion protection and will be constructed of materials that offer sustainability of the structures.
  - Entity with dedicated funding source made responsible for general maintenance (mowing, trash cleanup, etc.).
  - City to assume responsibility of dams and other structures.
- Allow limited variances for special conditions/situations that would utilize alternative approaches that could be shown to achieve similar water quality, flood control, and recreational opportunity. In situations where there is a clearly defined riparian corridor of environmental significance and/or flood prone soils, it should be relatively more difficult to obtain such a variance. However, obtaining such variances should be less difficult in situations where a riparian corridor does not exist and the subject waterway flows through an area that has experienced significant past disturbance or change from natural conditions (such as past agricultural activities and/or activities associated with residential, commercial, transportation, or industrial uses).
- Implement nonstructural storm water quality controls in addition to SPCs, including a program to educate the public on fertilizer use, a program to control the overuse of fertilizers, a procedure to ensure proper septic system installation and operation, and a continuation of development density (and impervious cover) limitations in the Lake Thunderbird watershed.
- Require the following compliance measures if development or significant land disturbance occurs within the stream banks of a stream in the City:
  - USACE's 404 permitting documentation and proof of permit to be submitted to the City prior to plat approval,
  - Riparian stream corridor mitigation will be required (tree replacement, re-vegetation, stream stabilization using bio-engineering techniques, etc.), and
  - Inlet and outlet structures will be provided as needed to incorporate erosion protection.

7.3 ACQUISITION OF DRAINAGE EASEMENTS AND RIGHTS-OF-WAY

Like many other municipalities, the City of Norman periodically needs access to streams/creeks, man-made channels, ditches, drains, storm sewers, and storm water detention ponds, for the purposes of construction, maintenance, repair, and overall management of these storm water systems to aid in their proper function. Unfortunately, investigations carried out in this SWMP project revealed that there is an overwhelming lack of drainage easements or rights-of-way (ROW) along streams, open channels, and storm water detention ponds in Norman. The location of easements/rights-of-way along streams and storm water detention facilities are available in the City's GIS system and are shown in the plan (odd numbered) exhibits in Section 6 for Level 1 and 2 study areas. This information clearly shows that most stream reaches and detention facilities have no easements/ROW at all, others have insufficient amounts, and a few have sufficient easements.

Analyses performed during the SWMP effort revealed that the City would need to acquire, or accept as a donation, easements/ROW on well over a thousand properties to gain the rights and access to major streams (assuming bank to bank plus approximately 10 ft beyond each bank) and storm water detention facilities in its urban area. The number of properties requiring easement/ROW purchases or donations would increase significantly if the City were to obtain the FEMA floodways along these creeks as easement or out right purchase.



Typical easement conditions in Norman

Adding to this overall problem, property owners have built structures, fences, and other flow obstructions adjacent to undersized waterways in the floodplain and even the floodway. These obstructions often block flood flows and increase flooding problems along waterways and contribute to the debris that washes into the streams. Additionally, many property owners have made attempts to "fix" problems such as eroding stream banks or beds by dumping various materials (e.g., concrete rubble, logs, wire mesh, cables, tin, etc.) into the waterways. In doing this, these property owners likely did not understand or contemplate the possible negative impacts that their action may cause to other properties along the stream or to the overall stream environment.

Several discussions on the subject of easement/ROW needs have been held with City Council in work session, the SWMP Task Force, the City staff, and other stakeholders (including City Council sessions). Guidance in a general sense was obtained that basically called for a targeted and controlled acquisition of easements and rights-of-way associated with the City's storm water planning. Easements and/or ROW needed to construct critical stream flood control and/or stream erosion stabilization projects as well as to allow access to streams needing critical maintenance will be targeted for acquisition with those involving project construction receiving the highest priority. It is hopeful that much of the easement/ROW area will be donated to the City although in some instances purchasing the easement may be required. The City has indicated that those that donate easement/ROW area will be looked on favorably when selecting projects to build around the City. Even though the City has indicated how they would like to proceed as stated above, the subject of obtaining easements and/or rights-of-way as considered during the SWMP is presented below.

7.3.1 Key Questions, Options, and Recommended Actions

Question 1: Does the City want to obtain (through donations or purchasing) drainage easements and/or rights-of-way in previously urbanized areas in order to possibly construct needed modifications, provide maintenance, and/or carry out inspections on an as-needed basis?

Discussion: This is an issue that has grown in significance and importance since the inception and initiation of the SWMP project. The lack of drainage easements or drainage-related rights-of-way was not fully understood by many until the SWMP investigations brought attention to the related issues. It is in the best interest (health, safety, maintenance of property values, etc.) of the local citizens to have properly functioning drainage systems. As part of the SWMP, there are apparent needs to construct modifications, clean out clogged and eroding stream reaches, and maintain the stream on a regular basis.

When considering the needs identified by the SWMP, it may be best to obtain rights-of-way or special easements in stream reaches where past structures and/or improvements are located or future structures will be located in order for the City to perform the type of repair, reconstruction, inspection, survey, and/or maintenance work needed in such reaches to keep the system operating properly. It must be very clear that these reaches having significant public investment must be easily accessible to protect those investments. In other stream reaches, it may be acceptable to obtain more or less standard easements primarily for access to maintain the waterway such as cleaning, shaping, seeding, stabilizing, or mowing. Another option on certain stream reaches would be to develop a right-of-entry program such that property owners are asked for "single event" access to a stream area on their property for maintenance or stabilization work. The City can opt to only enter if given the right-of-entry approval or possibly enter regardless if the planned work is for the health and safety of the public at large and inaction would significantly endanger other citizens and property. The City may also want to determine whether it has the legal authority to enter private property for storm water management maintenance or modifications if it would create an unacceptable risk to the health and safety of the public in not taking such action.

Costs of obtaining these rights or properties are also a big consideration especially since preliminary costs to obtain easements (creek area plus 10 ft beyond the top of bank) along all the Level 1 and 2 streams was estimated to exceed $18 million. Again, the City has decided to be much more selective in purchasing easements/ROW as discussed above. Costs to obtain wider easements such as obtaining the entire floodway along the respective creeks might cost significantly more than the figure given above since numerous buildings and other structures would have to be bought along with a much larger property footprint. Relocations of effected homeowners and businesses would also need to be considered. Some property owners might be willing to donate an easement to the City while others might not. Guidance received from the City indicates that approximately 20–30% might donate drainage easements to the City while 80% would want the easements to be purchased. In most all rights-of-way transfers of property, the owners might want to sell the property to the City rather than donate it although there would be exceptions. One exception might be that land owners along a creek needing improvements could come forward as a group and donate easements

or rights-of-way in order to move a project up on the City's priority list which could also reduce costs significantly. Finally, it should be recognized that whatever plan is selected, obtaining easements on a citywide scale would be spread out over a long time period such as 10 to 20 years, if not longer.

In looking at the options below, it is assumed that there will be some storm water management system improvements in the City as a result of the SWMP.

Options:

1) Obtain drainage easements along all streams identified in the SWMP along the Level 1 and 2 stream reaches studied.

2) Obtain drainage easements along only those streams that have a SWMP improvement project implemented or reaches that are judged to have a significant present and/or ongoing maintenance need (likely obtained when the improvement project is constructed or the first maintenance activity is carried out).

3) Obtain a mixture of drainage easements, rights-of-way, rights-of-entry, and reaches of "no action" depending on the situation/conditions. This option possibly offers the best solution as it is very flexible and allows the City to utilize their funds in the most efficient manner. For instance, rights-of-way could be obtained along reaches where substantial structures/improvements are built or will be built. Drainage easements could be obtained in areas that have a need to significant initial and/or ongoing maintenance. Rights-of-entry could be used in areas that will likely need maintenance every few years and/or only if certain things occurred (e.g., large storms or a buildup of debris over, say, five to ten years). Finally, there might be some reaches that are presently being maintained (e.g., mowed often like a lawn) by property owners and these property owners would like to continue doing so. The City could simply let the maintenance of those reaches stay with the property owner as they are doing a good job and want to continue doing so.

Recommended Actions: Option 3 – Obtain a mixture of drainage easements, rights-of-way, rights-of-entry, and reaches of "no action" depending on the situation/conditions. The preferred approach would be to obtain easements or rights-of-way wherever possible unless there are location-specific problems with this approach. However, and while it is preferred to obtain easements or rights-of-way, obtaining rights-of-entry and/or not obtaining any easement ("no action") may be the most prudent action in certain instances. When considering the needs in any specific area, it is recommended that rights-of-way or special easements be obtained in stream reaches where past structures and/or improvements are located or future structures will be located. This is needed to allow the City to perform the type of repair, reconstruction, inspection, survey, and/or maintenance work needed in such reaches to keep the system operating properly. It must be very clear that these reaches having significant public investment and therefore, must be easily accessible to protect those investments. In other stream reaches, it may be acceptable to obtain more or less standard easements primarily for access to maintain the waterway such as cleaning, shaping, seeding, stabilizing, or mowing. On stream reaches where one or more property owner are reluctant to provide easements or rights-of-way, the City should consider obtaining a rights-of-entry to targeted properties. In these instances, property owners are asked for "single event" access to a stream area on their property for maintenance or stabilization work. The City can opt to only enter if given the right-of-entry approval or possibly enter regardless if the planned work is for the health and safety of the public at large and inaction would significantly endanger other citizens and property. The City may also want to determine whether it has the legal authority to enter private property for storm water management maintenance or modifications if it would create an unacceptable risk to the health and safety of the public in not taking such action.

Consideration 2: Does the City want to obtain rights-of-way or easement widths that cover the respective creek channels (bed and banks), possibly going a distance of say 10 ft beyond the bank, or obtain a much larger area such as creek floodway areas.

Discussion: In instances where the City does want to pursue obtaining easements or rights-of-way, then a follow on question becomes how much to obtain. As mentioned above, two ideas have emerged related to the amount of easement/ROW to obtain if that is the direction the City chooses. As for obtaining the creek (bank to bank plus say 10 ft), this would cost the least and would be a much smaller undertaking compared to obtaining the FEMA floodway. Although many property owners might be reluctant to "give up" some of their property or property rights near the creek, they might prefer this to being bought out in the floodway-based easement buyout which would be required on numerous properties that are located in the floodway. FEMA defines the regulatory floodway as the channel of a river or other water course and the adjacent land areas that must be reserved in order to discharge the base (100-year or 1%) flood without cumulatively increasing the water surface elevation more than a designated height (usually 1 foot).

There are many benefits to obtaining the floodway as easement. One primary benefit would be to remove numerous structures from harms way in the floodway. This would also offer a much larger area for greenbelts and open space along waterways, a SWMP priority. Again, the main drawbacks would be the increased costs, the need to relocate many residents to different homes, and to move businesses to new locations. The benefits would be that the stream corridor would be more respected and returned to a more natural state (within limits) which would add to the "quality of life" in those stream areas and restore some lost environmental qualities.

Options:

1) When obtaining easements or rights-of-way, target the area extending from stream bank to stream bank plus 10 ft on each side.

2) When obtaining easements or rights-of-way, target the area that is encompassed by the FEMA floodway along the respective streams.

Recommended Actions: The City should use a combination of Options 1 and 2 and obtain easements/ROW extending bank to bank plus 10 ft (or a somewhat wider amount depending on specific site circumstances) on each side of Level 1 and 2 creeks while allowing that in a few special locations such as Imhoff Creek, a plan be developed to obtain properties in the FEMA floodway over a longer period of time.

7.4 ENHANCED MAINTENANCE OF CREEKS AND STORM WATER DETENTION FACILITIES

There is no formal maintenance program to maintain the many open waterways in the City. The lack of drainage easements along the City's streams has played a major role in the lack of maintenance as access and rights are limited. A large number of steam reaches have not been maintained at all, some have had sporadic maintenance by City workers or landowners, and certain ones appear to have been maintained regularly by landowners. The lack of maintenance has caused "log jams" on creeks such as Imhoff Creek where, in the past, fallen trees and debris have clogged the waterway and built a virtual dam across the stream. In the reaches that are unmaintained, the stream corridor does not appear capable of safely carrying storm flows, detracts from the aesthetic appeal of the creek, presents an environmentally damaged setting, and can subject local citizens to unsafe conditions. However, there are some stream reaches that look well maintained as local residents appear to be maintaining the creek near their properties.

As stated above, the lack of easements/ROW and resulting access limitations has historically played a big role in a significant deficiency in storm water maintenance throughout Norman. Many times property owner associations (POAs) have the responsibility of maintaining the creeks and storm water detention facilities located in their neighborhoods. This has led to poor maintenance or no maintenance in many of these storm water areas. There are some instances where POA maintenance appears to be adequate such as in the Hall Park neighborhood. However, the inadequate and inconsistent maintenance has led to numerous problems that the City Council and City staff feel need to be addressed. If the City of Norman wants to upgrade its maintenance, the acquisition of drainage easements or rights-of-way from existing and new developments must be part of the solution. Discussions with City Council members, the SWMP Task Force, the City staff, and other stakeholders documented the need for future maintenance activities in coordination with the acquisition of selective easements and rights-of-way.

Various cities and counties were contacted to obtain general program costs of maintaining various types of streams. These program costs include the manpower and equipment costs required. Typical costs were developed for each type/condition of a stream from this information. The City's GIS data were used to obtain estimates of stream lengths and storm water detention facility dimensions to provide the quantities of areas requiring maintenance. Estimating general maintenance costs for Levels 1 and 2 streams included delineating three stream types, obtaining lengths of each stream type, estimating unit maintenance costs by type, respectively multiplying stream lengths by unit costs for the three stream types, and totaling all costs for stream maintenance as shown below. Obtaining general maintenance cost estimates for storm water detention facilities included measuring the perimeter length around each storm water detention facility area, totaling the perimeter lengths, obtaining the unit maintenance cost, and multiplying the total perimeter length by the unit cost to arrive at the total cost. When added together, the general estimate of annual maintenance costs for streams and storm water detention facilities totals approximately $1.2 million.

Debris blocking Imhoff Creek

Woody debris in lower Bishop Creek

Stream maintenance is a significant commitment.

7.4.1 Key Questions, Options, and Recommended Actions

Consideration 1: Does the City want to incur the costs and significantly increase the maintenance provided in streams and waterways especially the Level 1 and 2 streams studied?

Discussion: Costs associated with maintaining the Level 1 and 2 stream reaches will be significant and should be considered in future actions. Costs for the Level 1 and 2 streams are discussed below.

Level 1 and 2 Streams:

- Type 1: Natural channels with lots of trees, steep banks, difficult access, debris problems, etc. (Example = lower Imhoff Creek or Brookhaven Creek below 36th Avenue SW or Main Street).
- Type 2: Natural channels that are able to be mowed with few trees, easy access, maybe a concrete low flow channel (Example: Imhoff Creek upstream of the articulated block channel lining near Lindsey Street).
- Type 3: Modified channels with lining such as concrete or articulated block – relatively small and easy. (Example = the WPA channels with mortared rock walls and concrete bottom, such as in upper Imhoff Creek and upper Bishop Creek).
- Unit Costs:
  - Type 1: Assume $12,000/mi/yr. ($24,000/mi for years that inspections are conducted). Assumes maintenance performed once every two years on average.
  - Type 2: Assume $8,000/mi/yr. Maintenance every year (once per year).
  - Type 3: Assume $2,000/mi/yr. Maintenance and/or inspection every year. Expectations would be that in most years only inspections would be performed.
- Total length (miles):
  - Type 1: 42.8
  - Type 2: 3.6
  - Type 3: 11.0
- Total Costs:
  - Type 1: $514,000/yr
  - Type 2: $29,000/yr
  - Type 3: $22,000/yr
- Grand Total Costs: $565,000/yr

Consideration 2: Does the City want to significantly increase the maintenance provided for storm water detention facilities? Does the City want to vary the maintenance based on certain types of detention facilities? Does the City want to share responsibility with property owner associations?

Discussion: Similar to what was discussed above for streams, the costs of maintaining storm water detention facilities will be a significant annual expense. A general cost estimate for the present system of detention facilities in the City (based on the City's GIS system data) is presented below.

Storm Water Detention Facilities:

- Number of detention facilities from City's GIS system = 286
- Total perimeter length around the facilities = 61.4 miles
- Unit Cost per mile: $10,000. Maintenance every year (once per year).
- Total Cost: $614,000

Total Costs for Streams and Storm Water Detention Facilities = $1,179,000 (use $1,200,000)

Recommended Actions for Considerations 1 and 2: A City stream maintenance program, with maintenance schedules as recommended above, should be ramped up over a few years consistent with the acquisition of easements, rights-of-way, rights-of-way, rights-of-entry, and reaches of "no action" depending on the situation/conditions. Maintenance should focus in those stream reaches and/or detention facility areas where capital improvements are constructed in order to protect those investments as well as in areas where serious problems have been identified, such as lower Imhoff Creek, lower Brookhaven Creek, and stream erosion sites along Bishop Creek and its tributaries.

The City should also consider outsourcing some, or all, of the maintenance activities if it is advantageous especially while a City's program is ramping up. The City should also focus on detention facilities in which dam maintenance becomes a safety issue as discussed below.

7.5 DAM SAFETY

A key issue that became a concern during the SWMP project involves dam safety. It is obvious from viewing aerial photos of Norman and viewing the City's drainage systems (see Exhibit 4-4) that the City has a great number of dams of significant height with homes and business located in low lying areas downstream of the dams. Many of these dams impound a significant pool of water and/or have the potential to temporarily store large volumes of storm water during flood events. These conditions pose a dam break public safety concern for those that live, work, drive, recreate, and generally occupy the floodplain area downstream of these impoundment structures. Generally speaking, as the height of a dam increases, risks, danger and public safety become more of a concern.

The Oklahoma National Dam Inventory identified approximately 20 dams in the Norman area as shown in Figure 7-1. Most all of these dams were reported to have been built in the 1960s, which makes them 38 to 48 years old. These 20 dams identified in the national inventory are the more substantial dams and came under the jurisdictional authority of the Oklahoma Water Resources Board pursuant to the enactment of Title 82 of Oklahoma Statutes. Consequently, all of the old (i.e., already in existence) jurisdictional dams in Oklahoma were inventoried and inspected by the USACE in the late 1970s as mandated by The National Dam Inspection Act, Public Law 92-367, 8 August 1972 under the "Phase One Inspection of the National Dam Safety Program."

Two key issues require consideration.

7.5.1 Key Questions, Options, and Recommended Actions

Consideration 1: Should the City investigate and identify, to the extent possible, the responsible parties for the inspection, maintenance, and overall safety of the dams that are judged to be a potential safety hazard?

Discussion: Although OWRB oversees dam safety in Oklahoma, it is unclear whether there is a program in place to systematically evaluate the dam sites in Norman. A dam safety concern involves the apparent limited maintenance of many of the dams located in the City as well as the associated principal spillways, the emergency spillways, and the upstream ponding areas in general. In many instances, it is not known who is responsible for the inspection and maintenance of most of these dams that pose a public safety concern in various areas throughout the City. According to the City and in most instances, property owner associations (POAs) have inherited the responsibility for dam inspection and maintenance. The City could undertake one or more investigative projects to determine ownership of the many dams, say 6 ft or higher, located in the City. The dams with the greatest height, unmaintained condition, and/or most downstream development should receive the highest priority during any such investigations. Once ownership is established, the effort should also include gathering information about the dam and its ponding area such as design drawings, inspection reports, maintenance records, and any other pertinent information.

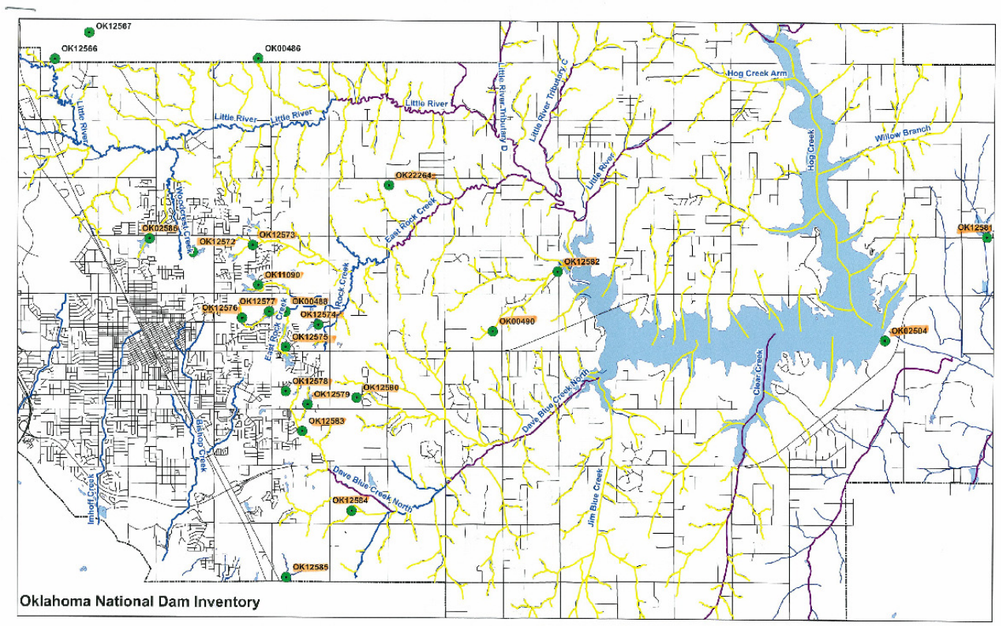


Figure 7-1: Oklahoma National Dam Inventory

Option 1: Undertake one or more investigative projects to determine dam ownership and responsible party for maintenance of the structure and its appurtenances. Collect all available pertinent information about each investigated structure.

Option 2: Forego undertaking any investigative projects.

Recommended Actions: Select Option 1 and undertake the investigative projects beginning with the dams judged to have the greatest public safety risk. An inventory and prioritization method will have to be developed at the beginning of the investigative work.

Consideration 2: Does the City want to take over ownership, liability, and maintenance from POAs or other owners to insure that dams are made safe and properly maintained?

Downstream side of unmaintained dam

Discussion: The City's GIS data indicate that there are almost 290 storm water detention facilities, retention ponds, or other waterbodies in the City. Many of these are likely small and inconsequential from a dam safety standpoint but many warrant public safety concerns.

Recommended Actions: The City should meet with OWRB and obtain their input and insight concerning the dams in Norman and their hazard potential. Considering discussions with City staff and other stakeholders, it is recommended that the City take over the inspection and maintenance for all dams that pose safety concerns or, at least, those that pose the greatest hazards. Further, the POAs should maintain the general mowing and small scale maintenance responsibilities while the City undertakes the more critical dam safety, inspection, and maintenance responsibilities.

It is recommended that the City determine the prevailing conditions for any dam and its appurtenances through an initial investigation prior to taking on any additional responsibilities. Should the City take over inspection, maintenance, and upgrading responsibilities for the structures, it should first be determined what actions they or the present owners might have to take to bring any structures into state dam safety compliance. Such actions could include determining whether the dam structures require modifications to strengthen them against failure or breach. Another important aspect is whether any of the dams need an emergency action plan which is developed to reduce the risk to lives and property that can result from dam failure.

8.0 FINANCIAL ANALYSES

8.1 INTRODUCTION

The City of Norman is establishing a storm water utility and has solicited input through a series of Storm Water Task Force and general public meetings held during 2007 and 2008. City and PBS&J staff have developed a comprehensive storm water master plan as the basis for the creation of the storm water utility. The storm water master plan estimates; 1) the operations and maintenance costs to meet the City's current Phase II permit requirements; 2) the upcoming expansion of Phase II requirements; and 3) capital program costs.

This section provides a storm water utility background, rate considerations, revenue requirements and the resulting storm water rates.

8.1.1 Background – The Storm Water Utility Concept

Historically, funding storm water management programs has been problematic for most local governments. Today hundreds of local governments have discovered a viable option: the storm water utility.

A storm water utility operates much like other utilities — water, sewer, or power, for example — that are funded by service fees and administered separately from the general fund, thereby providing a dedicated and stable source of funds that are raised through charges based on a user's contribution to local storm water runoff. An EPA study identified three major advantages of storm water utilities over funds generated through property tax revenues: (1) increased stability and predictability; (2) greater equity; and (3) it allows for incentives for on-site storm water management (Doll et al., 1998). Experts estimate that there are more than 800 storm water utilities in communities throughout the country. These storm water utilities serve cities with populations ranging from under 12,000 (Auburndale, Florida) to over 3.5 million (Los Angeles, California) (Black & Veatch Management Consulting, 2007). By contrast, there are thousands of water, sewer, and irrigation districts in the country that work under a similar framework.

While few people enjoy paying more fees, the utility approach is often seen as more equitable to rate payers. PBS&J's experience with storm water utilities has shown that they are capable of generating substantial revenues for local storm water management programs at relatively nominal charges.

A sound storm water utility rate structure is developed around two major themes. The first is the "user pay" concept — the parties that have the most storm water runoff and receive the most benefits from the storm water utility pay their proportionate share. The second is that the utility is structured so that it can be administered fairly and cost-effectively.

8.1.2 Rate Structure Considerations

A fundamental concept of any utility is the capacity of the service delivered by that utility to be bought in measurable, discrete units of services, i.e., kilowatt-hours in electric utilities, phone service in minutes of connect time, water in hundred cubic feet or thousands of gallons, etc. In each case, buyers pay for what they consume. This concept is founded on the intuitively appealing notion that one pays proportionate to the cost or burden one puts on the system. How much one pays for storm water services might better be related to the amount of "storm water management" services consumed, which can be reasonably and accurately estimated. Also, it follows that billing by "consumption" rather than by value of property could be the basis of a more equitable charge philosophy.

The unit of measurement for storm water service is most often based on impervious surface area. This is supported by research performed by PBS&J and detailed in a white paper titled *Results from National and University Specific Stormwater Surveys* shown in Appendix K. Many utilities establish a base-billing unit, commonly referred to as an equivalent runoff, or residential unit (ERU), or an equivalent storm water unit (ESU). Some utilities establish tiered flat rates in which parcels are billed depending on where they fall in the tier structure. Other topics for discussion when establishing rate structures include using fixed rates for overhead costs, assessing additional surcharges to areas with more complex storm water requirements, and the need to meet federal requirements.

Paramount to the establishment of storm water utility rates is obtaining buy-in from the community. It is recommended that public education is started at least a year before any fee program or change is put into place. If people understand what is being done and think it is fair, they will support and become part of the outreach process and pass the word along.

There is not one type of storm water utility rate-setting strategy that fits the needs of all communities. Being equitable across the board, having a solid basis for measuring service, and establishing a solid administration structure are the keys to success.

8.1.3 Storm Water Legislation

Legislation in most states indicates that reasonable storm water utility fees will be upheld if legally challenged. The storm water utility rate should be designed to defray the costs of the service provided by the municipality (*Bloom v. Ft. Collins*, 784 P. 2d 304, 308, 1989). While it is not necessary for there to be mathematical symmetry (*Sandy Springs Water Co. v. Department of Health and Envtl. Control*, 324, S.C. 177, 181, 478 S.E. 2d, 60, 62, 1996), an equitable relationship between the amounts of storm water generated by a given property, the benefit received by the rate-payer, and the corresponding fee is normally required.

Generally, case law suggests that a rate will be deemed valid where the

1. Revenue generated provides benefits for the payers, primarily even if not exclusively.
2. Revenue is only used for the projects for which they were generated.
3. Revenue generated does not exceed the costs of the projects.
4. The rate is uniformly applied among similarly situated (from a runoff view point) residents (*C.R. Campbell Constr. Co. Inc. v. Charleston*, 481 S. E.2d 437, 438, 1997).

Furthermore, benefits do not need to be either direct or quantifiable; intangible benefits such as an improved overall state of public health may be counted (*Kentucky River Auth. v. County of Danville*, 932 S.W.2d 374, 377, Ky. Appl., 1996). Any property that is part of the watershed may be considered to have benefited from surface drainage improvement, through improvements of health, comfort, convenience, and enhanced property values (*Kentucky River Auth. v. County of Danville*, 932 S.W.2d, 377, Ky. Appl., 1996).

The key to determining just exactly who benefits from a community's storm water management is the concept of "burden." Virtually all property has the potential to generate storm water runoff, and hence the aggregate runoff must be managed in an organized and systematic manner if owners are to enjoy the use of their property with some degree of reliability. The burden of managing the accumulating storm water falls to the community. Storm water systems and facilities must be constructed and maintained to reduce the undesired impacts of accumulated runoff.

While most communities split the responsibility of managing the burden of runoff between the parcel owner (developer) and the community (hydrologic drainage design criteria), the responsibility for managing storm water runoff that exceeds on-site design requirements is clearly the responsibility of the community. The amount of runoff generated by a parcel and sent to a storm water system represents its proportionate share of the burden of creating and maintaining the storm water system. Therefore, the costs of the storm water management program are a tangible, aggregate measure of the management of the burden of runoff generated by each parcel.

All rate structures are ultimately constrained by the legal context within which they must operate. Several of the most fundamental points that directly impact the design of a rate structure are highlighted below:

- Public Purpose – All components of the rate structure must work to affect a clear public purpose.
- Rational Nexus/Special Benefit – There must be a reasonable relationship between the amount of service rendered and the amount of charge levied.
- Not Arbitrary – Each component of the structure must have a purpose and should be the result of logically based consideration of fact. Specifically, the structure should not be inconsistent with basic tenants of storm water engineering science. It is also recommended that normal procedural and statistical rigor be well documented in the construction of the fundamental structure in the determination of all categories, classes and groups, and in the calibration of arithmetic parameters.
- Uniform/Equal Application of the Law – All parcel/customers equally situated must be equally treated, and exemptions, where used, must be awarded to all similarly situated customers.

A sound storm water utility rate structure is developed around two major themes. The first is the "user pay" concept, and the second involves the balance between simplicity and equity. The key is to strike a balance so that enough factors are considered so as to be fair, but so that the structure is simple enough to be explained easily and to be administered cost-effectively.

8.2 IMPERVIOUS SURFACE ANALYSIS

The City provided impervious data for each parcel from its GIS database and Vieux reviewed this data for accuracy and completeness. PBS&J categorized the parcel data into five user classes as shown in Table 8-1. Column A shows there are 39,851 parcels within the study area for a total of almost 292 million square feet of impervious surface as shown in Column C. Column D shows that the single-family user class accounts for 32% percent of the total impervious area. Column E shows the average impervious area for each user class and Column F shows the percent of individual user class total area that is impervious.

Table 8-1
Impervious Data Analysis Results

All Parcels	(A)	(B)	(C)	(D)	(E)	(F)
User Class	**Parcel Count**	**Total Area Sq Ft**	**Imp. Area Sq Ft**	**% of Total Impervious Area**	**Avg Impervious Area Sq Ft**	**% of User Class Area that is Impervious**
Single Family	26,078	636,195,726	94,245,445	32%	3,614	15%
Multi-family	6,626	193,751,640	42,293,081	15%	6,383	22%
Comm/Indust/Office	2,314	222,531,361	59,935,187	21%	25,901	27%
Agriculture	4,616	3,854,345,991	72,687,230	25%	15,747	2%
University of Oklahoma	199	76,314,671	15,637,104	5%	78,578	20%
Miscellaneous	18	17,709,556	6,827,420	2%	379,301	39%
Total	**39,851**	**5,000,848,945**	**291,625,467**	**100%**		

Table 8-1 shows data for all parcels within the City, including exempt parcels. The City Council decided to include all impervious parcels as billable parcels after first assessing the impact to rates if exempt parcels (including the University of Oklahoma, churches, schools, Indian land, county, state and federal land, and non-profit land) were excluded. This is further discussed in Section 8.3. The City chose a conservative approach, reflecting the economic environment of FY 2008–2009, by assuming no impervious surface growth for the 20-year study period.

While the data provided by the City shows that the average single-family residence has approximately 3,600 square feet of impervious area, the median impervious square footage is approximately 3,100 square feet. The various single-family square-footage deciles are tabulated below. The information provides a range showing how many single-family properties have impervious cover amounts less than or equal to the respective amount shown. For instance, the data indicate that 50% of the single-family properties in Norman have 3,100 square feet or less of impervious area and 30% of the single-family properties have 2,500 square feet or less of impervious cover.

Single-Family Impervious Cover (sq ft)	% Single-Family Properties Less Than or Equal To
2,500	30%
2,800	40%
3,100	50%
3,400	60%
3,800	70%
4,100	80%

8.3 STORM WATER REVENUE REQUIREMENT

8.3.1 Revenue Requirement Definition

The storm water revenue requirement is defined as the revenue required to pay for operation and maintenance, cash (or storm water fee) financed capital, debt service and reserve creation less any non-operating revenues such as interest earnings.

8.3.2 Revenue Requirement Discussion

The storm water revenue requirement is broken into eight main cost components as shown on Table 8-2 (lines 5, 10, and 11 not counted). The revenue requirement for each option is developed using the mid-year of a 5-year planning period to establish one user fee for the period of FY 2009–2010 to FY 2013–2014. The mid-year used in all of the following tables is FY 2011–2012 (except Table 8-4, which is in FY 2008–2009 dollars) and inflation is applied to all of the operations, maintenance, and capital numbers shown in Table 8-2. A brief description for each category of expenses follows:

1. Operation and maintenance: These expenses include general street sweeping and storm water system maintenance provided by the streets department. Other items covered under O&M are (but not limited to) office supplies, asphalt materials, minor tools, training, and temporary positions.

2. Shared city services: These costs are similar to those included in the City's water and wastewater user fees. They recover the costs of departments such as finance and City administration whose staff and services support the utility but are not directly charged to the utility.

3. Minimum control measures: These are the costs associated with compliance to the City's current storm water permit and are more fully described in Sections 5 and 6 as well as Appendix H of the report. These costs increase dramatically in FY 2012–2013 to cover the costs of the City's upcoming expanded Phase II permit.

4. Reserve funding: All utilities need a moderate amount of reserves for unforeseen operational or capital events. The revenue requirement includes funding for an operating reserve, rate stabilization reserve, and capital reserves. Reserves are slowly built up over time to minimize impacts on rates.

5. Enhanced maintenance: The City has millions of dollars in deferred trail, detention pond and creek maintenance. During the course of the master plan an annual program was defined and an annual average budget established at $1.2 million before inflation.

6. Trail construction: As part of the City's overall master planning process, a separate Greenway Master Plan (Halff, 2009) was prepared. Many communities have successfully established a dual purpose storm water/trail program that incorporates storm water and flooding concerns with recreation. An annual amount of $1 million before inflation has been incorporated for such a plan over 20 years.

7. Easements and Right-of-Way acquisition: As part of the master planning process it was determined that the City has acquired only a fraction of easements and/or right-of-ways to operate and maintain their storm water facilities. This is discussed in more detail in Section 7. Two hundred fifty thousand dollars per year before inflation is incorporated into the storm water revenue requirement to assist the City in this program.

8. Cash Financed (Pay-go) Capital Projects: The master plan has identified $83 million in capital improvement projects. As discussed in Section 8.2, the capital program is partially funded through general obligation bonds and storm water fees (pay-go). Line number 7 in Table 8-2 shows the storm water fee funded capital program under each of the three different options which are defined in Section 8.3.5 below.

8.3.3 Inflationary and Interest Assumptions

The expenses shown in Table 8-2 are adjusted for inflation using the inflationary factors shown in Table 8-3.

Table 8-2
Storm Water Utility Revenue Requirement (FY 2011–2012 Dollars)

Line No.	Stormwater Revenue Requirement, FY 2011–2012	Option 1	Option 2	Option 3
1	Operation and Maintenance	$459,799	$459,799	$459,799
2	Shared City Services	$129,465	$129,465	$129,465
3	Minimum Control Measures	$748,616	$748,616	$748,616
4	Reserve Funding	$265,000	$265,000	$265,000
5	Subtotal	$1,602,880	$1,602,880	$1,602,880
6	Enhanced Maintenance (Trails, Detention Ponds, Creek)	$1,273,080	$1,273,080	$1,273,080
7	Capital Improvement Program	$2,866,240	$2,406,560	$2,325,440
8	Trail Construction	$1,081,600	$1,081,600	$1,081,600
9	Easements and Right of Way	$265,225	$265,225	$265,225
10	Less Interest on Cash Accounts	$(25,758)	$(25,758)	$(25,758)
11	Total Revenue Requirement	$7,063,267	$6,603,587	$6,522,467

Table 8-3
Inflationary and Interest Assumptions

Budget Component	Rate	Use
Interest Earnings	3.0%	Cash Balances
Salary Inflation	4.0%	Salaries and Shared City Services
General Inflation	3.0%	O&M, Enhanced Maintenance, Easements and ROW
Construction Inflation	4.0%	Capital Projects, Trail Construction
MCM* Inflation	5.0%	Used for First 5 Years, General Inflation Used Thereafter

*Minimum Control Measure

8.3.4 General Obligation Bond Financing

The City decided to partially fund storm water capital improvement with general obligation (GO) bonds instead of revenue bonds due to the following:

1) The City feels property tax revenue (used to repay GO bond debt) is more secure and thus would result in a lower expected interest rate for GO bonds.
2) The impact of increased property taxes is, for most property owners, absorbed within the homeowner's mortgage payment. Relative to the overall mortgage payment, the increase does not "feel" as large as it would in a storm water fee that appears as a separate line item on the utility bill.
3) The separate vote that would be required to authorize GO bonds would give more of a feel of transparency to the process of approving the projects. If the projects are just a part of the storm water rate structure that is voted upon, voters may feel as if they had less of a say in the issuance of the debt backed by the utility revenue stream.

Once the GO bonds are authorized, the City would issue the bonds via a competitive sale as is mandated by Oklahoma state law and would determine whether it would be advantages to issue the debt all at once, or to schedule several sales to match cash flow needs of the capital projects (in general, it is less costly to combine the bond sales to achieve economies of scale in the fixed costs of issuing bonds regardless of the amount of the bond issue). The City would prepare documents and agenda items for the City Council to set a date of bidding on the bonds, and then award the bid to the lowest bidder based on the true interest cost method. A few weeks later the City would close the sale, deliver the bond specimen and receive the proceeds to pay for the projects.

The net assessed property valuation in Norman was $616,042,224 in 2007 (assessments are made at 12% of the estimated market value of the property). The City normally assumes the average house in Norman is $100,000 (the median home value in Norman is about $112,000). As a very rough rule of thumb, $10 million worth of capital projects costs a median homeowner in Norman about $1 a month in increased property taxes. A $40 million storm water project, financed with 20-year general obligation bonds, would raise property tax about $4.21 per month on average. Very little of property tax bill revenue in Norman goes to the City since property taxes in Oklahoma cannot be used by cities to pay for operations – only GO bond debt service. Most of the property tax revenue goes to school districts, county and libraries.

The one shortcoming of using GO bonds versus revenue bonds is that exempt properties do not receive property tax bills. With a few exceptions for "payments in lieu of taxes," exempt properties (such as the University of Oklahoma) DO NOT share in the cost of retiring City of Norman GO bond indebtedness. This is one of the "pros" for financing utility costs with utility user fees instead of GO bonds. However a special formula can be added to the storm water user fee bill for exempt properties to recover their proportionate share of the capital projects financed by GO bonds.

8.3.5 Three Revenue Requirement Options

The City asked to have three rate options developed thus creating three different revenue requirements. The revenue requirement changes in each option due to the amount of storm water fee based capital financing — also known as pay-go or cash financed capital. As shown in Table 8-4, the total 20-year capital improvement program in 2009 dollars is $83 million. The means of financing this program is also shown in Table 8-4. In Option 1, The City plans to raise $30 million through general obligation (GO) bonds, which leaves $53 million over 20 years to be financed through storm water user fees. Table 8-4 also shows the amount of bond financing and cash financing under options 2 and 3.

Under option 1, line 7 shows the average yearly cash financed capital expenditure is approximately $2.65 million in 2009 dollars.

Table 8-2 shows the storm water revenue requirement assumed for the first 5-year period – FY 2009–2010 through FY 2013–2014 under the three rate options. The City chose to implement one rate for the next 5 years and therefore FY 2011–2012 — the midyear in this 5-year period — is used to set rates for this 5-year period. Note that line 7 in Table 8-2 — the capital improvement program — is equivalent to line 7 in Table 8-4; however, it has been adjusted for inflation to reflect FY 2011–2012 dollars, which is the mid-point of the 5-year planning period.

Table 8-4
Three Rate Options – FY 2008–2009 Dollars (Uninflated)

Line No.	Item	Option 1	Option 2	Option 3
1	Capital Improvement Program (20-Year Period)	$83,000,000	$83,000,000	$83,000,000
2	Funding Source			
3	General Obligation Bonds	$30,000,000	$38,500,000	$40,000,000
4	Stormwater User Rates (Pay-go) Financing	$53,000,000	$44,500,000	$43,000,000
5	Total	$83,000,000	$83,000,000	$83,000,000
6	Study Period	20	20	20
7	Capital Improvement Projects per Year Funded by Rates	$2,650,000	$2,225,000	$2,150,000

8.4 STORM WATER RATES

8.4.1 Rate Calculation

The storm water rate, in dollars per square feet of impervious area, is calculated as follows;

$$\frac{\text{Revenue Requirement (\$)}}{\text{Impervious Area (sq ft)}}$$

Each user classes cost burden is proportional to its impervious area. The storm water rate is a flat rate across all user classes.

The corresponding bill for each parcel is calculated as:

Storm water Bill ($) = Storm water Rate ($/sq ft) x Parcel Impervious Area (sq ft)

8.4.2 Storm Water Rates

Table 8-5 shows the calculation of storm water rates for each of the three options for the first 5-year period (FY 2009–2010 to FY 2013–2014). The City is required to go to a vote of the people in order to create their storm water utility and set rates. The City chose to implement a storm water rate for a 5-year period. This means that each 5 years the City would go out to the electorate to establish the rates for the next 5 years.

Table 8-5
Storm Water Rate Calculation for FY 2009–2010 through 2013–2014

	Option 1	Option 2	Option 3
Revenue Requirement	$7,063,267	$6,603,587	$6,522,467
Total Impervious Sq Ft	291,625,467	291,625,467	291,625,467
Yearly Rate ($/Sq Ft)	$0.024	$0.023	$0.022
Monthly Rate ($/Sq Ft)	$0.0018	$0.0017	$0.0017

8.4.3 Average Bills

Table 8-6 shows the average impervious area and average yearly bill under each of the three options for the three different user classes as well as the University of Oklahoma.

Table 8-6
Average Bill for Each User Class

		Option 1		Option 2		Option 3	
User Class	Average Impervious Surface (Sq Ft)	Average Yearly Bill ($)	Average Monthly Bill ($)	Average Yearly Bill ($)	Average Monthly Bill ($)	Average Yearly Bill ($)	Average Monthly Bill ($)
Single Family	3,614	87.53	7.29	81.84	6.82	80.83	6.74
Multi-family	6,383	154.60	12.88	144.54	12.04	142.76	11.90
Commercial/Industrial/Office	25,901	627.33	52.28	586.50	48.88	579.30	48.27
Agriculture	15,747	381.40	31.78	356.58	29.71	352.20	29.35
University of Oklahoma	78,578	1,903.19	158.60	1,779.33	148.28	1,757.47	146.46

Table 8-7 shows various bills for each impervious cover deciles (i.e., groups of equal frequency). As indicated, approximately 40% of single-family customers have 2,800 square feet of impervious surface or less, which would result in 40% of Norman's single-family property owners receiving monthly bills of $5.65, $5.28, or $5.22 or less for Options 1, 2, and 3, respectively. The median single-family impervious square footage is approximately 3,100 square feet and implies a monthly bill of $6.26, $5.85, or $5.78 under Options 1, 2, and 3, respectively.

Table 8-7: Bill for Various Impervious Surface Deciles

		Option 1		Option 2		Option 3	
Single-Family Impervious Surface (sq ft)	Decile – % Properties ≤ sq ft Given	Average Yearly Bill ($)	Average Monthly Bill ($)	Average Yearly Bill ($)	Average Monthly Bill ($)	Average Yearly Bill ($)	Average Monthly Bill ($)
2,500	30	60.55	5.05	56.61	4.72	55.91	4.66
2,800	40	67.82	5.65	63.40	5.28	62.62	5.22
3,100	50	75.08	6.26	70.20	5.85	69.33	5.78
3,400	60	82.35	6.86	76.90	6.42	76.04	6.34
3,800	70	92.04	7.67	86.05	7.17	84.99	7.08
4,400	80	106.57	8.88	99.63	8.30	98.41	8.20

Table 8-8 shows how the average yearly single-family storm water bill breaks down for each of the different revenue requirement components under Option 1 as presented in Table 8-6. Table 8-8 shows that one of the largest drivers of the storm water bill is the capital improvement program.

8.4.4 Rate Discussion – All Impervious Parcels are Charged for Storm Water Service

The storm water rates shown in Table 8-5 are based on charging all impervious parcels within the City. During 2008, the Norman community and City Council reviewed storm water rate scenarios in which exempt parcels were not billed for storm water service. Table 8-9 shows the various exempt parcel data provided by the City.

Table 8-8
Storm Water Bill Components

Line No.	Yearly Rate	
1	Operation and Maintenance	$5.70
2	Shared City Services	$1.60
3	Minimum Control Measures	$9.28
4	Reserve Funding	$3.28
5	Base Rate	$19.86
6	Enhanced Maintenance (Trails, Detention Ponds, Creek)	$15.78
7	Capital Improvement Program	$35.52
8	Trail Construction	$13.40
9	Easements and Right of Way	$3.29
11	Total Rate	$87.53
13	**Monthly Rate**	
14	Operation and Maintenance	$0.47
15	Shared City Services	$0.13
16	Minimum Control Measures	$0.77
17	Reserve Funding	$0.27
18	Base Rate	$1.66
19	Enhanced Maintenance (Trails, Detention Ponds, Creek)	$1.31
20	Capital Improvement Program	$2.96
21	Trail Construction	$1.12
22	Easements and Right of Way	$0.27
23	Total Rate	$7.29

Table 8-9
Exempt Parcel Data

Exempt Type	Impervious Area (Sq Ft)
Church	4,773,247
City	4,073,940
County	871,160
Indian	1,181,350
Non-Profit	2,989,044
University of Oklahoma	15,637,104
School Land	7,033,443
State	6,865,783
Unknown	1,099,635
USA – Federal	11,498,621
Total	56,023,327

The City Council reviewed three scenarios in which the University of Oklahoma and other exempt parcels were excluded from storm water charges. Table 8-10 shows a summary of the three storm water rate scenarios reviewed by the City Council and the Norman community. PBS&J performed a nationwide survey to help the City ascertain whether it was common to exempt universities from storm water fees. The results were summarized in a white paper titled *Results from National and University Specific Stormwater Surveys*. The results, shown in Appendix K, indicate that most universities are not exempt from storm water charges. PBS&J also presented preliminary rate and sample bill results for each of the three scenarios. The details are provided in another white paper titled Creation of a Storm Water Utility and Associated User Charges presented by PBS&J to the Norman City Council and shown in Appendix L. The information in this appendix may be somewhat outdated as this white paper was completed months earlier and may not reflect recent changes. The City eventually decided to bill all impervious surfaces, both universities and other exempt properties, within the City.

Table 8-10
Storm Water Billing Scenarios

	Billed for Storm Water?		
Exempt Type	Scenario 1	Scenario 2	Scenario 3
University of Oklahoma	No	Yes	No
Other Exempt Parcels	Yes	No	No

8.4.5 Storm Water Rate Comparison with Other Storm Water Utilities

PBS&J conducted a survey to assess storm water fees in Cities with large universities such as Norman. Page 5 of Appendix K shows the results of the research. The average storm water fee, in Cities which claimed that their fees were fully adequate to fund the storm water utility, averaged $9.95 (in 2008 dollars). This compares quite favorably for the City of Norman's anticipated fee in the range of $6.74 (Option 3) to $7.29 (Option 1) in FY 2011–2012 dollars as shown in Table 8-6.

8.5 STORM WATER CAPACITY FEES (NEW DEVELOPMENT FEES)

Most water and wastewater utilities also include new development fees as an integral component of their capital funding plans, in part because state and federal assistance for system construction has become more limited. As much of the utility capital cost burden has shifted to the local level, concerns about equity between current and future system users have become heightened as communities are faced with significant costs for system rehabilitation and replacement, as well as additional capacity needs. Development fees are often assessed either to avoid charging existing users for extra capacity costs or to compensate (via reduced future utility bill increases) the existing users for the costs they have previously incurred to provide this capacity.

State enabling acts and case law provide broad guidelines related to development fee calculation and implementation. It is then up to the local community to select specific approaches that are consistent with both the constitutional standards and local circumstances and objectives.

Assessing new development can take several forms. The first is to assess a capacity fee. The second is to require new development to build their own in-tract facilities and contribute them to the City for ongoing operations and maintenance. The third is to require new development to contribute to or build regional facilities. And finally, a combination of the first three alternatives can be used.

During the course of the study much discussion centered on new development fees versus contributed storm water facilities. It is recommended that new development build their own in-tract storm water detention and water quality facilities as well as contribute to regional facilities in certain applicable instances. It is also recommended that the City continue to consider the possibility of charging developers a per-lot capacity fee to offset downstream storm water impacts.

8.6 LONG-RANGE FINANCIAL PLAN (UNDER OPTION 1 REVENUE REQUIREMENT)

The long-rang financial plan models the financial health of the storm water utility over the 20-year study period. The plan models the yearly ending cash balance in each of the reserves. The long-range financial plan uses the revenue requirement from the mid-year in each 5-year period to establish rates (revenue). The mid-year revenue requirement, for Option 1, is shown in Column C in each of Tables 8-11 through 8-13. These tables also show the projected storm water expenses used in developing the 20-year long-range financial plan. In other words, the revenue is fixed at the mid-year amount while the expenses vary from year to year. This is the reason for the rise and fall of the operating reserve as shown in Figure 8-1.

Table 8-11
Storm Water Expenses for FY 14/15 through FY 18/19

	(A) FY 14/15	(B) FY 15/16	(C) FY 16/17	(D) FY 17/18	(E) FY 18/19
Operation and Maintenance	$504,922	$520,941	$537,475	$554,541	$572,156
Shared City Services	$145,631	$151,456	$157,514	$163,815	$170,367
Minimum Control Measures	$1,962,724	$2,021,606	$2,082,254	$2,144,722	$2,209,063
Reserve Funding	$265,000	$265,000	$265,000	$265,000	$215,000
Subtotal	$2,878,277	$2,959,003	$3,042,243	$3,128,077	$3,166,587
Enhanced Maintenance (Trails, Detention Ponds, Creek)	$1,391,129	$1,432,863	$1,475,849	$1,520,124	$1,565,728
Capital Improvement Program	$3,224,130	$3,353,095	$3,487,219	$3,626,708	$3,771,776
Trail Construction	$1,216,653	$1,265,319	$1,315,932	$1,368,569	$1,423,312
Easements and Right of Way	$289,819	$298,513	$307,468	$316,693	$326,193
Less Interest on Cash Accounts	$(346)	$(20,402)	$(31,797)	$(33,936)	$(26,195)
Total Revenue Requirement	**$8,999,662**	**$9,288,391**	**$9,596,914**	**$9,926,235**	**$10,227,401**

Table 8-12
Storm Water Expenses for FY 19/20 through 23/24

	(A) FY 19/20	(B) FY 20/21	(C) FY 21/22	(D) FY 22/23	(E) FY 23/24
Operation and Maintenance	$590,340	$609,109	$628,484	$648,484	$669,131
Shared City Services	$177,182	$184,269	$191,640	$199,306	$207,278
Minimum Control Measures	$2,275,335	$2,343,595	$2,413,903	$2,486,320	$2,560,910
Reserve Funding	$15,000	$15,000	$15,000	$15,000	$15,000
Subtotal	$3,057,857	$3,151,974	$3,249,027	$3,349,110	$3,452,318
Enhanced Maintenance (Trails, Detention Ponds, Creek)	$1,612,700	$1,661,081	$1,710,913	$1,762,240	$1,815,108
Capital Improvement Program	$3,922,647	$4,079,553	$4,242,735	$4,412,445	$4,588,943
Trail Construction	$1,480,244	$1,539,454	$1,601,032	$1,665,074	$1,731,676
Easements and Right of Way	$335,979	$346,058	$356,440	$367,133	$378,147
Less Interest on Cash Accounts	$(7,919)	$(30,274)	$(42,238)	$(43,100)	$(32,112)
Total Revenue Requirement	**$10,401,508**	**$10,747,846**	**$11,117,910**	**$11,512,903**	**$11,934,080**

Table 8-13
Storm Water Expenses for FY 24/25 through 28/29

	(A) FY 24/25	(B) FY 25/26	(C) FY 26/27	(D) FY 27/28	(E) FY 28/29
Operation and Maintenance	$690,444	$712,446	$735,160	$758,609	$782,817
Shared City Services	$215,569	$224,192	$233,159	$242,486	$252,185
Minimum Control Measures	$2,637,737	$2,716,869	$2,798,375	$2,882,327	$2,968,796
Reserve Funding	$15,000	$5,000	$5,000	$5,000	$5,000
Subtotal	$3,558,750	$3,658,507	$3,771,695	$3,888,421	$4,008,798
Enhanced Maintenance (Trails, Detention Ponds, Creek)	$1,869,561	$1,925,648	$1,983,417	$2,042,920	$2,104,207
Capital Improvement Program	$4,772,500	$4,963,400	$5,161,936	$5,368,414	$5,583,150
Trail Construction	$1,800,944	$1,872,981	$1,947,900	$2,025,817	$2,106,849
Easements and Right of Way	$389,492	$401,177	$413,212	$425,608	$438,377
Less Interest on Cash Accounts	$(8,489)	$(34,946)	$(49,283)	$(50,357)	$(37,272)
Total Revenue Requirement	**$12,382,757**	**$12,786,767**	**$13,228,877**	**$13,700,822**	**$14,204,110**

The City requested a 20-year long-range plan to assess the long term impacts of near term financing and capital investment decisions. Table 8-14 shows the resulting storm water rates, under Option 1, for each 5-year planning period. The resulting rates are approximate since it is difficult to pinpoint inflation so far in the future. Inflation has ranged from over 6% to just over 1% in the past 15 years. Hence, the City may need to adjust operation and maintenance expenses. As the City further assesses and refines its storm water capital improvement program it may also choose to adjust its capital program. The City may also have more impervious surface area in the future. All of these factors will affect the rates shown in Table 8-14.

Table 8-14
Storm Water Rates for the Subsequent 5-Year Planning Periods

	5-Year Planning Period		
	FY 14/15 to 18/19	FY 19/20 to 23/24	FY 24/25 to 28/29
Revenue Requirement	$9,596,914	$11,117,910	$13,228,877
Total Impervious Sq Ft	291,625,467	291,625,467	291,625,467
Yearly Rate ($/Sq Ft)	$0.0329	$0.0381	$0.0454
Monthly Rate ($/Sq Ft)	$0.0027	$0.0032	$0.0038
Average Yearly Single Family Bill	$118.93	$137.78	$163.94
Average Monthly Single Family Bill	$9.91	$11.48	$13.66

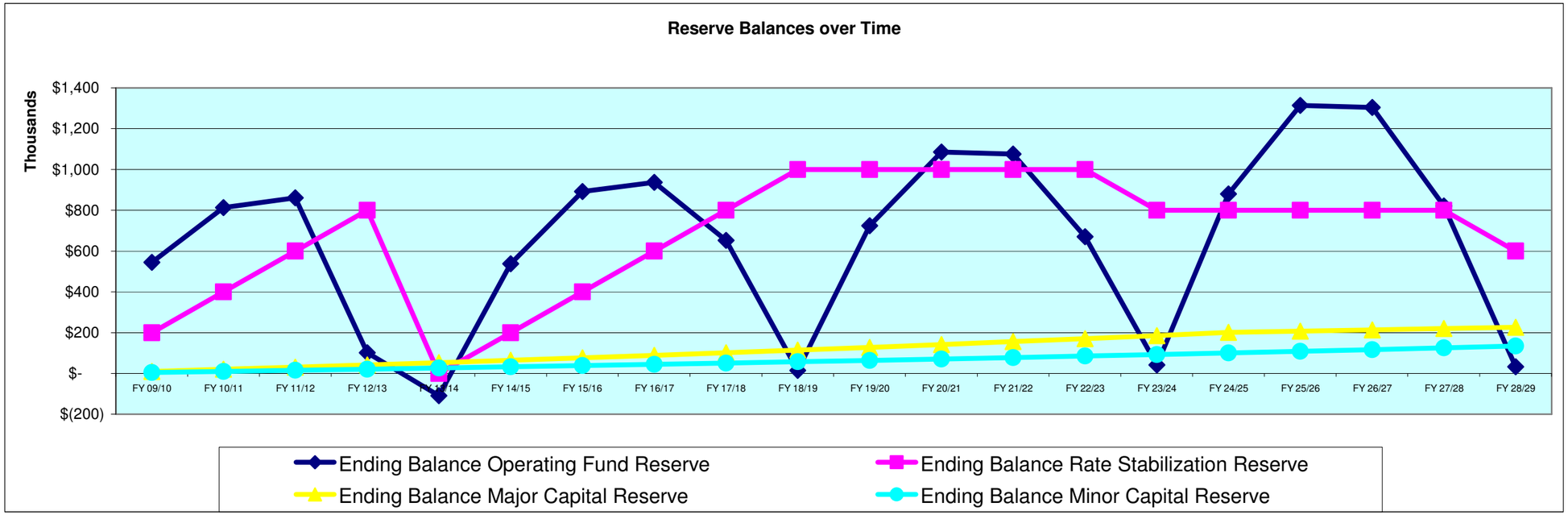
As shown by analyzing the operating reserve in Figure 8-1, the operating reserve balance rises and falls due to the City's decision to set rates for 5-year periods. For the first 2 or 3 years the operating reserve increases, since the storm water rate is slightly above the rate needed to fully cover expenses. However in the later half of the 5-year period, the operating reserve decreases since the rate is insufficient to cover all expenses.

For the first 5-year period (FY 2009–2010 to FY 2013–2014), the rate stabilization reserve increases until FY 2012–2013. The large decrease in FY 2013–2014 is due to a transfer from the rate stabilization reserve to the operating reserve to cover shortfalls in revenue. This is a necessary depletion of the rate stabilization reserve in order to cover shortfalls in revenue during the first 5 years. In the subsequent three 5-year periods, smaller transfers from the rate stabilization reserve may be required.

Figure 8-1
Long-Range Financial Plan

Reserve	FY 09/10	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16	FY 16/17	FY 17/18	FY 18/19
Ending Balance Operating Fund Reserve	$545,208	$812,416	$861,030	$101,358	$(109,299)	$537,607	$891,856	$936,815	$651,662	$14,530
Ending Balance Rate Stabilization Reserve	$200,000	$400,000	$600,000	$800,000	–	$200,000	$400,000	$600,000	$800,000	$1,000,000
Ending Balance Major Capital Reserve	$10,000	$20,300	$30,909	$41,836	$53,091	$64,684	$76,625	$88,923	$101,591	$114,639
Ending Balance Minor Capital Reserve	$5,000	$10,148	$15,452	$20,916	$26,543	$32,340	$38,310	$44,459	$50,793	$57,314
Total All Reserves	$760,208	$1,242,864	$1,507,392	$964,110	$(29,665)	$834,630	$1,406,790	$1,670,197	$1,604,046	$1,186,483

Reserve	FY 19/20	FY 20/21	FY 21/22	FY 22/23	FY 23/24	FY 24/25	FY 25/26	FY 26/27	FY 27/28	FY 28/29
Ending Balance Operating Fund Reserve	$723,449	$1,084,942	$1,075,253	$669,418	$41,218	$880,086	$1,313,653	$1,303,779	$820,591	$32,704
Ending Balance Rate Stabilization Reserve	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$800,000	$800,000	$800,000	$800,000	$800,000	$600,000
Ending Balance Major Capital Reserve	$128,078	$141,920	$156,178	$170,863	$185,989	$201,569	$207,616	$213,844	$220,260	$226,867
Ending Balance Minor Capital Reserve	$64,034	$70,955	$78,084	$85,426	$92,989	$100,779	$108,802	$117,066	$125,578	$134,345
Total All Reserves	$1,915,561	$2,297,818	$2,309,514	$1,925,707	$1,120,196	$1,982,433	$2,430,071	$2,434,690	$1,966,428	$993,917



9.0 RECOMMENDATIONS AND IMPLEMENTATION PLAN

The previous eight report sections presented the investigations undertaken and the resultant findings that make up the primary framework for Norman's SWMP. This section expands on several of the key findings to formalize recommendations and provide an "Implementation Plan" (see Section 9.11 below) for future actions that will help improve storm water management in Norman. By necessity, storm water management will always be an ongoing activity at the City and the recommendations made in this report will provide the direction needed to move beyond the SWMP in the future. Some of these recommendations would be best implemented by City staff while others may require the City to obtain assistance from consultants and/or other professionals. Again, these recommendations align with many of the SWMP investigations completed since future actions will be a natural outgrowth of these investigations.

9.1 GENERAL

- Continue to involve stakeholders in all aspects of the SWMP, including implementation.
- Refine storm water and watershed protection goals and needs in the future based on continued public involvement and new studies.
- Develop a formal public outreach campaign or program to continue educating citizens about the City's storm water needs, the importance of obtaining adequate funding to meet those needs, and the general support needed to sustain a viable storm water program at the City level. Some of these primary needs include reliable funding mechanisms such as GO bonding and a storm water utility, MS4 permit compliance requirements, a storm water CIP program, basic operations and maintenance of the storm water system, enhanced maintenance to keep streams clear of debris and trash, enhanced maintenance of detention facilities, acquisition of easements and rights-of-way, and dam safety.

9.2 WATERSHED AND STREAM ASSESSMENTS (SECTION 3)

- Incorporate all of the digital and reference data developed during the SWMP project into the City's GIS and other records. This includes the GIS map overlay system developed to display geo-reference field photo locations taken at strategic creek locations during reconnaissance with the link to view the photos by clicking on the location symbol. Establish a process to systematically update this data and information.
- Update the photo library and GIS layers with new photos of critical areas in the future during maintenance inspections or other field work.
- Inspect and monitor the stream erosion areas identified on a regular schedule (e.g., every 1 or 2 years) until streams are stabilized with adequate improvements.
- Assess the Little River, Rock Creek, and Dave Blue Creek corridors in more detail if significant and contiguous stream access can be obtained.

9.3 HYDROLOGIC MODELING FOR LEVEL 2 AND OTHER STREAMS (SECTION 4)

- Develop modeling for Level 2 (initially) and Level 3 streams that is consistent with the Level 1 modeling performed for the master plan, which used the most up-to-date data and methods. Advances in modeling technology (new versions of HEC-HMS or HEC-RAS) should be integrated as appropriate.
- Continually update modeling needs and change priorities to fit those needs.
- Update drainage area delineations based on the City's 2007 topographic data including resolution of all watershed boundary discrepancies. Update both the GIS layer with the watershed boundaries and the areas in the hydrologic models.
- Update all Level 2 hydrologic models to use HEC-HMS (many are still HEC-1). Also update all HEC-HMS models to version 3.3 (current version at this time) or to the latest version in the future (this should not have any impact on the results of our modeling, which was done with version 3.1.0).
- Update models to include consistent design storm rainfalls (totals and distributions) based on the USGS WRI 99-4232 and the Frequency Storm rainfall distribution (storm centering at 50%).
- Use a standard procedure for design rainfall areal reductions in all modeling of watersheds greater than 9.6 square miles. No areal reduction should be used for smaller watersheds.
- Use standard procedures (NRCS curve numbers) for rainfall loss rate development in all modeling. This includes both the derivation and application of the parameters.
- Use standard procedures for the development of unit hydrograph lag times and update the lag times in the Level 2 and other models as needed.
- Establish standard procedures for hydrograph routing that consider floodplain storage such as the Modified Puls Method. This should be implemented wherever corresponding HEC-RAS models are available.
- Incorporate regional detention facilities into the hydrologic models if an ongoing maintenance program is established (thereby assuring their proper function) and the facilities measurably reduce downstream discharges.

9.4 HYDRAULIC MODELING FOR LEVEL 2 AND OTHER STREAMS (SECTION 4)

- Develop modeling for Level 2 (initially) and Level 3 streams that is consistent with Level 1 modeling (as modified with future advancements) which used the most up-to-date data and methods.
- Continually update modeling needs and change priorities to fit those needs.
- Update flows based on any modifications to the hydrologic models.

- Create updated cross sections based on the City's 2007 topographic data that are fully georeferenced. This will ensure that the latest topography is used and will greatly facilitate accurate floodplain mapping. At a minimum, a georeferenced cross section layer containing all of the cross sections (some locations may have to be estimated if new cross sections are not generated) for each Level 2 model should be created. Fully georeferenced cross section will greatly facilitate floodplain mapping, model updates and the use of the models for development purposes.
- Update roughness coefficients along the streams and in the adjacent overbank areas to better match current existing conditions.
- Review and update bridge/culvert modeling as needed. Structures in models that were converted from HEC-2 should receive special attention.
- Revise the junction modeling for the Brookhaven Creek model. The junctions in the HEC-RAS model received from the City were improperly converted from a previous HEC-2 model yielding slightly conservative water surface elevations.

9.5 CRITERIA MANUAL UPDATES

- Develop a new Drainage Criteria Manual that includes the following:
  - Update design rainfall totals from TP-40/Hydro-35 to USGS WRI 99-4232.
  - Document aerial reduction procedures (most of the City, especially in the urban areas would not need to worry about areal reduction since the watersheds are smaller than 9.6 square miles).
  - Document standard procedure for design rainfall aerial reductions.
  - Document standard procedures for rainfall loss rate development.
  - Document the unit hydrograph methodology standards.
    - Specify the unit hydrograph methodology to be used for modeling – NRCS, Snyder, or either.
    - Document standard procedures used for the development of unit hydrograph lag times.
  - Document standard procedures for hydrograph routing that specify the use of Modified Puls routing where hydraulic models are available.
  - Require full buildout peak discharges for new developments and make necessary changes to City policy, the subdivision regulations, and drainage criteria manual.
- Develop a Storm Water Quality Manual (or incorporate into Drainage Criteria Manual).
- Develop an Erosion Control Manual.

9.6 MODEL MANAGEMENT

- The City of Norman has invested a significant amount in the development of hydrologic and hydraulic models a part of the SWMP. Since the master plan will not directly result in an update of the FEMA floodplains, it will be incumbent upon the City to maintain available and up-to-date copies of these models if they are to be of use to the community as a whole. There are varying levels of solution that can be implemented in order to facilitate the management and distribution of models and supporting data. The following recommendations outline a basic approach that would provide for easy access to the models by City staff and a procedure for tracking updates to these models.
  - Develop an Arc Hydro-compliant stream network and subbasin geodatabase and provide hyperlinks to an associated directory structure built to contain the models for each watershed. Basic tools to store and access the models through these hyperlinks could be adapted from recent systems developed by other entities. There are a variety of options that could be built-on to such an existing system to allow the city to track access to the models, enforce standards, document model changes, etc.).
    - Internal Option – Deploy on an internal server that will allow City staff to store, access and distribute models as needed.
    - External Option – Deploy on a web server and allow the engineering community to access the system and download models for selected stream reaches or watersheds.
  - Include a "metadata" file (can be a simple text or XML file) to document the origin and history/evolution of each hydrologic and hydraulic model.

9.7 FEMA LOMRs

- Submit Letters of Map Revision (LOMRs) to FEMA for the Level 1 streams studied during the SWMP. If other streams are studied or updated, those updates should be submitted as FEMA LOMRs at that time.
- Incorporate regional detention facilities into the hydrologic models if an ongoing maintenance program is established (thereby assuring their proper function) and the facilities measurably reduce downstream discharges.

9.8 STORM WATER PROBLEMS AND SOLUTIONS (SECTIONS 5 AND 6)

- Stream flooding, stream erosion, and local drainage.
  - Continue to monitor and document conditions associated with the problems identified in the SWMP until CIP improvements solve or mitigate them.
  - Review and update solutions prioritization on an annual, two, or five year cycle.
  - Incorporate any new problems and possible solutions on a continuing basis.
  - Continue to explore ways to integrate solutions to address multiple problem types and incorporate greenway opportunities.
  - Develop collaborative agency partnerships to assist in project funding and cooperation.
  - Use stream equilibrium and other geomorphological principals for stream erosion project designs.
  - Any update to the SWMP in the Little River corridor needs to be performed in concert with a roadway planning study as the numerous creek crossings and roadway lengths across the wide Littler River floodplain warrant special consideration in this area.
- Water quality.
  - Maintain awareness and knowledge of all water quality monitoring being carried out in watersheds that originate in, or flow through, the City of Norman.

- Develop collaborative agency partnerships to assist in project funding and cooperation.
- Assure compliance with requirements of the MS4 Program and the City's MS4 OPDES storm water permit.
- Continue to follow and monitor information related to the ODEQ Lake Thunderbird Watershed Management Plan development and provide input when allowed.
- Comply with recently developed Canadian River Bacteria TMDL requirements as the City may be required to participate in a coordinated monitoring program or develop their own to document the effectiveness of their selected BMPs and to demonstrate progress toward attainment of water quality standards. Reporting requirements include documentation of actions taken by the permittee that affect MS4 storm water discharges to Bishop Creek and the Canadian River.
- Increase monitoring of erosion controls at construction sites to assure compliance with regulations.
- See items for Stream Planning Corridors as well as structural and nonstructural storm water controls in Section 9.9 below.

• Capital Improvements Program.

- Consider developing program staff under the direction of the Director of Public Works to manage the SWMP CIP program and associated projects. These staff can be part of an existing group or make up a new group at the City. If the amount of work is variable, cyclic, or heavy at times, it is recommended that staffing levels target the steady work flow and have consultants assist during times of high work flow.
- Assuming that funding is available, complete construction the identified CIP projects over a 20- to 25-year period.

9.9 KEY ISSUES (SECTION 7)

• Stream Planning Corridors and 100-year full buildout floodplain dedications as well as structural and nonstructural storm water quality controls.

- Dedicate Stream Planning Corridors (SPCs) and/or the 100-year full buildout floodplains to the City of Norman by easement or title for streams located in the Lake Thunderbird watershed that have a drainage area greater than 40 acres.
  - Prohibit development or significant land disturbance in the SPCs and/or 100-year full buildout floodplain. Exemptions should include items such as, but not limited to, maintenance activities, greenway trails, road crossings, utilities, and stream stabilization measures.
  - Require additional stream-side buffers of 15 ft to each side of steams with drainage areas greater than 40 acres that are located in the Lake Thunderbird watershed and also in Suburban Residential and Country Residential areas as defined in the Norman 2025 Plan including subsequent updates to the comprehensive plan as adopted by the City Council.
- Require that water quality facilities be constructed to capture and treat runoff from all proposed developments in the City of Norman that exceed 1 acre (or some other size selected by the City) in size. The runoff "capture and treatment volume" should be set to 0.5 inch of runoff from the development area unless specified otherwise for a special condition.
  - Allow very small developments less than 1 acre in size or some other size limit to pay into a regional detention/water quality program in lieu of building very small water quality structures. The City's present regional detention program should be broadened to include this water quality fee in lieu process.
  - Allow and encourage low impact development techniques such as rain gardens and biofilters to provide a portion or all of their storm water quality control requirements subject to the developer providing sufficient technical justification for the techniques.
  - For developments that do not dedicate the SPC or full buildout 100-year floodplain by virtue of obtaining a variance, the runoff capture and treatment volume for their development area should be increased to 0.7 inch of runoff.
- Allow limited variances for special conditions/situations that would utilize alternative approaches that could be shown to achieve similar water quality, flood control, and recreational opportunity. In situations where there is a clearly defined riparian corridor of environmental significance and/or flood prone soils, it should be relatively more difficult to obtain such a variance. However, obtaining such variances should be less difficult in situations where a riparian corridor does not exist and the subject waterway flows through an area that has experienced significant past disturbance or change from natural conditions (such as past agricultural activities and/or activities associated with residential, commercial, transportation, or industrial uses).
- Implement nonstructural storm water quality controls in addition to SPCs, including a program to educate the public on fertilizer use, a program to control the overuse of fertilizers, a procedure to ensure proper septic system installation and operation, and a continuation of development density (and impervious cover) limitations in the Lake Thunderbird watershed.
- Require the following compliance measures if development or significant land disturbance occurs within the stream banks of a stream in the City:
  - USACE's 404 permitting documentation and proof of permit to be submitted to the City prior to plat approval,
  - Riparian stream corridor mitigation will be required (tree replacement, re-vegetation, stream stabilization using bio-engineering techniques, etc.), and
  - Inlet and outlet structures will be provided as needed to incorporate erosion protection.

• Acquisition of drainage easements and rights-of-way along streams and detention facility areas.

- Obtain a mixture of drainage easements, rights-of-way, rights-of-entry, and reaches of "no action," depending on the situation/conditions in existing developments.
- Develop a plan and begin to obtain drainage easements and/or rights-of-way (as needed) in Level 1 and 2 streams and for storm water detention facilities where access is needed for continuous/routine maintenance activities. For streams, the amount of easement or right-of-way would be as needed based on specific site conditions but, in general, would include a width of stream extending bank to bank plus 10 ft on each side of the stream channel. This can include those areas where storm water CIP projects have been identified if the maintenance need justifies obtaining the easements in advance of designing and constructing the proposed CIP project.

- Enhanced maintenance of creeks and storm water detention facilities.
  - Consistent with available funding, a City stream maintenance program should be implemented over the next 2 or 3 years consistent with the acquisition of easements, rights-of-way, rights-of-way, rights-of-entry, and reaches of "no action," depending on the situation/conditions. Maintenance should focus on those stream reaches and/or detention facility areas where capital improvements are constructed in order to protect those investments. The City should also consider outsourcing some, or all, of the maintenance activities if it is advantageous, especially while a City's program is ramping up. The City should also focus on detention facilities in which dam maintenance may become a safety issue.

- Dam safety.
  - The City should investigate and identify, to the extent possible, the responsible parties for the inspection, maintenance, and overall safety of dams that are judged to be a potential safety hazard. This work should be undertaken beginning with the dams judged to have the greatest public safety risk. An inventory and prioritization method should be developed at the beginning of the investigative work.
  - While stopping short of taking over dam ownership, liability, and routine maintenance from Property Owner Associations (POAs) or other owners, on a case by case basis the City should take over the inspection and maintenance of dams that pose significant safety concerns. POAs should maintain the general/routine mowing and small scale maintenance responsibilities while the City undertakes the more critical inspection and maintenance responsibilities.
  - For any dam for which the City considers taking over certain inspection and maintenance responsibilities, it is recommended that the City first study and determine the prevailing conditions for such dam and its appurtenances. Should the City take over inspection, maintenance, and upgrade responsibilities for the structures, it should first be determined what actions they or the present owners might have to take to bring such structures into state dam safety compliance. Such actions could include determining whether the dam structures, including emergency spillways, require modifications to strengthen them against failure or breach. Another important aspect is whether any of the dams need an emergency action plan to reduce the risk to lives and property that can result from dam failure.

9.10 STORM WATER FINANCING (SECTION 8)

- Establish long-range funding options for storm water such as those presented in Section 8.
- Educate the public on the need to have adequate funding or storm water management as described under the general recommendations.

9.11 IMPLEMENTATION PLAN

An implementation plan is presented here that provides the actions that the City of Norman can take to advance the work that was performed to develop the City's Storm Water Master Plan. In some instances, it may overlap or repeat certain aspects of the recommendations provided above, but that is to be expected as these implementation actions reflect the work that was performed as well as the recommendations. These implementation items focus on the immediate future covering the next few months and years although some items may unfold for many years to come.

The successful implementation of the storm water master plan and the associated future actions needed to implement the plan will rely heavily on additional public input and support. Additional meetings with stakeholders, including or such as the Storm Water Task Force, will help greatly in determining the specifics of educating and involving the public about future storm water master plan activities. Without the support of the public and approval of the funding needed, implementation of the master plan will be severely limited.

In listing these key implementation actions below, it is assumed that funding, such as the storm water utility and general obligation bonding described in this SWMP report (Section 8), will eventually become available to allow the City to pursue the actions. Additionally, the implementation actions can be taken out of the order given below as the ultimate order of these actions will depend on many events that have yet to occur.

General

1. Develop a formal public outreach campaign or program to continue educating citizens about the City's storm water needs, the importance of obtaining adequate funding to meet those needs, and the general support needed to sustain a viable storm water program at the City level. Some of these primary needs include reliable funding mechanisms such as GO bonding and a storm water utility, MS4 permit compliance requirements, a storm water CIP program, basic operations and maintenance of the storm water system, enhanced maintenance to keep streams clear of debris and trash, enhanced maintenance of detention facilities, acquisition of easements and rights-of-way, and dam safety.

Financing

2. Develop and carry out a strategic work plan for a citizen vote on the proposed storm water utility as described in Section 8. The City must also decide whether establishment of the master account file and other key billing logistics will be worked out before or after the citizen vote (assuming it passes). Regardless, preliminary discussions on billing and administration requirements should begin.

3. Develop and carry out a strategic work plan for a citizen vote on the proposed general obligation bond program as described in Section 8.

Data Management

4. Incorporate all of the digital and reference data developed during the SWMP project into the City's GIS and other records. This includes the GIS map overlay system developed to display geo-reference field photo locations taken at strategic creek locations during reconnaissance with the link to view the photos by clicking on the location symbol. Establish a process to systematically update this data and information.

Criteria Manuals

5. Update the City's Drainage Criteria Manual with SWMP findings and recommendations.

6. Develop a Storm Water Quality Criteria Manual with SWMP findings and recommendations.

7. Develop an Erosion Control Manual aimed at preventing erosion problems associated with construction.

Hydrology and Hydraulic Analyses

8. Following detailed recommendations in Section 9, develop detailed modeling for Level 2 (existing models used, some becoming outdated) and Level 3 (future detailed) streams consistent with the detailed Level 1 modeling performed for the master plan, which used the most up-to-date topographic and other data as well as hydrologic/hydraulic modeling methods. Advances in modeling technology (new versions of HEC-HMS or HEC-RAS) should be integrated as appropriate. This should be done prior to, or at the beginning of, developing designs for CIP projects.

9. Institute a storm water hydrologic and hydraulic model management system to maintain and facilitate distribution of the latest models to users. This system should be network and/or internet based to minimize the overall effort.

10. Submit Letters of Map Revision (LOMRs) to FEMA for the Level 1 streams studied during the SWMP. If other streams are studied or updated, those updates should be submitted as FEMA LOMRs at that time.

Water Quality

11. Meet with the cities of Moore and Oklahoma City to explore ways to improve water quality and preserve Lake Thunderbird's water quality.

12. Meet with the Oklahoma Department of Environmental Quality (ODEQ) and get updates on the Lake Thunderbird Watershed Management Plan development and the Canadian River TMDL status. Assign a City coordinator to follow the progress and status of these two programs as well as the MS4 program as compliance activities associated with these three programs will impact water quality in Norman for the foreseeable future.

13. Dedicate Stream Planning Corridors (SPCs) and/or the 100-year full buildout floodplains to the City of Norman by easement or title for streams located in the Lake Thunderbird watershed that have a drainage area greater than 40 acres.
    - Prohibit development or significant land disturbance in the SPCs and/or 100-year full buildout floodplain. Exemptions should include items such as, but not limited to, maintenance activities, greenway trails, road crossings, utilities, and stream stabilization measures.
    - Require additional stream-side buffers of 15 ft to each side of steams with drainage areas greater than 40 acres that are located in the Lake Thunderbird watershed and also in Suburban Residential and Country Residential areas as defined in the Norman 2025 Plan including subsequent updates to the comprehensive plan as adopted by the City Council.

14. Require that water quality facilities be constructed to capture and treat runoff from all proposed developments in the City of Norman that exceed 1 acre (or some other size selected by the City) in size. The runoff "capture and treatment volume" should be set to 0.5 inch of runoff from the development area unless specified otherwise for a special condition.
    - Allow very small developments less than 1 acre in size or some other size limit to pay into a regional detention/water quality program in lieu of building very small water quality structures. The City's present regional detention program should be broadened to include this water quality fee in lieu process.
    - Allow and encourage low impact development techniques such as rain gardens and biofilters to provide a portion or all of their storm water quality control requirements subject to the developer providing sufficient technical justification for the techniques.
    - For developments that do not dedicate the SPC or full buildout 100-year floodplain by virtue of obtaining a variance, the runoff capture and treatment volume for their development area should be increased to 0.7 inch of runoff.

15. Allow limited variances for special conditions/situations that would utilize alternative approaches that could be shown to achieve similar water quality, flood control, and recreational opportunity. In situations where there is a clearly defined riparian corridor of environmental significance and/or flood prone soils, it should be relatively more difficult to obtain such a variance. However, obtaining such variances should be less difficult in situations where a riparian corridor does not exist and the subject waterway flows through an area that has experienced significant past disturbance or change from natural conditions (such as past agricultural activities and/or activities associated with residential, commercial, transportation, or industrial uses).

16. Implement nonstructural storm water quality controls in addition to SPCs, including a program to educate the public on fertilizer use, a program to control the overuse of fertilizers, a procedure to ensure proper septic system installation and operation, and a continuation of development density (and impervious cover) limitations in the Lake Thunderbird watershed.

17. Require the following compliance measures if development or significant land disturbance occurs within the stream banks of a stream in the City:
    - USACE's 404 permitting documentation and proof of permit to be submitted to the City prior to plat approval,
    - Riparian stream corridor mitigation will be required (tree replacement, re-vegetation, stream stabilization using bio-engineering techniques, etc.), and
    - Inlet and outlet structures will be provided as needed to incorporate erosion protection.

18. Establish an education outreach program for, and voluntary compliance with, fertilizer application controls in City areas located in the Lake Thunderbird watershed.

19. Continually assess the water quality of Lake Thunderbird and update or modify activities and controls to protect this important water supply.

CIP/Easements/Maintenance

20. Establish an ongoing program activity to inspect and monitor the stream erosion areas identified on a regular schedule (e.g., every 1 or 2 years) until streams are stabilized with adequate improvements.

21. Develop a plan and begin to obtain drainage easements and/or rights-of-way (as needed) in Level 1 and 2 streams and for storm water detention facilities where access is needed for continuous/routine maintenance

activities. For streams, the amount of easement or right-of-way would be as needed based on specific site conditions but, in general, would include a width of stream extending bank to bank plus 10 ft on each side of the stream channel. This can include those areas where storm water CIP projects have been identified if the maintenance need justifies obtaining the easements in advance of designing and constructing the proposed CIP project.

22. Develop an analysis outlining the "pros and cons" of obtaining the FEMA floodway as drainage easement or right-of-way along various reaches of Imhoff Creek as part of a long-term solution to flooding and limited access along this creek.

23. A citywide stream maintenance program should be implemented over the next 2 or 3 years consistent with the acquisition of easements, rights-of-way, rights-of-way, rights-of-entry, and reaches of "no action," depending on the situation/conditions. Obtaining easements and rights-of-way is the preferred method of gaining routine access to the city's streams. Maintenance should focus on those stream reaches and/or detention facility areas where capital improvements are constructed in order to protect those investments. The City should also consider outsourcing some, or all, of the maintenance activities if it is advantageous, especially while a City's program is ramping up. The City should also focus on detention facilities in which dam maintenance may become a safety issue.

24. As funds permit, preliminary designs along with refined construction cost estimates should be developed for the top priority projects.

25. Consider developing program staff under the direction of the Director of Public Works to manage the SWMP CIP program and associated projects. These staff can be part of an existing group or make up a new group at the City. If the amount of work is variable, cyclic, or heavy at times, it is recommended that staffing levels target the steady work flow and have consultants assist during times of high work flow.

26. The CIP projects have been identified, described (functionality/character/costs), and prioritized. In order of their priority, a list should be developed outlining the specific projects (and therefore the total budget outlay) that would be funded through general obligation bonds (options investigated ranged from $30 to $40 million) versus those that would be funded through a storm water utility (financing investigated ranged from $43 to $53 million) over a 20-year period. Preliminary discussions have been held on this issue but it should be finalized.

27. Develop a future roadway improvement plan for Franklin Road east of Interstate Highway 35 that includes a significant drainage or flood prevention study element as this roadway and many of its intersecting roadways are significantly flood prone for several miles of roadway length.

Dams

28. The City should investigate and identify, to the extent possible, the responsible parties for the inspection, maintenance, and overall safety of dams that are judged to be a potential safety hazard. This work should be undertaken beginning with the dams judged to have the greatest public safety risk. An inventory and prioritization method should be developed at the beginning of the investigative work.

29. While stopping short of taking over dam ownership, liability, and routine maintenance from Property Owner Associations (POAs) or other owners, on a case by case basis the City should take over the inspection and maintenance of dams that pose significant safety concerns. POAs should maintain the general/routine mowing and small scale maintenance responsibilities while the City undertakes the more critical inspection and maintenance responsibilities.

30. For any dam for which the City considers taking over certain inspection and maintenance responsibilities, it is recommended that the City first study and determine the prevailing conditions for such dam and its appurtenances. Should the City take over inspection, maintenance, and upgrade responsibilities for the structures, it should first be determined what actions they or the present owners might have to take to bring such structures into state dam safety compliance. Such actions could include determining whether the dam structures, including emergency spillways, require modifications to strengthen them against failure or breach. Another important aspect is whether any of the dams need an emergency action plan to reduce the risk to lives and property that can result from dam failure.

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Storm Water Master Plan
City of Norman
Cleveland County, Oklahoma

October 2009

Appendix A

Citywide Subarea and Stream Reach Data

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
BC-1	---	6323.6	31.8	1143.8	0.29	0.7	43.5	7.7	47.5	0.6	2	0	Natural	AE	Optimal
BC-2	BC-1	5179.8	32.8	1041.3	0.36	0.0	39.5	5.7	54.2	0.5	6	6	Natural	AE	Suboptimal
BC-3	BC-2	4138.5	36.1	455.8	0.30	0.0	32.7	5.2	61.6	0.5	0	0	Natural	AE	Suboptimal
BC-4	BC-3	2276.6	42.9	101.9	0.40	0.0	19.7	4.9	74.5	0.9	5	0	Natural	AE	Suboptimal
BC-5	BC-4	1514.9	39.8	132.7	0.44	0.0	15.8	1.9	82.2	0.1	0	5	Natural	AE	Optimal
BC-6	BC-5	1382.2	39.9	74.5	0.42	0.0	15.6	1.8	82.6	0.0	0	5	Natural	AE	Suboptimal
BC-7	BC-6	1307.8	39.9	546.7	0.45	0.0	14.7	1.1	84.2	0.0	6	6	Natural/Concrete	AE	Suboptimal
BC-8	BC-7	477.1	42.5	314.8	0.39	0.0	0.8	0.0	99.2	0.0	3	25	Concrete	AE	Suboptimal
BC-9	BC-8	162.3	25.7	162.3	0.48	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
BHC-1	---	2641.2	34.3	654.4	0.28	2.6	38.7	19.0	38.5	1.2	5	2	Natural	AE	Optimal
BHC-2	BHC-1	1986.8	37.1	70.1	0.24	2.5	36.4	8.9	50.6	1.6	0	8	Natural	AE	Suboptimal
BHC-3	BHC-2	1916.7	37.0	287.1	0.25	2.2	34.8	8.9	52.4	1.7	1	21	Natural/Concrete	AE	Suboptimal
BHC-4	BHC-3	1629.6	35.3	294.8	0.32	2.5	24.1	9.7	61.7	2.0	7	8	Natural	AE	Suboptimal
BHC-5	BHC-4	1334.8	31.6	522.1	0.38	3.1	15.4	9.3	71.9	0.3	11	16	Natural	AE	Suboptimal
BHC-6	BHC-5	812.7	26.8	119.7	0.46	1.7	5.0	1.4	91.9	0.0	0	15	Natural	AE	Poor
BHC-7	BHC-6	247.2	27.9	247.2	0.49	0.0	0.0	0.0	100.0	0.0	1	---	---	---	---
CC-1	---	260.7	6.0	248.7	0.24	0.0	44.2	0.0	55.8	0.0	0	0	Natural	X	Optimal
CC-2	CC-1	12.1	10.2	12.1	0.21	0.0	64.9	0.0	35.1	0.0	0	---	---	---	---
CC-3	---	396.4	5.0	307.6	0.24	0.0	42.1	2.7	55.2	0.0	0	0	Natural	X	Optimal
CC-4	CC-3	88.8	6.8	88.8	0.24	0.0	38.1	0.0	61.9	0.0	0	---	---	---	---
CC-5	CC-36	186.1	4.9	155.0	0.24	0.0	28.9	3.9	66.7	0.5	0	0	Natural	X	Optimal
CC-6	CC-5	31.1	5.0	31.1	0.24	0.0	13.1	0.0	86.9	0.0	0	---	---	---	---
CC-7	CC-36	358.8	2.8	126.5	0.24	0.0	39.7	1.7	58.6	0.0	0	0	Natural	X	Optimal
CC-8	CC-7	232.3	2.6	193.9	0.24	0.0	37.4	0.3	62.3	0.0	0	0	Natural	X	Optimal
CC-9	CC-8	38.4	1.4	38.4	0.23	0.0	40.9	0.0	59.1	0.0	0	---	---	---	---
CC-10	CC-30	76.8	4.6	30.2	0.24	0.0	27.9	0.0	72.1	0.0	0	0	Natural	X	Suboptimal
CC-11	CC-10	46.5	3.9	46.5	0.24	0.0	16.8	0.0	83.2	0.0	0	---	---	---	---
CC-12	CC-30	142.4	2.9	100.3	0.24	0.0	57.9	0.0	42.1	0.0	0	0	Natural	X	Marginal
CC-13	CC-12	42.1	2.5	42.1	0.24	0.0	53.8	0.0	46.2	0.0	0	---	---	---	---
CC-14	CC-22	111.9	3.5	65.6	0.23	0.0	51.7	0.0	48.3	0.0	0	0	Natural	X	Suboptimal
CC-15	CC-14	46.2	0.4	46.2	0.24	0.0	46.3	0.0	53.7	0.0	0	---	---	---	---
CC-16	CC-22	111.5	3.9	70.2	0.24	0.0	81.5	0.0	18.5	0.0	0	0	Natural	X	Suboptimal
CC-17	CC-16	41.2	3.1	41.2	0.24	0.0	91.6	0.0	8.4	0.0	0	---	---	---	---
CC-18	CC-22	484.3	0.8	145.7	0.23	0.0	68.5	0.0	31.5	0.0	0	0	Natural	X	Suboptimal
CC-19	CC-18	338.6	0.7	338.6	0.24	0.0	66.8	0.0	33.2	0.0	0	---	---	---	---
CC-20	CC-22	71.6	0.2	23.9	0.24	0.0	60.4	2.0	37.6	0.0	0	0	Natural	X	Suboptimal
CC-21	CC-20	47.6	0.3	47.6	0.24	0.0	68.0	0.0	32.0	0.0	0	---	---	---	---
CC-22	CC-30	1559.6	1.3	191.5	0.24	0.0	64.3	1.8	33.9	0.0	0	0	Natural	A	Marginal
CC-23	CC-22	290.5	0.5	290.5	0.24	0.0	69.8	1.7	28.5	0.0	0	---	---	---	---
CC-24	CC-22	144.7	1.1	103.7	0.24	0.0	52.1	5.2	42.7	0.0	0	0	Natural	X	Marginal
CC-25	CC-24	40.9	1.1	40.9	0.24	0.0	23.3	0.1	76.6	0.0	0	---	---	---	---
CC-26	CC-22	86.4	0.6	38.4	0.23	0.0	57.3	0.0	42.7	0.0	0	0	Natural	X	Suboptimal
CC-27	CC-26	48.0	0.5	48.0	0.24	0.0	57.5	0.0	42.5	0.0	0	---	---	---	---
CC-28	CC-22	67.4	5.5	25.7	0.23	0.0	64.2	0.0	35.8	0.0	0	0	Natural	X	Suboptimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
CC-29	CC-28	41.7	5.0	41.7	0.24	0.0	66.3	0.0	33.7	0.0	0	---	---	---	---
CC-30	CC-36	2900.6	2.0	259.3	0.24	0.0	59.2	1.0	39.9	0.0	1	0	Natural	A	Marginal
CC-31	CC-30	862.5	2.4	377.2	0.24	0.0	54.5	0.0	45.5	0.0	0	0	Natural	X	Marginal
CC-32	CC-31	485.2	3.7	443.1	0.24	0.0	57.5	0.0	42.5	0.0	0	0	Natural	X	Suboptimal
CC-33	CC-32	42.1	6.3	42.1	0.24	0.0	33.3	0.0	66.7	0.0	0	---	---	---	---
CC-34	CC-36	125.9	0.2	99.1	0.24	0.0	44.0	0.0	56.0	0.0	0	0	Natural	X	Marginal
CC-35	CC-34	26.8	0.2	26.8	0.24	0.0	35.5	0.0	64.5	0.0	0	---	---	---	---
CC-36	---	3885.1	2.2	210.0	0.23	0.0	54.4	1.6	43.8	0.1	0	0	Natural	A	Optimal
CC-37	CC-36	103.8	2.8	60.8	0.24	0.0	54.9	1.7	43.5	0.0	0	0	Natural	X	Optimal
CC-38	CC-37	43.0	0.0	43.0	0.24	0.0	60.3	0.0	39.7	0.0	0	---	---	---	---
CC-39	---	1325.4	3.6	520.5	0.24	0.0	48.4	2.2	49.4	0.0	0	0	Natural	A	Suboptimal
CC-40	CC-39	804.9	4.0	543.1	0.24	0.0	51.0	0.8	48.2	0.0	0	0	Natural	A	Suboptimal
CC-41	CC-40	261.8	3.5	218.2	0.24	0.0	44.3	0.0	55.7	0.0	0	0	Natural	X	Optimal
CC-42	CC-41	43.6	2.0	43.6	0.24	0.0	35.4	0.0	64.6	0.0	0	---	---	---	---
CR-1	---	79.8	0.9	79.8	0.39	0.0	0.0	98.5	1.5	0.0	0	0	Natural	AE	Poor
CR-2	---	2948.5	6.5	2948.5	0.21	8.6	33.4	36.4	1.6	19.9	3	9	Natural	AE	Suboptimal
CR-3	---	1668.7	6.4	1668.7	0.31	1.0	58.2	28.3	9.9	2.7	2	10	Natural	AE	Optimal
CR-4	---	204.7	1.2	204.7	0.40	0.0	52.0	0.0	46.9	1.1	0	0	Natural	X	Optimal
DB-1	---	14150.6	4.3	171.4	0.26	0.0	57.7	2.7	38.6	0.9	0	0	Natural	A	Optimal
DB-2	DB-1	100.9	1.0	60.2	0.25	0.0	51.1	3.5	45.4	0.0	0	0	Natural	X	Optimal
DB-3	DB-2	40.7	0.2	40.7	0.24	0.0	27.1	0.0	72.9	0.0	0	---	---	---	---
DB-4	DB-1	158.1	2.8	93.1	0.25	0.0	50.1	5.7	44.2	0.0	0	0	Natural	X	Suboptimal
DB-5	DB-4	65.0	2.7	65.0	0.24	0.0	59.1	0.0	40.9	0.0	0	---	---	---	---
DB-6	DB-1	13214.4	4.3	114.4	0.29	0.0	58.2	2.5	38.5	0.9	0	0	Natural	A	Optimal
DB-7	DB-6	13100.0	4.3	392.2	0.25	0.0	58.2	2.5	38.5	0.9	0	0	Natural	A	Suboptimal
DB-8	DB-7	39.4	2.8	39.4	0.24	0.0	32.1	0.0	67.9	0.0	0	---	---	---	---
DB-9	DB-7	47.6	2.8	9.0	0.30	0.0	58.6	0.0	41.4	0.0	0	0	Natural	X	Marginal
DB-10	DB-9	38.6	3.4	38.6	0.26	0.0	56.8	0.0	43.2	0.0	0	---	---	---	---
DB-11	DB-7	8597.3	4.2	141.6	0.30	0.0	59.3	2.6	37.0	1.1	0	0	Natural	A	Suboptimal
DB-12	DB-11	1323.4	4.3	216.0	0.24	0.0	64.4	6.3	28.5	0.8	0	0	Natural	A	Suboptimal
DB-13	DB-12	1107.4	4.3	273.0	0.24	0.0	65.1	5.2	28.8	1.0	0	0	Natural	A	Marginal
DB-14	DB-13	834.4	3.5	283.3	0.25	0.0	69.3	3.0	26.4	1.3	0	0	Natural	X	Optimal
DB-15	DB-14	51.0	1.7	51.0	0.33	0.0	63.5	0.0	36.5	0.0	0	---	---	---	---
DB-16	DB-14	500.1	2.6	152.7	0.29	0.0	65.3	1.9	30.7	2.1	0	0	Natural	X	Optimal
DB-17	DB-16	347.4	2.9	250.8	0.34	0.0	56.9	0.0	40.0	3.1	0	0	Natural	X	Optimal
DB-18	DB-17	52.5	0.6	52.5	0.39	0.0	56.9	0.0	43.1	0.0	0	---	---	---	---
DB-19	DB-17	44.1	1.5	44.1	0.38	0.0	68.0	0.0	32.0	0.0	0	---	---	---	---
DB-20	DB-24	126.6	1.3	69.0	0.29	0.0	66.9	9.0	24.1	0.0	0	0	Natural	X	Poor
DB-21	DB-20	57.7	1.7	57.7	0.24	0.0	83.2	0.0	16.8	0.0	0	---	---	---	---
DB-22	DB-24	276.6	3.1	248.0	0.29	0.0	72.5	4.0	21.7	1.8	0	0	Natural	X	Suboptimal
DB-23	DB-22	28.6	5.5	28.6	0.39	0.0	44.8	0.0	55.2	0.0	0	---	---	---	---
DB-24	DB-11	7132.3	4.1	102.8	0.33	0.0	58.3	1.6	38.9	1.2	0	0	Natural	A	Suboptimal
DB-25	DB-24	1712.3	0.7	131.8	0.32	0.0	60.3	1.3	37.8	0.6	0	0	Natural	A	Suboptimal
DB-26	DB-25	1580.5	0.5	387.8	0.37	0.0	59.9	0.0	39.7	0.3	1	0	Natural	A	Suboptimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
DB-27	DB-26	537.3	0.6	456.9	0.38	0.0	52.3	0.0	47.4	0.3	0	0	Natural	A	Suboptimal
DB-28	DB-27	80.5	0.4	80.5	0.39	0.0	55.1	0.0	44.9	0.0	0	---	---	---	---
DB-29	DB-26	655.4	0.3	655.4	0.38	0.0	55.9	0.0	43.6	0.5	0	0	Natural	X	Marginal
DB-30	DB-24	4359.2	5.6	110.6	0.35	0.0	57.2	0.2	41.1	1.6	0	0	Natural	A	Marginal
DB-31	DB-30	4248.7	5.7	99.1	0.36	0.0	56.2	0.2	42.1	1.5	0	0	Natural	A	Marginal
DB-32	DB-31	44.9	0.0	44.9	0.39	0.0	37.8	0.0	62.2	0.0	0	---	---	---	---
DB-33	DB-31	67.1	2.7	22.0	0.39	0.0	40.7	0.0	59.3	0.0	0	0	Natural	X	Poor
DB-34	DB-33	45.0	1.5	45.0	0.41	0.0	25.6	0.0	74.4	0.0	0	---	---	---	---
DB-35	DB-31	240.6	3.3	57.5	0.37	0.0	65.3	0.0	34.2	0.4	0	0	Natural	X	Marginal
DB-36	DB-35	183.0	2.5	118.3	0.36	0.0	61.4	0.0	38.6	0.0	0	0	Natural	X	Optimal
DB-37	DB-36	64.7	0.7	64.7	0.38	0.0	73.8	0.0	26.2	0.0	0	---	---	---	---
DB-38	DB-41	869.2	1.4	103.7	0.36	0.0	70.7	0.4	28.7	0.2	0	0	Natural	A	Suboptimal
DB-39	DB-38	765.5	1.3	288.9	0.38	0.0	68.6	0.4	30.8	0.2	0	0	Natural	A	Optimal
DB-40	DB-39	476.6	2.0	476.6	0.38	0.0	66.0	0.0	34.0	0.0	0	---	---	---	---
DB-41	DB-31	2084.5	4.3	99.4	0.32	0.0	66.0	0.3	32.3	1.4	1	0	Natural	A	Marginal
DB-42	DB-41	268.7	3.6	205.3	0.34	0.0	68.0	0.0	31.3	0.7	2	0	Natural	X	Suboptimal
DB-43	DB-42	63.4	1.0	63.4	0.39	0.0	58.8	0.0	41.2	0.0	0	---	---	---	---
DB-44	DB-41	847.2	7.8	178.9	0.31	0.0	59.2	0.5	38.3	2.0	0	0	Natural	A	Optimal
DB-45	DB-44	668.3	9.4	556.3	0.40	0.0	56.1	0.6	43.1	0.2	6	1	Natural	X	Suboptimal
DB-46	DB-45	111.9	1.2	111.9	0.46	0.0	12.8	3.1	84.1	0.0	0	---	---	---	---
DB-47	DB-31	1608.7	8.6	394.7	0.34	0.0	40.4	0.0	57.6	2.0	3	0	Natural	A	Marginal
DB-48	DB-47	1214.0	10.0	279.7	0.37	0.0	31.4	0.0	66.3	2.3	1	7	Natural	AE	Suboptimal
DB-49	DB-48	185.6	19.4	143.2	0.35	0.0	45.7	0.0	45.2	9.1	0	2	Natural	X	Optimal
DB-50	DB-49	42.3	26.0	42.3	0.35	0.0	21.4	0.0	60.5	18.1	0	---	---	---	---
DB-51	DB-48	495.6	13.0	322.9	0.41	0.0	22.7	0.0	75.0	2.3	3	7	Natural	X	Suboptimal
DB-52	DB-51	17.2	23.2	17.2	0.43	0.0	43.5	0.0	56.5	0.0	0	---	---	---	---
DB-53	DB-51	155.5	7.2	113.6	0.38	0.0	32.0	0.0	60.7	7.4	0	1	Natural	X	Suboptimal
DB-54	DB-53	41.8	19.0	41.8	0.39	0.0	68.4	0.0	31.6	0.0	0	---	---	---	---
DB-55	DB-48	253.2	3.4	133.5	0.42	0.0	15.5	0.0	84.5	0.0	0	0	Natural	X	Optimal
DB-56	DB-55	119.7	4.6	119.7	0.41	0.0	13.3	0.0	86.7	0.0	0	---	---	---	---
DB-57	DB-31	103.9	4.1	60.9	0.37	0.0	79.6	0.0	20.3	0.1	0	0	Natural	X	Marginal
DB-58	DB-57	43.0	4.5	43.0	0.40	0.0	51.0	0.0	49.0	0.0	0	---	---	---	---
DB-59	DB-24	389.2	2.2	335.5	0.38	0.0	41.7	0.0	58.3	0.0	0	0	Natural	A	Suboptimal
DB-60	DB-59	53.7	0.9	53.7	0.41	0.0	12.1	0.0	87.9	0.0	0	---	---	---	---
DB-61	DB-24	37.7	2.7	3.0	0.31	0.0	73.7	1.1	25.2	0.0	0	0	Natural	X	Optimal
DB-62	DB-61	34.8	2.9	34.8	0.30	0.0	72.6	0.0	27.4	0.0	0	---	---	---	---
DB-63	DB-24	127.8	11.4	59.5	0.25	0.0	86.2	3.9	9.9	0.0	0	0	Natural	X	Optimal
DB-64	DB-63	68.3	14.0	68.3	0.28	0.0	81.5	0.0	18.5	0.0	0	---	---	---	---
DB-65	DB-7	3363.0	4.4	99.7	0.33	0.0	54.4	0.6	44.4	0.6	0	0	Natural	A	Suboptimal
DB-66	DB-65	98.8	7.2	57.3	0.25	0.0	93.2	2.4	4.4	0.0	0	0	Natural	X	Marginal
DB-67	DB-66	41.6	5.9	41.6	0.24	0.0	93.6	0.0	6.4	0.0	0	---	---	---	---
DB-68	DB-65	2792.0	4.2	224.7	0.28	0.0	50.0	0.0	49.2	0.8	0	0	Natural	A	Suboptimal
DB-69	DB-68	50.1	5.1	14.0	0.25	0.0	80.1	0.0	19.9	0.0	0	0	Natural	X	Suboptimal
DB-70	DB-69	36.0	6.5	36.0	0.32	0.0	72.3	0.0	27.7	0.0	0	---	---	---	---

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ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
DB-71	DB-68	978.4	4.0	228.6	0.31	0.0	53.4	0.0	46.1	0.5	0	0	Natural	A	Optimal
DB-72	DB-71	749.8	4.2	415.1	0.33	0.0	48.4	0.0	50.9	0.6	0	0	Natural	A	Optimal
DB-73	DB-72	334.8	4.6	290.4	0.37	0.0	48.8	0.0	49.8	1.4	2	0	Natural	X	Optimal
DB-74	DB-73	44.4	0.1	44.4	0.39	0.0	17.6	0.0	82.4	0.0	0	---	---	---	---
DB-75	DB-68	608.6	3.4	224.2	0.31	0.0	25.4	0.0	71.9	2.7	2	0	Natural	X	Optimal
DB-76	DB-75	82.4	5.5	82.4	0.41	0.0	2.4	0.0	91.0	6.6	0	---	---	---	---
DB-77	DB-75	302.1	2.6	109.3	0.25	0.0	28.2	0.0	70.1	1.7	0	0	Natural	X	Optimal
DB-78	DB-77	192.8	3.1	165.6	0.39	0.0	12.4	0.0	85.0	2.6	0	0	Natural	X	Marginal
DB-79	DB-78	27.2	0.0	27.2	0.45	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
DB-80	DB-68	930.2	4.4	197.6	0.26	0.0	51.5	0.0	48.5	0.0	0	0	Natural	A	Suboptimal
DB-81	DB-80	732.6	3.8	506.7	0.26	0.0	48.0	0.0	52.0	0.0	0	0	Natural	X	Optimal
DB-82	DB-81	225.9	1.9	215.6	0.36	0.0	16.1	0.0	83.9	0.0	0	0	Natural	X	Suboptimal
DB-83	DB-82	10.3	0.0	10.3	0.47	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
DB-84	DB-65	372.3	5.7	112.4	0.26	0.0	69.7	4.1	26.1	0.0	0	0	Natural	X	Suboptimal
DB-85	DB-84	260.0	6.3	191.4	0.24	0.0	65.7	2.6	31.7	0.0	0	0	Natural	X	Optimal
DB-86	DB-85	68.6	2.7	68.6	0.24	0.0	56.0	9.7	34.4	0.0	0	---	---	---	---
DB-87	DB-7	91.8	4.8	59.7	0.26	0.0	100.0	0.0	0.0	0.0	0	0	Natural	X	Marginal
DB-88	DB-87	32.0	3.1	32.0	0.24	0.0	100.0	0.0	0.0	0.0	0	---	---	---	---
DB-89	DB-7	568.8	5.9	370.9	0.26	0.0	68.0	9.7	22.2	0.0	0	0	Natural	X	Marginal
DB-90	DB-89	197.8	8.2	158.8	0.24	0.0	61.5	10.6	27.9	0.0	0	0	Natural	X	Suboptimal
DB-91	DB-90	39.0	8.3	39.0	0.23	0.0	67.2	3.9	28.9	0.0	0	---	---	---	---
DB-92	DB-1	156.6	4.1	116.2	0.27	0.0	56.9	0.0	43.1	0.0	0	0	Natural	X	Optimal
DB-93	DB-92	40.4	5.4	40.4	0.22	0.0	72.3	0.0	27.7	0.0	0	---	---	---	---
DB-94	DB-1	349.3	6.8	88.3	0.25	0.0	57.7	4.6	37.6	0.0	0	0	Natural	X	Optimal
DB-95	DB-94	261.0	7.4	221.4	0.24	0.0	56.3	6.2	37.5	0.0	0	0	Natural	X	Suboptimal
DB-96	DB-95	39.6	3.0	39.6	0.24	0.0	47.1	0.3	52.6	0.0	0	---	---	---	---
DB-97	---	154.5	5.9	112.3	0.22	0.0	37.5	10.1	47.1	5.4	0	0	Natural	X	Optimal
DB-98	DB-97	42.2	6.5	42.2	0.24	0.0	37.5	0.2	62.3	0.0	0	---	---	---	---
EC-1	LR-10	20938.4	1.6	20820.7	0.27	0.0	46.4	2.1	38.6	12.8	0	0	Natural	A	Suboptimal
EC-2	EC-1	117.8	0.4	117.8	0.26	0.0	77.5	0.0	22.5	0.0	0	---	---	---	---
ELR-1	---	19247.2	0.7	2249.9	0.28	0.1	51.2	5.7	42.7	0.3	4	0	Natural	A	Optimal
HC-1	---	2799.5	2.9	245.5	0.23	0.4	45.2	7.0	47.0	0.5	0	0	Natural	A	Suboptimal
HC-2	HC-1	390.3	1.1	340.0	0.23	0.0	39.5	4.0	54.8	1.6	0	0	Natural	X	Optimal
HC-3	HC-2	50.3	2.5	50.3	0.24	0.0	48.6	0.0	51.4	0.0	0	---	---	---	---
HC-4	HC-1	279.2	5.2	236.2	0.24	0.0	37.8	5.3	56.9	0.0	0	0	Natural	X	Suboptimal
HC-5	HC-4	43.0	3.1	43.0	0.24	0.0	26.9	0.0	73.1	0.0	0	---	---	---	---
HC-6	HC-1	1884.5	3.1	107.5	0.23	0.6	47.6	6.9	44.9	0.0	0	0	Natural	A	Suboptimal
HC-7	HC-6	452.5	1.7	380.2	0.24	0.1	42.3	9.5	48.0	0.0	0	0	Natural	X	Optimal
HC-8	HC-7	72.3	3.9	72.3	0.24	0.0	51.3	1.7	46.9	0.0	0	---	---	---	---
HC-9	HC-6	1310.1	3.4	226.4	0.23	0.8	48.7	5.9	44.6	0.0	0	0	Natural	A	Optimal
HC-10	HC-9	300.1	3.9	252.6	0.24	3.0	48.3	6.1	42.6	0.0	1	0	Natural	X	Suboptimal
HC-11	HC-10	47.5	4.6	47.5	0.24	0.0	33.9	0.0	66.1	0.0	0	---	---	---	---
HC-12	HC-9	783.6	3.6	218.4	0.24	0.1	51.2	3.1	45.6	0.0	0	0	Natural	A	Optimal
HC-13	HC-12	211.8	4.7	177.4	0.24	0.4	51.6	2.3	45.8	0.0	0	0	Natural	X	Suboptimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
HC-14	HC-13	34.5	4.2	34.5	0.24	0.0	32.9	0.0	67.1	0.0	0	---	---	---	---
HC-15	HC-12	73.6	1.8	36.6	0.24	0.0	40.1	0.0	59.9	0.0	0	0	Natural	X	Optimal
HC-16	HC-15	37.1	1.7	37.1	0.24	0.0	39.5	0.0	60.5	0.0	0	---	---	---	---
HC-17	HC-12	54.4	4.5	54.4	0.24	0.0	68.3	0.0	31.7	0.0	0	---	---	---	---
HC-18	HC-12	86.0	2.8	43.4	0.24	0.0	61.8	0.0	38.2	0.0	0	0	Natural	X	Optimal
HC-19	HC-18	42.6	3.9	42.6	0.24	0.0	67.3	0.0	32.7	0.0	0	---	---	---	---
HC-20	HC-12	82.5	3.4	37.7	0.24	0.0	48.3	0.2	51.5	0.0	0	0	Natural	X	Suboptimal
HC-21	HC-20	44.8	2.2	44.8	0.24	0.0	41.5	0.0	58.5	0.0	0	---	---	---	---
HC-22	HC-12	56.8	2.6	8.0	0.24	0.0	27.3	3.1	69.6	0.0	0	0	Natural	X	Optimal
HC-23	HC-22	48.8	3.1	48.8	0.24	0.0	23.5	0.0	76.5	0.0	0	---	---	---	---
HC-24	HC-6	14.4	4.1	14.4	0.23	0.0	40.2	0.0	59.8	0.0	0	---	---	---	---
HC-25	---	40359.3	2.1	241.4	0.22	0.8	65.1	6.8	26.8	0.5	0	0	Natural	X	Optimal
HC-26	HC-25	77.6	0.4	39.4	0.24	0.0	77.7	0.0	22.3	0.0	0	0	Natural	X	Optimal
HC-27	HC-26	38.2	0.9	38.2	0.23	0.0	97.5	0.0	2.5	0.0	0	---	---	---	---
HC-28	HC-25	73.6	2.7	33.8	0.24	0.0	71.2	1.0	27.8	0.0	0	0	Natural	X	Optimal
HC-29	HC-28	39.8	4.7	39.8	0.22	0.0	99.1	0.0	0.9	0.0	0	---	---	---	---
HC-30	HC-25	6442.4	1.3	156.0	0.24	0.3	50.1	5.5	44.0	0.0	0	0	Natural	A	Optimal
HC-31	HC-30	242.9	1.6	226.4	0.24	0.0	45.7	5.3	49.0	0.0	0	0	Natural	X	Optimal
HC-32	HC-31	16.5	1.7	16.5	0.23	0.0	98.6	0.0	1.4	0.0	0	---	---	---	---
HC-33	HC-30	49.8	1.0	2.3	0.24	0.0	22.6	1.8	75.6	0.0	0	0	Natural	X	Optimal
HC-34	HC-33	47.5	1.1	47.5	0.24	0.0	20.8	0.0	79.2	0.0	0	---	---	---	---
HC-35	HC-30	5908.6	1.2	410.6	0.24	0.3	50.7	5.3	43.7	0.0	0	0	Natural	A	Suboptimal
HC-36	HC-35	221.6	2.8	155.6	0.24	0.0	40.9	9.0	50.1	0.0	0	0	Natural	X	Suboptimal
HC-37	HC-36	66.0	6.3	66.0	0.24	0.0	51.2	0.0	48.8	0.0	0	---	---	---	---
HC-38	HC-35	753.1	1.5	224.1	0.24	0.0	61.3	2.9	35.8	0.0	0	0	Natural	X	Suboptimal
HC-39	HC-38	529.0	0.8	462.3	0.24	0.0	68.4	0.3	31.2	0.0	0	0	Natural	X	Suboptimal
HC-40	HC-39	66.7	1.7	66.7	0.24	0.0	78.7	0.0	21.3	0.0	0	---	---	---	---
HC-41	HC-35	4268.7	0.8	4268.7	0.24	0.4	50.3	5.2	44.1	0.0	0	0	Natural	A	Suboptimal
HC-42	HC-35	51.7	6.1	11.7	0.24	0.0	41.8	2.4	55.8	0.0	0	0	Natural	X	Suboptimal
HC-43	HC-42	40.0	7.8	40.0	0.24	0.0	45.2	0.0	54.8	0.0	0	---	---	---	---
HC-44	HC-35	203.0	4.1	137.2	0.24	0.0	58.2	1.1	40.7	0.0	0	0	Natural	X	Suboptimal
HC-45	HC-44	65.8	3.2	65.8	0.24	0.0	72.8	0.0	27.2	0.0	0	---	---	---	---
HC-46	HC-30	85.1	1.7	41.8	0.23	0.0	51.9	1.6	46.6	0.0	0	0	Natural	X	Optimal
HC-47	HC-46	43.2	1.8	43.2	0.24	0.0	54.5	0.0	45.5	0.0	0	---	---	---	---
HC-48	HC-25	33524.3	2.3	344.6	0.22	0.9	68.0	7.1	23.5	0.5	0	0	Natural	A	Optimal
HC-49	HC-48	26810.5	2.7	25423.9	0.24	1.1	72.6	7.4	18.4	0.5	0	0	Natural	A	Suboptimal
HC-50	HC-49	181.1	1.4	135.1	0.24	0.0	36.6	10.1	53.3	0.0	0	0	Natural	X	Marginal
HC-51	HC-50	45.9	0.9	45.9	0.24	0.0	42.1	0.0	57.9	0.0	0	---	---	---	---
HC-52	HC-54	81.3	0.2	36.7	0.24	0.0	50.2	0.0	49.8	0.0	0	0	Natural	X	Optimal
HC-53	HC-52	44.7	0.1	44.7	0.24	0.0	51.1	0.0	48.9	0.0	0	---	---	---	---
HC-54	HC-49	925.1	1.0	495.1	0.24	0.0	59.5	0.0	40.5	0.0	0	0	Natural	A	Suboptimal
HC-55	HC-54	32.0	0.7	32.0	0.24	0.0	60.6	0.0	39.4	0.0	0	---	---	---	---
HC-56	HC-54	213.7	0.7	161.3	0.24	0.0	62.7	0.0	37.3	0.0	0	0	Natural	X	Suboptimal
HC-57	HC-56	52.4	0.9	52.4	0.24	0.0	72.8	0.0	27.2	0.0	0	---	---	---	---

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
HC-58	HC-54	103.0	3.6	74.9	0.24	0.0	45.8	0.0	54.2	0.0	0	0	Natural	X	Suboptimal
HC-59	HC-58	28.1	7.0	28.1	0.24	0.0	39.3	0.0	60.7	0.0	0	---	---	---	---
HC-60	HC-49	82.0	0.4	26.1	0.24	0.0	46.7	0.0	53.3	0.0	0	0	Natural	X	Optimal
HC-61	HC-60	55.9	0.2	55.9	0.24	0.0	49.1	0.0	50.9	0.0	0	---	---	---	---
HC-62	HC-49	198.5	2.2	164.2	0.24	0.0	46.5	16.9	36.6	0.0	1	0	Natural	X	Marginal
HC-63	HC-62	34.2	6.0	34.2	0.24	0.0	43.9	0.0	56.1	0.0	0	---	---	---	---
HC-64	HC-48	3838.6	0.5	233.0	0.24	0.0	47.8	6.0	46.1	0.1	0	0	Natural	A	Suboptimal
HC-65	HC-64	3605.6	0.5	464.0	0.24	0.0	48.7	4.0	47.1	0.1	0	0	Natural	A	Suboptimal
HC-66	HC-65	3141.6	0.5	3141.6	0.24	0.0	48.3	3.4	48.1	0.2	0	0	Natural	X	Optimal
HC-67	HC-48	2530.6	0.6	163.8	0.22	0.0	53.8	3.2	42.4	0.5	0	0	Natural	A	Optimal
HC-68	HC-67	2366.8	0.7	188.2	0.24	0.0	55.9	1.0	42.9	0.1	0	0	Natural	A	Suboptimal
HC-69	HC-68	1719.6	0.7	1719.6	0.23	0.0	57.1	0.4	42.3	0.2	0	0	Natural	X	Suboptimal
HC-70	HC-68	459.0	0.8	413.6	0.24	0.0	51.4	0.0	48.6	0.0	0	0	Natural	X	Suboptimal
HC-71	HC-70	45.4	0.5	45.4	0.24	0.0	72.1	0.0	27.9	0.0	0	---	---	---	---
IC-1	---	2167.0	40.8	102.5	0.30	1.1	52.0	9.2	37.7	0.1	0	1	Natural	AE	Suboptimal
IC-2	IC-1	2064.5	42.0	159.6	0.28	1.1	53.1	6.8	38.9	0.0	0	4	Natural	AE	Poor
IC-3	IC-2	1904.9	42.7	307.4	0.30	0.4	50.9	6.5	42.2	0.0	0	7	Articulated Block	AE	Marginal
IC-4	IC-3	1597.5	44.7	416.3	0.32	0.5	41.4	7.8	50.3	0.0	3	7	Concrete/Natural	AE	Poor
IC-5	IC-4	1181.2	44.7	225.3	0.29	0.0	24.1	7.8	68.1	0.0	0	8	Concrete/Natural	AE	Suboptimal
IC-6	IC-5	955.9	46.3	774.6	0.36	0.0	9.4	8.5	82.1	0.0	1	14	Concrete	AE	Suboptimal
IC-7	IC-6	181.2	44.2	181.2	0.42	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
JB-1	JB-4	468.9	4.0	256.6	0.24	0.0	44.7	7.8	47.2	0.3	1	0	Natural	A	Suboptimal
JB-2	JB-1	212.4	3.5	170.0	0.24	0.0	50.2	2.6	47.2	0.0	0	0	Natural	X	Suboptimal
JB-3	JB-2	42.3	4.1	42.3	0.24	0.0	54.8	0.0	45.2	0.0	0	---	---	---	---
JB-4	---	5499.4	2.0	270.6	0.24	0.0	58.3	5.4	36.1	0.1	0	0	Natural	A	Optimal
JB-5	JB-4	148.3	9.1	105.8	0.24	0.0	42.8	7.4	49.8	0.0	0	0	Natural	X	Suboptimal
JB-6	JB-5	42.5	12.1	42.5	0.24	0.0	34.6	0.0	65.4	0.0	0	---	---	---	---
JB-7	JB-4	4026.8	1.4	369.3	0.24	0.0	63.6	3.4	32.9	0.1	0	0	Natural	A	Marginal
JB-8	JB-7	218.0	4.1	174.5	0.24	0.0	46.4	4.9	48.7	0.0	0	0	Natural	X	Suboptimal
JB-9	JB-8	43.5	2.4	43.5	0.24	0.0	66.2	0.0	33.8	0.0	0	---	---	---	---
JB-10	JB-7	72.2	3.1	29.3	0.24	0.0	43.9	6.3	49.8	0.0	0	0	Natural	X	Suboptimal
JB-11	JB-10	42.9	3.8	42.9	0.24	0.0	30.1	0.0	69.9	0.0	0	---	---	---	---
JB-12	JB-7	819.7	0.7	246.2	0.24	0.0	57.5	0.0	42.5	0.0	0	0	Natural	X	Suboptimal
JB-13	JB-12	573.5	0.9	240.0	0.24	0.0	58.2	0.0	41.8	0.0	0	0	Natural	X	Suboptimal
JB-14	JB-13	333.4	0.8	272.9	0.24	0.0	62.1	0.0	37.9	0.0	0	0	Natural	X	Suboptimal
JB-15	JB-14	60.6	0.5	60.6	0.23	0.0	64.6	0.0	35.4	0.0	0	---	---	---	---
JB-16	JB-7	2269.9	1.4	80.6	0.24	0.0	69.0	2.0	28.8	0.2	0	0	Natural	A	Marginal
JB-17	JB-24	699.3	1.5	273.8	0.24	0.0	60.8	1.3	37.6	0.2	0	0	Natural	X	Suboptimal
JB-18	JB-17	42.1	2.6	42.1	0.24	0.0	65.9	0.0	34.1	0.0	0	---	---	---	---
JB-19	JB-17	50.8	3.8	11.8	0.24	0.0	52.8	0.0	47.2	0.0	0	0	Natural	X	Suboptimal
JB-20	JB-19	39.0	3.0	39.0	0.24	0.0	58.2	0.0	41.8	0.0	0	---	---	---	---
JB-21	JB-17	105.0	1.5	59.5	0.24	0.0	53.1	0.7	46.3	0.0	0	0	Natural	X	Suboptimal
JB-22	JB-21	45.6	1.0	45.6	0.24	0.0	65.7	0.0	34.3	0.0	0	---	---	---	---
JB-23	JB-17	227.6	2.2	227.6	0.28	0.0	86.2	0.1	13.8	0.0	0	---	---	---	---

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
JB-24	JB-16	1144.2	1.1	249.6	0.27	0.0	64.4	0.8	34.6	0.2	0	0	Natural	A	Suboptimal
JB-25	JB-24	195.4	0.8	156.2	0.29	0.0	72.7	0.0	27.3	0.0	0	0	Natural	X	Optimal
JB-26	JB-25	39.1	2.0	39.1	0.40	0.0	40.8	0.0	59.2	0.0	0	---	---	---	---
JB-27	JB-16	1045.1	1.7	174.8	0.24	0.0	75.0	3.5	21.2	0.3	0	0	Natural	X	Suboptimal
JB-28	JB-27	870.3	1.9	437.5	0.25	0.0	77.9	3.9	17.8	0.4	0	0	Natural	X	Suboptimal
JB-29	JB-28	432.9	1.1	367.1	0.32	0.0	80.0	0.0	19.2	0.8	0	0	Natural	X	Optimal
JB-30	JB-29	65.8	1.4	65.8	0.39	0.0	47.3	0.0	52.7	0.0	0	---	---	---	---
JB-31	JB-7	277.7	1.6	242.9	0.24	0.0	78.8	4.1	17.1	0.0	0	0	Natural	X	Optimal
JB-32	JB-31	34.9	2.4	34.9	0.24	0.0	96.8	0.0	3.2	0.0	0	---	---	---	---
JB-33	JB-4	584.7	2.8	138.6	0.23	0.0	50.9	4.3	44.7	0.0	0	0	Natural	X	Suboptimal
JB-34	JB-33	446.1	3.2	205.5	0.24	0.0	51.8	5.3	42.9	0.0	0	0	Natural	X	Suboptimal
JB-35	JB-34	240.6	1.6	195.5	0.24	0.0	57.2	3.1	39.7	0.0	0	0	Natural	X	Suboptimal
JB-36	JB-35	45.0	0.0	45.0	0.24	0.0	57.2	0.0	42.8	0.0	0	---	---	---	---
LR-1	---	73186.7	7.6	330.7	0.27	0.0	43.0	2.5	50.1	4.4	0	0	Natural	A	Optimal
LR-2	LR-1	80.2	3.7	34.9	0.24	0.0	40.8	0.0	59.0	0.2	0	0	Natural	X	Suboptimal
LR-3	LR-2	45.3	5.5	45.3	0.24	0.0	40.1	0.0	59.9	0.0	0	---	---	---	---
LR-4	LR-1	153.5	1.9	114.0	0.24	0.0	46.0	0.0	54.0	0.0	0	0	Natural	X	Optimal
LR-5	LR-4	39.5	0.7	39.5	0.24	0.0	72.7	0.0	27.3	0.0	0	---	---	---	---
LR-6	LR-1	68006.2	8.0	247.5	0.34	0.0	42.2	2.2	50.8	4.7	0	0	Natural	A	Suboptimal
LR-7	LR-6	59789.2	8.3	194.3	0.32	0.0	40.1	2.4	52.3	5.1	1	0	Natural	A	Suboptimal
LR-8	LR-7	103.4	2.0	51.7	0.29	0.0	67.2	0.0	32.8	0.0	0	0	Natural	X	Poor
LR-9	LR-8	51.6	2.1	51.6	0.24	0.0	73.7	0.0	26.3	0.0	0	---	---	---	---
LR-10	LR-7	57024.7	8.6	141.7	0.33	0.0	38.8	2.3	53.5	5.3	0	0	Natural	A	Suboptimal
LR-11	LR-10	69.8	2.5	18.7	0.36	0.0	69.7	0.0	30.3	0.0	0	0	Natural	X	Poor
LR-12	LR-11	51.1	2.6	51.1	0.26	0.0	59.6	0.0	40.4	0.0	0	---	---	---	---
LR-13	LR-10	137.3	3.7	81.9	0.24	0.0	60.5	0.0	39.5	0.0	0	0	Natural	X	Suboptimal
LR-14	LR-13	55.5	5.2	55.5	0.24	0.0	71.0	0.0	29.0	0.0	0	---	---	---	---
LR-15	LR-10	137.8	3.2	99.6	0.24	0.0	65.5	0.0	34.5	0.0	0	0	Natural	X	Suboptimal
LR-16	LR-15	38.2	7.4	38.2	0.24	0.0	78.4	0.0	21.6	0.0	0	---	---	---	---
LR-17	LR-10	35599.7	12.8	180.1	0.31	0.0	33.9	2.5	62.6	0.9	0	0	Natural	A	Suboptimal
LR-18	LR-17	279.3	3.0	243.0	0.24	0.0	66.9	1.7	31.5	0.0	0	0	Natural	X	Suboptimal
LR-19	LR-18	36.3	6.4	36.3	0.25	0.0	64.4	0.0	35.6	0.0	0	---	---	---	---
LR-20	LR-17	34893.6	13.0	145.7	0.32	0.0	33.0	2.5	63.5	1.0	0	0	Natural	A	Suboptimal
LR-21	LR-20	318.5	4.3	147.0	0.24	0.0	76.8	0.0	23.2	0.0	0	0	Natural	X	Suboptimal
LR-22	LR-21	171.6	1.7	120.3	0.26	0.0	72.9	0.0	27.1	0.0	0	0	Natural	X	Suboptimal
LR-23	LR-22	51.2	0.0	51.2	0.26	0.0	85.6	0.0	14.4	0.0	0	---	---	---	---
LR-24	LR-20	591.8	4.0	88.3	0.25	0.0	57.6	0.0	42.4	0.0	0	0	Natural	X	Suboptimal
LR-25	LR-24	503.5	3.5	228.1	0.29	0.0	54.2	0.0	45.8	0.0	0	0	Natural	X	Suboptimal
LR-26	LR-25	275.4	3.9	234.0	0.33	0.0	40.0	0.0	60.0	0.0	2	0	Natural	X	Suboptimal
LR-27	LR-26	41.4	1.5	41.4	0.46	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
LR-28	LR-20	32683.1	13.8	213.8	0.31	0.0	30.8	2.7	65.5	1.0	0	0	Natural	A	Suboptimal
LR-29	LR-28	29682.0	15.0	154.6	0.35	0.1	28.8	2.9	67.5	0.8	0	0	Natural	A	Suboptimal
LR-30	LR-29	431.4	1.5	130.3	0.30	0.0	37.7	3.0	59.3	0.0	0	0	Natural	A	Optimal
LR-31	LR-30	301.2	1.5	225.0	0.37	0.0	31.6	4.3	64.1	0.0	0	0	Natural	X	Suboptimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
LR-32	LR-31	76.2	1.3	76.2	0.40	0.0	31.0	0.0	69.0	0.0	0	---	---	---	---
LR-33	LR-29	370.8	4.3	134.0	0.34	0.0	55.6	2.6	41.8	0.0	0	0	Natural	A	Suboptimal
LR-34	LR-33	236.8	4.6	192.9	0.37	0.0	49.5	2.8	47.7	0.0	0	0	Natural	X	Suboptimal
LR-35	LR-34	43.9	4.8	43.9	0.36	0.0	13.5	0.0	86.5	0.0	0	---	---	---	---
LR-36	LR-39	262.3	2.5	46.7	0.32	0.0	55.4	5.0	39.6	0.0	0	0	Natural	X	Marginal
LR-37	LR-36	215.6	2.6	199.1	0.37	0.0	54.4	2.1	43.6	0.0	0	0	Natural	X	Suboptimal
LR-38	LR-37	16.5	4.4	16.5	0.36	0.0	62.8	2.1	35.2	0.0	0	---	---	---	---
LR-39	LR-29	28646.7	15.5	236.0	0.36	0.1	27.8	2.9	68.4	0.8	0	0	Natural	A	Suboptimal
LR-40	LR-39	558.3	4.4	139.3	0.33	0.0	57.1	6.3	35.6	1.0	0	0	Natural	A	Suboptimal
LR-41	LR-43	189.8	4.4	142.0	0.33	0.0	53.3	8.1	35.7	2.9	4	1	Natural	A	Suboptimal
LR-42	LR-41	47.9	12.0	47.9	0.30	0.0	47.9	0.0	40.6	11.5	0	---	---	---	---
LR-43	LR-40	419.1	5.5	200.3	0.34	0.0	55.2	6.7	36.8	1.3	0	4	Natural	X	Optimal
LR-44	LR-43	29.0	11.7	29.0	0.37	0.0	89.2	0.0	10.8	0.0	0	---	---	---	---
LR-45	LR-39	26853.3	16.2	165.6	0.34	0.1	25.7	2.9	70.5	0.8	0	2	Natural	A	Optimal
LR-46	LR-48	95.4	4.1	60.2	0.33	0.0	51.3	0.0	48.7	0.0	0	0	Natural	X	Marginal
LR-47	LR-46	35.1	0.4	35.1	0.35	0.0	14.8	0.0	85.2	0.0	0	---	---	---	---
LR-48	LR-45	15949.9	18.8	142.1	0.34	0.1	20.2	3.8	75.4	0.6	0	0	Natural	A	Optimal
LR-49	LR-53	1399.9	14.2	243.8	0.35	0.0	17.2	2.8	80.1	0.0	4	0	Natural	X	Poor
LR-50	LR-49	1156.2	15.3	439.5	0.42	0.0	7.4	2.9	89.7	0.0	2	2	Natural	X	Marginal
LR-51	LR-50	716.6	20.4	658.8	0.48	0.0	0.6	0.0	99.4	0.0	2	3	Natural	X	Poor
LR-52	LR-51	57.8	46.6	57.8	0.49	0.0	0.0	0.0	100.0	0.0	1	---	---	---	---
LR-53	LR-48	13361.9	19.2	305.4	0.35	0.1	16.3	4.1	79.1	0.4	0	1	Natural	A	Optimal
LR-54	LR-56	307.5	19.6	192.2	0.41	0.0	18.3	0.0	80.2	1.5	3	0	Natural	X	Poor
LR-55	LR-54	115.4	23.6	115.4	0.47	0.0	0.0	0.0	100.0	0.0	1	---	---	---	---
LR-56	LR-53	951.2	14.2	41.7	0.40	0.0	12.5	0.0	87.1	0.5	0	0	Natural	X	Suboptimal
LR-57	LR-56	602.0	12.3	164.5	0.43	0.0	5.8	0.0	94.2	0.0	0	0	Natural	X	Suboptimal
LR-58	LR-57	316.2	13.8	209.6	0.48	0.0	0.1	0.0	99.9	0.0	4	4	Natural	X	Marginal
LR-59	LR-58	82.1	5.3	23.3	0.45	0.0	0.0	0.0	100.0	0.0	1	0	Natural	X	Marginal
LR-60	LR-59	58.8	5.1	58.8	0.49	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
LR-61	LR-58	24.6	14.9	24.6	0.47	0.0	0.0	0.0	100.0	0.0	0	2	Natural	X	Marginal
LR-62	LR-57	121.2	16.1	66.2	0.44	0.0	4.7	0.0	95.3	0.0	0	2	Natural	X	Marginal
LR-63	LR-62	55.1	15.2	55.1	0.49	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
LR-64	LR-53	10600.8	20.8	234.8	0.37	0.1	14.0	4.6	80.9	0.4	0	0	Natural	A	Suboptimal
LR-65	LR-64	7618.8	25.3	72.9	0.39	0.0	12.3	2.3	85.0	0.3	0	0	Natural	A	Optimal
LR-66	LR-65	227.9	11.7	136.7	0.43	0.0	16.6	15.5	68.0	0.0	2	2	Natural	X	Marginal
LR-67	LR-66	91.3	18.2	91.3	0.49	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
LR-68	LR-65	7250.5	26.1	153.4	0.39	0.0	11.3	1.9	86.4	0.4	0	4	Natural	A	Optimal
LR-69	LR-68	5829.9	29.9	2505.1	0.47	0.0	9.8	2.0	88.2	0.0	8	4	Natural	A	Optimal
LR-70	LR-69	32.6	5.7	32.6	0.47	0.0	14.4	0.0	85.6	0.0	0	---	---	---	---
LR-71	LR-69	3292.3	38.9	143.4	0.43	0.0	11.7	1.4	86.9	0.0	0	0	Natural	AE	Suboptimal
LR-72	LR-71	3148.9	39.8	3148.9	0.44	0.0	10.2	1.4	88.3	0.0	0	---	---	---	---
LR-73	LR-68	740.7	14.0	67.4	0.41	0.0	11.5	0.0	88.5	0.0	0	2	Natural	X	Suboptimal
LR-74	LR-73	673.3	15.2	673.3	0.46	0.0	7.2	0.0	92.8	0.0	0	---	---	---	---
LR-75	LR-68	55.1	0.6	55.1	0.43	0.0	9.5	0.0	90.5	0.0	0	1	Natural	X	Suboptimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
LR-76	LR-68	471.3	9.1	136.7	0.42	0.0	13.0	0.0	81.5	5.5	0	1	Natural	X	Optimal
LR-77	LR-76	334.6	11.2	334.6	0.40	0.0	8.6	0.0	83.6	7.8	0	---	---	---	---
LR-78	LR-65	67.6	5.6	29.1	0.39	0.0	37.3	0.0	62.7	0.0	0	0	Natural	X	Marginal
LR-79	LR-78	38.5	8.5	38.5	0.45	0.0	14.7	0.0	85.3	0.0	0	---	---	---	---
LR-80	LR-64	139.5	7.1	82.0	0.41	0.0	28.0	3.8	68.2	0.0	0	3	Natural	X	Marginal
LR-81	LR-80	57.5	11.1	57.5	0.45	0.0	3.3	0.0	96.7	0.0	0	---	---	---	---
LR-82	LR-53	104.5	22.6	66.4	0.35	0.0	71.0	13.2	10.9	5.0	0	0	Natural	X	Marginal
LR-83	LR-82	38.1	24.5	38.1	0.41	0.0	46.1	36.2	17.7	0.0	0	---	---	---	---
LR-84	LR-48	418.9	4.3	120.7	0.38	0.0	34.4	10.8	52.8	2.0	0	0	Natural	X	Suboptimal
LR-85	LR-84	298.2	2.3	282.8	0.42	0.0	15.9	15.2	66.1	2.8	1	0	Natural	X	Suboptimal
LR-86	LR-85	15.4	1.3	15.4	0.45	0.0	0.0	5.0	94.8	0.1	0	---	---	---	---
LR-87	LR-39	736.7	4.1	125.7	0.37	0.0	51.8	1.0	47.3	0.0	0	0	Natural	A	Suboptimal
LR-88	LR-87	484.7	5.4	301.8	0.40	0.0	44.0	1.0	55.0	0.0	0	2	Natural	A	Suboptimal
LR-89	LR-88	182.9	9.4	182.9	0.43	0.0	22.4	0.0	77.6	0.0	0	---	---	---	---
LR-90	LR-87	126.3	2.5	94.1	0.41	0.0	34.7	1.7	63.6	0.0	0	0	Natural	A	Suboptimal
LR-91	LR-90	32.2	8.0	32.2	0.47	0.0	18.2	0.0	81.8	0.0	0	---	---	---	---
LR-92	LR-29	78.5	1.8	78.5	0.36	0.0	88.2	0.0	6.2	5.6	0	0	Natural	A	Suboptimal
LR-93	LR-28	1180.5	1.4	146.7	0.33	0.0	48.0	1.7	45.9	4.4	0	0	Natural	A	Suboptimal
LR-94	LR-93	1033.8	1.5	139.5	0.36	0.0	42.2	1.9	52.2	3.7	0	0	Natural	A	Suboptimal
LR-95	LR-94	809.7	1.6	809.7	0.38	0.0	39.8	0.7	54.7	4.8	0	0	Natural	A	Suboptimal
LR-96	LR-94	84.6	0.3	68.3	0.38	0.0	35.6	0.0	64.4	0.0	0	---	---	---	---
LR-97	LR-96	16.2	0.0	16.2	0.44	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
LR-98	LR-28	1606.8	0.9	310.7	0.31	0.0	47.3	0.3	49.6	2.8	0	2	Natural	X	Suboptimal
LR-99	LR-98	1296.1	1.0	1296.1	0.32	0.0	43.3	0.3	55.4	0.9	0	---	---	---	---
LR-100	LR-20	342.4	0.9	114.3	0.26	0.0	59.3	0.0	40.7	0.0	0	0	Natural	X	Marginal
LR-101	LR-100	228.1	1.2	228.1	0.31	0.0	57.5	0.0	42.5	0.0	0	---	---	---	---
LR-102	LR-20	126.8	0.2	109.4	0.29	0.0	73.8	0.0	26.2	0.0	0	0	Natural	X	Poor
LR-103	LR-102	17.4	0.7	17.4	0.24	0.0	40.3	0.0	59.7	0.0	0	---	---	---	---
LR-104	LR-20	685.4	0.3	348.9	0.25	0.0	63.5	0.0	36.5	0.0	0	0	Natural	X	Marginal
LR-105	LR-104	336.4	0.2	336.4	0.32	0.0	54.0	0.0	46.0	0.0	0	---	---	---	---
LR-106	LR-17	119.7	0.7	61.3	0.28	0.0	91.0	0.0	9.0	0.0	0	0	Natural	X	Poor
LR-107	LR-106	58.4	0.1	58.4	0.24	0.0	91.3	0.0	8.7	0.0	0	---	---	---	---
LR-108	LR-17	127.0	0.5	101.3	0.25	0.0	77.0	0.0	23.0	0.0	0	0	Natural	X	Poor
LR-109	LR-108	25.7	1.1	25.7	0.24	0.0	44.7	0.0	55.3	0.0	0	---	---	---	---
LR-110	LR-7	2466.8	1.7	413.5	0.26	0.0	64.8	5.4	28.8	1.0	0	0	Natural	A	Suboptimal
LR-111	LR-110	2053.2	1.9	1066.5	0.24	0.0	61.8	4.7	32.5	1.0	3	0	Natural	A	Suboptimal
LR-112	LR-111	986.8	2.3	986.8	0.23	0.0	59.9	3.9	33.9	2.2	0	---	---	---	---
LR-113	LR-6	407.2	1.8	373.2	0.25	0.0	84.5	2.7	12.4	0.4	2	0	Natural	X	Marginal
LR-114	LR-113	34.0	2.4	34.0	0.24	0.0	80.8	0.0	19.2	0.0	0	---	---	---	---
LR-115	LR-1	2417.9	1.6	382.0	0.28	0.1	57.8	4.9	37.2	0.0	0	0	Natural	A	Optimal
LR-116	LR-115	2035.9	1.4	688.1	0.24	0.1	54.3	5.0	40.6	0.0	0	0	Natural	A	Suboptimal
LR-117	LR-116	1347.8	0.5	1274.6	0.24	0.1	51.8	3.3	44.7	0.0	1	0	Natural	X	Optimal
LR-118	LR-117	73.2	1.1	73.2	0.24	0.0	68.2	0.0	31.8	0.0	0	---	---	---	---
LR-119	LR-1	2198.2	3.7	409.2	0.26	0.0	48.4	8.2	43.3	0.1	0	0	Natural	A	Suboptimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
LR-120	LR-119	401.8	4.4	368.5	0.24	0.0	50.7	1.1	48.2	0.0	0	0	Natural	X	Suboptimal
LR-121	LR-120	33.3	0.3	33.3	0.24	0.0	25.3	0.0	74.7	0.0	0	---	---	---	---
LR-122	LR-119	1387.2	4.1	518.4	0.24	0.0	48.3	8.9	42.8	0.0	0	0	Natural	A	Suboptimal
LR-123	LR-122	868.8	4.5	826.9	0.24	0.0	50.3	7.2	42.4	0.0	0	0	Natural	X	Suboptimal
LR-124	LR-123	41.8	5.8	41.8	0.24	0.0	76.8	0.0	23.2	0.0	0	---	---	---	---
LR-125	LR-45	10737.8	12.6	128.1	0.36	0.0	33.4	1.5	63.9	1.2	0	0	Natural	A	Suboptimal
LR-126	LR-125	85.5	4.1	62.7	0.35	0.0	70.8	0.0	24.2	5.0	0	0	Natural	X	Poor
LR-127	LR-126	22.8	3.3	22.8	0.39	0.0	60.6	0.0	39.4	0.0	0	---	---	---	---
LR-128	LR-125	601.7	3.5	108.2	0.39	0.0	27.5	1.6	69.5	1.4	0	0	Natural	X	Suboptimal
LR-129	LR-128	493.5	4.0	244.9	0.44	0.0	19.1	1.4	78.4	1.2	0	0	Natural	X	Suboptimal
LR-130	LR-129	248.5	4.0	198.2	0.43	0.0	20.0	0.2	77.5	2.3	0	0	Natural	X	Marginal
LR-131	LR-130	50.3	6.1	50.3	0.47	0.0	16.1	0.0	83.9	0.0	0	---	---	---	---
LR-132	LR-125	9922.5	13.4	199.1	0.36	0.0	32.7	1.5	64.7	1.1	0	0	Natural	A	Optimal
LR-133	LR-132	69.5	0.9	35.9	0.35	0.0	74.4	3.9	21.8	0.0	0	0	Natural	X	Poor
LR-134	LR-133	33.6	1.8	33.6	0.37	0.0	88.0	0.0	11.9	0.0	0	---	---	---	---
LR-135	LR-132	9653.9	13.8	9653.9	0.40	0.0	31.3	1.5	66.1	1.1	0	---	---	---	---
LT-1	---	206.0	4.2	159.7	0.24	0.0	42.3	4.0	53.7	0.0	0	0	Natural	X	Optimal
LT-2	LT-1	46.3	5.0	46.3	0.24	0.0	30.0	0.0	70.0	0.0	0	---	---	---	---
LT-3	---	148.1	5.2	136.4	0.24	0.0	46.8	0.0	53.2	0.0	0	0	Natural	X	Optimal
LT-4	LT-3	11.8	5.1	11.8	0.24	0.0	44.8	0.0	55.2	0.0	0	---	---	---	---
LT-5	---	75.5	4.6	75.5	0.24	0.0	60.7	0.0	39.3	0.0	0	0	Natural	X	Optimal
LT-6	---	127.9	2.1	92.3	0.24	0.0	34.3	7.3	58.4	0.0	0	0	Natural	X	Optimal
LT-7	LT-6	35.7	2.6	35.7	0.24	0.0	44.9	6.1	49.1	0.0	0	---	---	---	---
LT-8	---	259.2	4.3	253.3	0.24	0.0	52.0	0.0	48.0	0.0	0	0	Natural	X	Optimal
LT-9	LT-8	6.0	7.0	6.0	0.24	0.0	14.8	0.0	85.2	0.0	0	---	---	---	---
LT-10	---	678.6	4.0	152.3	0.24	0.0	51.2	3.9	44.8	0.0	0	0	Natural	X	Suboptimal
LT-11	LT-12	338.6	3.6	177.2	0.24	0.0	53.4	0.0	46.6	0.0	0	0	Natural	X	Suboptimal
LT-12	LT-10	526.3	3.2	187.7	0.24	0.0	49.2	2.8	47.9	0.0	0	0	Natural	X	Suboptimal
LT-13	LT-11	161.4	5.0	129.1	0.25	0.0	65.7	0.0	34.3	0.0	1	0	Natural	X	Suboptimal
LT-14	LT-13	32.3	5.2	32.3	0.24	0.0	100.0	0.0	0.0	0.0	1	---	---	---	---
LT-15	---	91.6	4.3	52.5	0.22	0.0	72.7	0.0	25.3	2.0	0	0	Natural	X	Optimal
LT-16	LT-15	39.1	5.3	39.1	0.24	0.0	94.3	0.0	5.7	0.0	0	---	---	---	---
LT-17	LT-20	292.3	2.4	111.1	0.24	0.0	59.9	3.4	36.7	0.0	0	0	Natural	X	Suboptimal
LT-18	LT-17	181.2	2.0	131.3	0.24	0.0	59.2	0.0	40.8	0.0	0	0	Natural	X	Suboptimal
LT-19	LT-18	49.9	3.5	49.9	0.24	0.0	74.0	0.0	26.0	0.0	0	---	---	---	---
LT-20	---	836.7	4.4	151.3	0.24	0.0	52.0	6.3	41.8	0.0	0	0	Natural	X	Suboptimal
LT-21	LT-20	393.1	6.3	64.8	0.24	0.0	48.0	5.8	46.3	0.0	0	0	Natural	X	Suboptimal
LT-22	LT-21	328.3	6.8	185.1	0.24	0.0	48.1	4.8	47.1	0.0	0	0	Natural	X	Suboptimal
LT-23	LT-22	143.2	8.5	127.5	0.25	0.0	58.5	1.1	40.4	0.0	0	0	Natural	X	Suboptimal
LT-24	LT-23	15.7	4.9	15.7	0.24	0.0	60.3	0.0	39.7	0.0	0	---	---	---	---
LT-25	---	36.4	3.9	36.4	0.24	0.0	73.0	0.0	27.0	0.0	0	0	Natural	X	Optimal
LT-26	---	101.7	6.3	101.7	0.24	0.0	67.2	0.0	32.8	0.0	0	0	Natural	X	Optimal
LT-27	---	372.4	4.2	112.0	0.24	0.0	51.1	3.9	45.0	0.0	0	0	Natural	X	Optimal
LT-28	LT-27	260.3	4.2	113.9	0.24	0.0	47.1	1.8	51.1	0.0	0	0	Natural	X	Optimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
LT-29	LT-28	146.4	5.3	103.2	0.24	0.0	56.6	0.0	43.4	0.0	0	0	Natural	X	Optimal
LT-30	LT-29	43.2	3.6	43.2	0.25	0.0	31.9	0.0	68.1	0.0	0	---	---	---	---
LT-31	---	182.4	3.2	137.9	0.24	0.0	80.6	0.0	19.4	0.0	0	0	Natural	X	Optimal
LT-32	LT-31	44.5	2.3	44.5	0.23	0.0	94.3	0.0	5.7	0.0	0	---	---	---	---
LT-33	---	217.9	1.0	169.7	0.24	0.0	42.8	0.0	56.4	0.8	0	0	Natural	X	Optimal
LT-34	LT-33	48.3	0.0	48.3	0.24	0.0	37.3	0.0	62.7	0.0	0	---	---	---	---
LT-35	---	63.3	0.5	63.3	0.24	0.0	32.3	0.0	67.7	0.0	0	0	Natural	X	Optimal
LT-36	---	69.3	2.6	69.3	0.24	0.0	39.0	0.0	61.0	0.0	0	0	Natural	X	Optimal
LT-37	---	311.7	2.2	102.5	0.23	0.0	27.3	0.0	71.2	1.5	0	0	Natural	X	Optimal
LT-38	LT-37	39.2	5.0	39.2	0.24	0.0	33.1	0.0	66.9	0.0	0	---	---	---	---
LT-39	LT-37	92.3	0.5	47.0	0.24	0.0	22.4	0.0	77.6	0.0	0	0	Natural	X	Optimal
LT-40	LT-37	77.6	1.6	33.9	0.23	0.0	20.3	0.0	78.4	1.2	0	0	Natural	X	Optimal
LT-41	LT-39	45.3	1.0	45.3	0.24	0.0	21.2	0.0	78.8	0.0	0	---	---	---	---
LT-42	LT-40	43.7	0.0	43.7	0.24	0.0	13.8	0.0	86.2	0.0	0	---	---	---	---
LT-43	---	315.9	1.7	153.9	0.24	0.0	38.7	3.1	58.2	0.0	0	0	Natural	X	Optimal
LT-44	LT-43	162.0	2.4	79.4	0.24	0.0	42.1	1.5	56.4	0.0	0	0	Natural	X	Optimal
LT-45	LT-44	82.6	1.1	82.6	0.24	0.0	49.6	0.0	50.4	0.0	0	---	---	---	---
LT-46	---	378.0	2.1	132.8	0.24	0.0	32.1	2.7	65.0	0.1	0	0	Natural	X	Optimal
LT-47	LT-46	170.5	2.5	120.2	0.24	0.0	31.4	0.0	68.6	0.0	0	0	Natural	X	Suboptimal
LT-48	LT-47	50.3	2.7	50.3	0.24	0.0	30.4	0.0	69.6	0.0	0	---	---	---	---
LT-49	LT-46	74.6	0.4	35.8	0.24	0.0	28.7	0.0	71.3	0.0	0	0	Natural	X	Optimal
LT-50	LT-49	38.9	0.0	38.9	0.24	0.0	20.8	0.0	79.2	0.0	0	---	---	---	---
LT-51	---	307.4	0.6	172.3	0.25	0.0	42.4	0.0	57.6	0.0	0	0	Natural	X	Optimal
LT-52	LT-51	31.3	0.0	31.3	0.24	0.0	29.1	0.0	70.9	0.0	0	---	---	---	---
LT-53	LT-51	103.8	1.6	61.2	0.24	0.0	54.1	0.0	45.9	0.0	0	0	Natural	X	Optimal
LT-54	LT-53	42.6	3.3	42.6	0.24	0.0	63.5	0.0	36.5	0.0	0	---	---	---	---
LT-55	---	237.6	3.8	108.7	0.24	0.0	65.9	0.0	34.1	0.0	0	0	Natural	X	Optimal
LT-56	LT-55	128.8	4.6	71.3	0.24	0.0	63.9	0.0	36.1	0.0	0	0	Natural	X	Optimal
LT-57	LT-56	57.5	4.5	57.5	0.23	0.0	68.9	0.0	31.1	0.0	0	---	---	---	---
LT-58	---	320.5	3.3	122.6	0.24	0.0	94.9	0.0	5.1	0.1	0	0	Natural	X	Optimal
LT-59	LT-58	197.9	2.9	62.6	0.24	0.0	98.8	0.0	1.2	0.0	0	0	Natural	X	Suboptimal
LT-60	LT-59	79.3	1.9	35.3	0.24	0.0	100.0	0.0	0.0	0.0	0	0	Natural	X	Suboptimal
LT-61	LT-60	44.1	2.5	44.1	0.24	0.0	100.0	0.0	0.0	0.0	0	---	---	---	---
LT-62	LT-59	55.9	2.7	21.0	0.24	0.0	99.2	0.0	0.8	0.0	0	0	Natural	X	Suboptimal
LT-63	LT-62	34.9	1.5	34.9	0.24	0.0	98.7	0.0	1.3	0.0	0	---	---	---	---
LT-64	---	104.8	0.0	70.2	0.24	0.0	31.2	0.0	68.8	0.0	0	0	Natural	X	Optimal
LT-65	LT-64	34.6	0.0	34.6	0.24	0.0	45.0	0.0	55.0	0.0	0	---	---	---	---
MC-1	---	2901.9	35.4	120.6	0.18	1.0	31.1	14.1	52.7	1.2	0	1	Natural	AE	Optimal
MC-2	MC-1	2781.3	36.3	22.0	0.26	0.6	30.5	13.5	54.9	0.5	0	2	Natural	AE	Optimal
MC-3	MC-2	2759.3	36.4	625.8	0.30	0.6	29.9	13.6	55.4	0.5	5	5	Natural	AE	Suboptimal
MC-4	MC-3	2133.5	32.4	60.5	0.25	0.0	18.6	11.3	70.1	0.0	0	6	Natural	AE	Suboptimal
MC-5	MC-4	2073.0	32.1	105.2	0.24	0.0	16.2	11.7	72.2	0.0	1	6	Natural	AE	Suboptimal
MC-6	MC-5	1967.8	31.7	174.7	0.33	0.0	11.7	12.3	76.0	0.0	0	5	Concrete	AE	Suboptimal
MC-7	MC-6	1793.1	30.6	191.7	0.38	0.0	6.8	9.9	83.4	0.0	3	7	Concrete/Articulated Block	AE	Suboptimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
MC-8	MC-7	1601.4	26.2	360.9	0.47	0.0	2.5	7.0	90.5	0.0	8	3	Natural/Articulated Block	AE	Poor
MC-9	MC-8	1240.5	21.5	261.6	0.48	0.0	2.6	2.2	95.2	0.0	0	3	Natural	AE	Poor
MC-10	MC-9	978.9	18.2	201.9	0.48	0.0	1.9	2.7	95.4	0.0	0	3	Natural	AE	Marginal
MC-11	MC-10	777.0	18.8	777.0	0.49	0.0	0.9	1.3	97.8	0.0	5	---	---	---	---
RC-1	LR-6	7562.3	6.5	107.1	0.29	0.0	55.1	0.5	42.4	2.1	0	0	Natural	A	Optimal
RC-2	RC-1	63.1	3.5	25.2	0.24	0.0	42.5	0.0	57.5	0.0	0	0	Natural	X	Optimal
RC-3	RC-2	37.8	3.3	37.8	0.24	0.0	39.9	0.0	60.1	0.0	1	---	---	---	---
RC-4	RC-1	7303.1	6.7	146.5	0.29	0.0	54.7	0.5	42.6	2.1	0	0	Natural	A	Optimal
RC-5	RC-4	251.2	3.7	209.5	0.24	0.0	66.2	4.5	29.3	0.0	0	0	Natural	X	Optimal
RC-6	RC-5	41.7	5.7	41.7	0.24	0.0	72.4	0.0	27.6	0.0	0	---	---	---	---
RC-7	RC-4	635.3	4.9	155.2	0.24	0.0	61.2	3.3	34.7	0.8	2	0	Natural	X	Suboptimal
RC-8	RC-7	480.1	5.7	212.8	0.24	0.0	56.4	4.4	38.1	1.0	0	0	Natural	X	Suboptimal
RC-9	RC-8	267.3	4.1	229.6	0.27	0.0	47.2	2.2	48.7	1.8	0	0	Natural	X	Optimal
RC-10	RC-9	37.7	2.8	37.7	0.38	0.0	11.1	0.0	75.8	13.0	0	---	---	---	---
RC-11	RC-4	6018.1	7.2	127.2	0.31	0.0	51.4	0.0	46.1	2.5	0	0	Natural	A	Suboptimal
RC-12	RC-11	52.0	2.9	7.7	0.23	0.0	75.6	0.0	24.4	0.0	0	0	Natural	X	Marginal
RC-13	RC-12	44.3	3.4	44.3	0.24	0.0	76.8	0.0	23.2	0.0	0	---	---	---	---
RC-14	RC-16	62.8	2.0	17.0	0.26	0.0	64.4	0.0	35.6	0.0	0	0	Natural	X	Marginal
RC-15	RC-14	45.8	1.3	45.8	0.24	0.0	55.1	0.0	44.9	0.0	0	---	---	---	---
RC-16	RC-11	5388.1	7.5	128.1	0.29	0.0	47.1	0.0	50.1	2.7	0	0	Natural	A	Suboptimal
RC-17	RC-16	27.8	0.1	5.1	0.26	0.0	58.2	0.0	41.8	0.0	0	0	Natural	X	Optimal
RC-18	RC-17	22.8	0.0	22.8	0.23	0.0	59.3	0.0	40.7	0.0	0	---	---	---	---
RC-19	RC-22	351.7	1.6	175.4	0.26	0.0	52.8	0.0	47.2	0.0	0	0	Natural	X	Suboptimal
RC-20	RC-19	176.3	2.7	132.2	0.38	0.0	27.1	0.0	72.9	0.0	0	0	Natural	X	Optimal
RC-21	RC-20	44.0	1.0	44.0	0.45	0.0	3.3	0.0	96.7	0.0	0	---	---	---	---
RC-22	RC-16	4629.8	8.4	111.0	0.31	0.0	43.8	0.1	53.3	2.8	0	0	Natural	A	Optimal
RC-23	RC-22	212.4	3.7	171.3	0.38	0.0	42.0	0.0	58.0	0.0	1	0	Natural	X	Suboptimal
RC-24	RC-23	41.1	2.7	41.1	0.39	0.0	7.9	0.0	92.1	0.0	0	---	---	---	---
RC-25	RC-22	3421.7	10.6	32.0	0.32	0.0	42.1	0.1	54.3	3.5	0	0	Natural	A	Optimal
RC-26	RC-25	3389.7	10.6	89.2	0.31	0.0	41.8	0.1	54.7	3.5	0	0	Natural	A	Optimal
RC-27	RC-26	108.5	4.1	72.5	0.38	0.0	61.4	0.0	38.6	0.0	0	0	Natural	X	Optimal
RC-28	RC-27	36.0	3.5	36.0	0.41	0.0	53.3	0.0	46.7	0.0	0	---	---	---	---
RC-29	RC-26	438.2	5.4	213.8	0.34	0.0	49.1	0.0	50.1	0.8	0	0	Natural	X	Optimal
RC-30	RC-29	224.5	7.4	170.4	0.36	0.0	47.3	0.0	51.2	1.5	1	0	Natural	X	Optimal
RC-31	RC-30	54.1	4.0	54.1	0.36	0.0	20.2	0.0	79.8	0.0	1	---	---	---	---
RC-32	RC-26	1471.4	15.3	252.8	0.37	0.0	41.4	0.2	52.6	5.9	0	0	Natural	X	Optimal
RC-33	RC-32	127.8	5.1	58.6	0.35	0.0	44.3	0.0	51.5	4.3	0	---	---	---	---
RC-34	RC-33	69.2	7.7	69.2	0.35	0.0	49.2	0.0	43.5	7.2	0	0	Natural	AE	Optimal
RC-35	RC-38	365.0	28.5	87.3	0.35	0.0	47.0	0.0	45.9	7.1	2	5	Natural	A	Optimal
RC-36	RC-35	277.7	30.4	191.3	0.39	0.0	41.8	0.0	51.7	6.5	2	9	Natural	X	Suboptimal
RC-37	RC-36	86.4	31.0	86.4	0.32	0.0	57.2	0.0	28.9	13.9	3	---	---	---	---
RC-38	RC-32	720.6	20.4	321.7	0.38	0.0	42.7	0.0	51.0	6.3	2	2	Natural	X	Suboptimal
RC-39	RC-38	33.9	14.6	33.9	0.45	0.0	21.6	0.0	78.4	0.0	0	---	---	---	---
RC-40	RC-32	370.2	17.1	35.1	0.32	0.0	25.8	0.7	64.8	8.8	0	0	Natural	X	Optimal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
RC-41	RC-40	335.0	18.4	276.2	0.39	0.0	23.2	0.7	66.9	9.2	0	0	Natural	X	Marginal
RC-42	RC-41	58.8	17.0	58.8	0.40	0.0	22.7	0.0	69.4	7.8	0	---	---	---	---
RC-43	RC-26	1282.3	7.9	592.4	0.37	0.0	35.4	0.0	62.3	2.3	0	3	Natural	X	Suboptimal
RC-44	RC-43	689.9	11.9	162.3	0.34	0.0	33.9	0.0	63.1	3.0	0	0	Natural	X	Suboptimal
RC-45	RC-44	527.6	12.2	450.1	0.39	0.0	32.3	0.0	63.8	3.9	3	0	Natural	X	Optimal
RC-46	RC-45	77.5	27.2	77.5	0.43	0.0	16.8	0.0	76.9	6.3	0	---	---	---	---
RC-47	RC-22	344.4	2.3	27.5	0.35	0.0	29.5	0.0	70.5	0.0	0	0	Natural	X	Optimal
RC-48	RC-47	316.9	2.2	108.6	0.37	0.0	23.6	0.0	76.4	0.0	0	0	Natural	X	Optimal
RC-49	RC-48	208.2	1.9	142.5	0.41	0.0	7.7	0.0	92.3	0.0	0	0	Natural	X	Marginal
RC-50	RC-49	65.8	1.1	65.8	0.41	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
RC-51	RC-22	188.7	2.2	136.8	0.30	0.0	60.0	0.0	38.8	1.2	0	0	Natural	X	Optimal
RC-52	RC-51	51.9	0.0	51.9	0.40	0.0	27.7	0.0	72.3	0.0	0	---	---	---	---
RC-53	RC-16	482.8	1.6	43.0	0.21	0.0	63.6	0.0	33.2	3.2	0	0	Natural	X	Poor
RC-54	RC-53	439.8	1.6	116.9	0.25	0.0	62.8	0.0	35.9	1.4	0	0	Natural	X	Marginal
RC-55	RC-54	322.9	1.2	266.0	0.30	0.0	59.4	0.0	39.4	1.2	0	0	Natural	X	Optimal
RC-56	RC-55	56.9	0.0	56.9	0.43	0.0	15.3	0.0	84.7	0.0	0	---	---	---	---
RC-57	RC-16	56.8	3.6	14.0	0.27	0.0	94.8	0.0	4.2	1.0	0	0	Natural	X	Marginal
RC-58	RC-57	42.7	3.5	42.7	0.23	0.0	99.9	0.0	0.0	0.1	0	---	---	---	---
RC-59	RC-11	331.4	3.9	286.9	0.24	0.0	97.1	0.0	2.6	0.4	0	0	Natural	X	Suboptimal
RC-60	RC-59	44.5	4.5	44.5	0.23	0.0	92.7	0.0	7.3	0.0	0	---	---	---	---
RC-61	RC-11	119.4	7.6	68.7	0.24	0.0	85.7	0.0	11.2	3.2	0	0	Natural	X	Suboptimal
RC-62	RC-61	50.7	11.0	50.7	0.24	0.0	93.1	0.0	6.9	0.0	0	---	---	---	---
RC-63	RC-4	142.3	4.1	91.6	0.25	0.0	99.8	0.0	0.2	0.0	0	0	Natural	X	Optimal
RC-64	RC-63	50.7	4.7	50.7	0.24	0.0	99.4	0.0	0.6	0.0	0	---	---	---	---
RC-65	RC-4	109.7	5.0	66.8	0.26	0.0	84.3	0.0	15.7	0.0	0	0	Natural	X	Suboptimal
RC-66	RC-65	42.9	1.8	42.9	0.24	0.0	92.0	0.0	8.0	0.0	0	---	---	---	---
RC-67	RC-1	89.1	3.0	47.4	0.29	0.0	82.6	0.0	17.4	0.0	0	0	Natural	X	Marginal
RC-68	RC-67	41.7	1.0	41.7	0.24	0.0	67.9	0.0	32.1	0.0	0	---	---	---	---
T1ELR	ELR-1	5099.5	0.3	5099.5	0.24	0.0	46.5	7.3	46.1	0.1	0	0	Natural	A	Suboptimal
T1LT-1	---	2240.6	3.7	165.8	0.20	0.4	64.5	6.7	26.8	1.6	0	0	Natural	A	Suboptimal
T1LT-2	T1LT-1	769.9	3.0	382.9	0.24	0.0	74.9	3.6	20.8	0.7	0	0	Natural	A	Suboptimal
T1LT-3	T1LT-2	387.0	3.3	350.7	0.23	0.0	93.3	0.0	5.3	1.4	0	0	Natural	A	Marginal
T1LT-4	T1LT-3	36.3	0.8	36.3	0.21	0.0	100.0	0.0	0.0	0.0	0	---	---	---	---
T1LT-5	T1LT-1	919.7	4.3	162.9	0.24	1.0	61.5	7.3	30.2	0.0	0	0	Natural	A	Suboptimal
T1LT-6	T1LT-5	408.4	3.6	289.6	0.24	1.2	68.0	5.9	25.0	0.0	0	0	Natural	X	Suboptimal
T1LT-7	T1LT-6	40.8	6.3	40.8	0.30	0.0	48.7	0.0	51.3	0.0	0	---	---	---	---
T1LT-8	T1LT-6	78.0	5.7	37.1	0.30	0.0	75.7	1.2	23.1	0.0	0	0	Natural	X	Suboptimal
T1LT-9	T1LT-8	40.9	3.9	40.9	0.23	0.0	85.5	0.0	14.5	0.0	0	---	---	---	---
T1LT-10	T1LT-5	166.7	4.8	121.0	0.23	2.9	65.3	2.2	29.6	0.0	0	0	Natural	X	Suboptimal
T1LT-11	T1LT-10	45.7	3.4	45.7	0.24	0.0	80.6	0.0	19.4	0.0	0	---	---	---	---
T1LT-12	T1LT-5	77.7	5.3	32.3	0.24	0.0	59.5	2.4	38.1	0.0	0	0	Natural	X	Suboptimal
T1LT-13	T1LT-12	45.4	3.8	45.4	0.24	0.0	78.3	0.0	21.7	0.0	0	---	---	---	---
T1LT-14	T1LT-5	104.0	5.7	51.2	0.24	0.0	59.0	3.0	38.0	0.0	0	0	Natural	X	Suboptimal
T1LT-15	T1LT-14	52.8	5.1	52.8	0.24	0.0	75.1	0.0	24.9	0.0	0	---	---	---	---

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
T1LT-16	T1LT-1	385.1	4.1	345.3	0.24	0.0	59.0	7.7	32.1	1.2	0	0	Natural	X	Suboptimal
T1LT-17	T1LT-16	39.8	2.1	39.8	0.24	0.0	74.2	0.0	25.8	0.0	0	---	---	---	---
T2ELR	ELR-1	7779.5	0.4	7779.5	0.24	0.0	48.2	5.7	46.1	0.0	2	0	Natural	A	Optimal
T2LT-1	---	1504.0	3.8	248.3	0.24	0.0	40.2	7.2	52.7	0.0	0	0	Natural	X	Suboptimal
T2LT-2	T2LT-1	221.9	5.2	175.0	0.24	0.0	43.4	2.7	53.9	0.0	0	0	Natural	X	Suboptimal
T2LT-3	T2LT-2	46.8	3.7	46.8	0.24	0.0	36.7	0.0	63.3	0.0	0	---	---	---	---
T2LT-4	T2LT-1	470.8	3.5	192.5	0.24	0.0	32.2	8.1	59.7	0.0	0	0	Natural	X	Optimal
T2LT-5	T2LT-4	79.7	4.7	42.7	0.24	0.0	29.4	0.5	70.2	0.0	0	0	Natural	X	Suboptimal
T2LT-6	T2LT-5	36.9	7.1	36.9	0.24	0.0	23.4	0.0	76.6	0.0	0	---	---	---	---
T2LT-7	T2LT-4	80.1	9.4	23.0	0.24	0.0	29.2	4.4	66.4	0.0	0	0	Natural	X	Optimal
T2LT-8	T2LT-7	57.0	12.3	57.0	0.24	0.0	27.1	0.0	72.9	0.0	0	---	---	---	---
T2LT-9	T2LT-4	31.8	1.4	31.8	0.24	0.0	24.3	0.0	75.7	0.0	0	---	---	---	---
T2LT-10	T2LT-4	86.7	0.4	42.5	0.24	0.0	49.5	3.4	47.1	0.0	0	0	Natural	X	Suboptimal
T2LT-11	T2LT-10	44.3	0.2	44.3	0.24	0.0	71.5	0.0	28.5	0.0	0	---	---	---	---
T2LT-12	T2LT-1	370.2	3.7	331.0	0.24	0.0	48.7	7.1	44.2	0.0	0	0	Natural	X	Optimal
T2LT-13	T2LT-12	39.1	2.4	39.1	0.24	0.0	65.4	0.0	34.6	0.0	0	---	---	---	---
T2LT-14	T2LT-1	192.8	6.0	152.8	0.24	0.0	43.3	2.5	54.2	0.0	0	0	Natural	X	Suboptimal
T2LT-15	T2LT-14	40.0	10.6	40.0	0.24	0.0	72.2	0.0	27.8	0.0	0	---	---	---	---
T3ELR	ELR-1	1051.3	4.4	1051.3	0.23	0.0	68.8	6.2	23.3	1.7	0	0	Natural	A	Optimal
T4ELR	ELR-1	3067.0	0.5	2226.6	0.24	0.1	48.3	6.1	44.3	1.3	0	0	Natural	A	Optimal
T5ELR	T4ELR	840.4	0.5	840.4	0.24	0.3	37.8	5.9	56.1	0.0	0	0	Natural	---	Optimal
TABC-1	BC-3	1406.1	31.3	34.3	0.32	0.0	34.8	4.8	60.3	0.0	0	0	Natural	AE	Poor
TABC-2	TABC-1	1371.8	31.8	587.6	0.40	0.0	33.7	4.5	61.8	0.0	6	11	Natural	AE	Suboptimal
TABC-3	TABC-2	784.3	33.4	566.7	0.45	0.0	18.6	0.1	81.3	0.0	8	9	Natural/Concrete	AE	Marginal
TABC-4	TABC-3	217.6	33.9	217.6	0.43	0.0	40.8	0.0	59.2	0.0	3	---	---	---	---
TABHC-1	BHC-6	289.7	33.9	107.8	0.43	4.8	14.1	3.9	77.2	0.0	2	5	Natural	AE	Marginal
TABHC-2	TABHC-1	181.9	33.7	181.9	0.43	7.7	12.8	2.3	77.3	0.0	4	---	---	---	---
TBBC-1	BC-7	283.9	36.0	46.0	0.47	0.0	10.9	2.4	86.7	0.0	0	3	Natural/Concrete	AE	Marginal
TBBC-2	TBBC-1	237.9	36.7	180.3	0.47	0.0	9.8	2.9	87.3	0.0	3	3	Natural	AE	Marginal
TBBC-3	TBBC-2	57.6	38.8	57.6	0.48	0.0	4.4	0.0	95.6	0.0	2	---	---	---	---
TBBHC-1	BHC-6	156.2	10.5	21.7	0.47	0.0	0.0	0.0	100.0	0.0	0	1	Natural	AE	Poor
TBBHC-2	TBBHC-1	134.5	7.4	134.5	0.49	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
TCBC-1	BC-4	659.7	50.0	239.0	0.25	0.0	28.8	11.8	58.0	1.4	0	4	Natural	AE	Suboptimal
TCBC-2	TCBC-1	420.7	54.6	420.7	0.27	0.0	13.0	7.7	79.3	0.0	0	---	---	---	---
TGLR-1	LR-64	2607.6	9.9	132.7	0.40	0.6	11.4	11.5	76.0	0.5	0	4	Natural	A	Optimal
TGLR-2	TGLR-1	2346.6	9.7	228.8	0.41	0.6	8.8	10.0	80.0	0.6	3	2	Natural	A	Suboptimal
TGLR-3	TGLR-2	434.1	17.6	334.4	0.46	3.4	3.5	0.0	92.1	1.0	4	1	Natural	X	Suboptimal
TGLR-4	TGLR-3	99.7	32.2	99.7	0.44	5.6	14.3	0.0	80.1	0.0	5	---	---	---	---
TGLR-5	TGLR-7	166.7	18.2	71.0	0.45	0.1	9.3	0.0	90.6	0.0	0	0	Natural	X	Suboptimal
TGLR-6	TGLR-5	95.7	31.2	95.7	0.46	0.2	10.6	0.0	89.2	0.0	3	---	---	---	---
TGLR-7	TGLR-2	1683.8	6.0	79.9	0.43	0.0	8.3	13.1	78.0	0.5	0	2	Natural	A	Optimal
TGLR-8	TGLR-7	339.8	6.3	311.2	0.44	0.0	16.8	14.2	69.0	0.0	4	1	Natural	X	Marginal
TGLR-9	TGLR-8	28.6	2.1	28.6	0.35	0.0	49.6	28.4	22.0	0.0	0	---	---	---	---
TGLR-10	TGLR-7	772.2	2.9	245.7	0.45	0.0	4.7	22.0	73.3	0.0	0	0	Natural	X	Marginal

Appendix A: Citywide Subarea and Stream Reach Data

ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
TGLR-11	TGLR-10	83.4	0.0	59.7	0.45	0.0	17.6	0.5	81.9	0.0	0	0	Natural	X	Marginal
TGLR-12	TGLR-11	23.7	0.0	23.7	0.41	0.0	33.6	0.0	66.4	0.0	0	---	---	---	---
TGLR-13	TGLR-10	153.5	1.6	153.5	0.45	0.0	1.9	62.0	36.2	0.0	0	---	---	---	---
TGLR-14	TGLR-10	289.6	5.6	185.1	0.48	0.0	0.3	4.5	95.2	0.0	0	2	Natural	X	Marginal
TGLR-15	TGLR-14	60.7	0.8	60.7	0.48	0.0	0.0	13.9	86.1	0.0	0	---	---	---	---
TGLR-16	TGLR-14	43.7	12.8	43.7	0.49	0.0	0.0	0.0	100.0	0.0	0	0	Natural	X	Marginal
TGLR-17	TGLR-7	136.9	6.0	61.6	0.46	0.0	2.2	0.0	97.8	0.0	0	0	Natural	X	Marginal
TGLR-18	TGLR-17	75.3	6.0	75.3	0.49	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
TGLR-19	TGLR-7	188.2	8.4	144.4	0.45	0.0	0.1	0.0	95.1	4.8	0	0	Natural	X	Marginal
TGLR-20	TGLR-19	43.8	3.2	43.8	0.49	0.0	0.0	0.0	100.0	0.0	0	---	---	---	---
TGLR-21	TGLR-1	128.3	19.8	42.3	0.41	0.0	15.2	42.0	42.8	0.0	0	0	Natural	X	Marginal
TGLR-22	TGLR-21	86.0	25.0	86.0	0.30	0.0	7.7	43.2	49.0	0.0	0	---	---	---	---
TMFC-1	---	7004.5	5.3	391.3	0.31	4.6	35.7	44.7	14.3	0.8	2	1	Natural	AE	Optimal
TMFC-2	TMFC-1	6613.2	4.2	148.1	0.34	4.7	35.6	44.3	14.7	0.7	0	1	Natural	AE	Optimal
TMFC-3	TMFC-2	6465.1	3.7	183.1	0.34	4.8	35.7	44.1	14.8	0.7	5	0	Natural	AE	Optimal
TMFC-4	TMFC-3	6282.0	3.3	320.4	0.41	5.0	35.8	43.6	15.0	0.7	0	0	Natural	AE	Poor
TMFC-5	TMFC-4	5961.7	3.4	1388.5	0.33	5.2	37.6	41.2	15.3	0.7	3	2	Natural	AE	Poor
TMFC-6	TMFC-5	4573.2	1.5	1666.7	0.34	5.0	37.6	40.2	16.3	0.9	3	8	Natural	AE	Poor
TMFC-7	TMFC-6	2906.5	1.1	2906.5	0.34	2.2	42.8	37.2	16.7	1.2	0	---	---	---	---
WB-1	---	3269.6	0.9	165.8	0.24	0.0	47.7	2.7	49.6	0.0	0	0	Natural	A	Optimal
WB-2	WB-1	102.4	2.3	45.4	0.24	0.0	37.9	0.0	62.1	0.0	0	0	Natural	X	Suboptimal
WB-3	WB-2	57.0	4.2	57.0	0.24	0.0	17.3	0.0	82.7	0.0	0	---	---	---	---
WB-4	WB-1	1474.8	0.5	427.7	0.24	0.0	51.5	3.6	44.9	0.0	0	0	Natural	A	Optimal
WB-5	WB-4	1047.1	0.5	420.2	0.24	0.0	54.4	2.1	43.5	0.0	0	0	Natural	A	Suboptimal
WB-6	WB-5	626.9	0.7	626.9	0.24	0.0	51.5	0.0	48.5	0.0	0	---	---	---	---
WB-7	WB-1	1149.6	0.9	189.0	0.24	0.0	45.9	2.3	51.9	0.0	0	0	Natural	A	Suboptimal
WB-8	WB-7	191.4	1.8	116.0	0.23	0.0	63.6	2.1	34.3	0.0	0	0	Natural	X	Suboptimal
WB-9	WB-8	75.4	1.6	75.4	0.24	0.0	73.1	0.0	26.9	0.0	0	---	---	---	---
WB-10	WB-7	636.1	0.4	613.9	0.24	0.0	47.1	0.4	52.5	0.0	0	0	Natural	A	Suboptimal
WB-11	WB-10	22.1	0.2	22.1	0.24	0.0	17.4	0.0	82.6	0.0	0	---	---	---	---
WB-12	WB-7	133.2	0.3	92.1	0.24	0.0	30.6	0.0	69.4	0.0	0	0	Natural	X	Optimal
WB-13	WB-12	41.2	0.0	41.2	0.24	0.0	17.1	0.0	82.9	0.0	0	---	---	---	---
WB-14	WB-1	129.8	2.0	81.2	0.24	0.0	40.9	0.0	59.1	0.0	0	0	Natural	X	Optimal
WB-15	WB-14	48.6	3.0	48.6	0.24	0.0	44.7	0.0	55.3	0.0	0	---	---	---	---
WB-16	WB-1	141.4	1.8	94.5	0.25	0.0	49.6	0.0	50.4	0.0	0	0	Natural	X	Optimal
WB-17	WB-16	47.0	3.6	47.0	0.24	0.0	50.4	0.0	49.6	0.0	0	---	---	---	---
WB-18	WB-1	105.7	2.0	39.4	0.25	0.0	31.1	1.4	67.5	0.0	0	0	Natural	X	Optimal
WB-19	WB-18	66.3	3.1	66.3	0.25	0.0	22.4	0.0	77.6	0.0	0	---	---	---	---
WC-1	LR-48	1931.6	20.9	153.1	0.35	0.0	38.5	0.5	59.0	2.0	0	0	Natural	AE	Optimal
WC-2	WC-1	106.5	3.4	68.5	0.34	0.0	28.0	0.0	72.0	0.0	0	3	Natural	X	Suboptimal
WC-3	WC-2	38.0	1.7	38.0	0.37	0.0	24.0	0.0	76.0	0.0	0	---	---	---	---
WC-4	WC-1	1672.0	23.6	62.0	0.34	0.0	36.7	0.2	60.7	2.3	3	3	Natural	AE	Optimal
WC-5	WC-4	1009.9	20.5	184.5	0.37	0.0	38.8	0.0	59.6	1.6	7	7	Natural	AE	Suboptimal
WC-6	WC-5	825.4	17.9	252.3	0.39	0.0	32.6	0.0	65.4	2.0	10	3	Natural	AE	Suboptimal

Appendix A: Citywide Subarea and Stream Reach Data															
ID	Downstream ID	Cumulative Drainage Area	Cumulative Impervious Cover	Subarea Data								Stream Reach Data			
				Drainage Area	Soil Erodibility Factor	Hydrologic Soil Groups and Water					No. of Detention Facilities	No. of Storm Water Outfalls	Channel Configuration	FEMA Floodplain Type	Floodplain Vegetation [1]
						A	B	C	D	W					
		(Ac)	%	(Ac)	K	%	%	%	%	%					
WC-7	WC-6	573.1	14.6	305.4	0.40	0.0	17.7	0.0	79.5	2.9	2	0	Natural	AE	Optimal
WC-8	WC-7	267.7	20.7	267.7	0.43	0.0	9.6	0.0	89.3	1.1	6	---	---	---	---
WC-9	WC-10	150.0	43.8	150.0	0.49	0.0	0.0	0.0	99.9	0.1	1	---	---	---	---
WC-10	WC-11	422.1	32.3	272.1	0.41	0.0	17.6	0.0	77.3	5.1	6	7	Natural	X	Marginal
WC-11	WC-4	600.1	30.6	178.0	0.38	0.0	29.9	0.1	66.4	3.6	12	8	Natural	X	Marginal

[1] See the Unified Stream Assessment-Reach Assessment form for descriptions describing Poor, Optimal, Suboptimal, and Marginal.

Citywide Stream Abbreviations

BC - Bishop Creek
BHC - Brookhaven Creek
CC - Clear Creek
CR - Canadian River
DB - Dave Blue Creek
EC - Elm Creek
ELR - East Little River
HC - Hog Creek
IC - Imhoff Creek
JB - Jim Blue Creek
LR - Little River
LT - Lake Thunderbird
MC - Merkle Creek
RC - Rock Creek
T1ELR - Tributary 1 to East Little River
T1LT - Tributary 1 to Lake Thunderbird
T2ELR - Tributary 2 to East Little River
T2LT - Tributary 2 to Lake Thunderbird
T3ELR - Tributary 3 to East Little River
T4ELR - Tributary 4 to East Little River
T5ELR - Tributary 5 to East Little River
TABC - Tributary A to Bishop Creek
TABHC - Tributary A to Brookhaven Creek
TBBC - Tributary B to Bishop Creek
TBBHC - Tributary B to Brookhaven Creek
TCBC - Tributary C to Bishop Creek
TGLR - Tributary G to Little River
TMFC - Ten Mile Flat Creek
WB - Willow Branch
WC - Woodcrest Creek

Storm Water Master Plan
City of Norman
Cleveland County, Oklahoma

October 2009

Appendix B

Current Zoning

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
BC-1	0.1	13.7	1.4	4.0	0.8	0.7	0.0	5.0	2.7	0.0	0.5	1.4	2.6	20.3	0.0	2.1	4.3	0.0	1.9	0.3	5.4	0.2	0.0	15.2	0.0	17.6
BC-2	0.1	9.6	1.6	4.7	0.9	0.8	0.0	5.0	1.5	0.0	0.6	1.5	3.2	23.3	0.0	2.3	4.4	0.0	2.2	0.4	6.3	0.2	0.0	16.8	0.0	14.6
BC-3	0.1	8.4	1.7	4.2	1.2	0.8	0.0	0.6	1.5	0.0	0.2	1.5	2.7	25.0	0.0	2.9	5.5	0.0	2.3	0.5	6.3	0.1	0.0	16.9	0.0	17.7
BC-4	0.1	1.7	1.5	5.7	2.1	0.3	0.0	0.1	0.0	0.0	0.2	0.0	2.8	27.7	0.0	5.1	8.4	0.0	1.2	0.0	2.9	0.2	0.0	20.2	0.0	19.9
BC-5	0.1	2.6	1.7	7.0	1.0	0.4	0.0	0.0	0.0	0.0	0.3	0.0	1.9	34.5	0.0	7.3	1.4	0.0	1.4	0.0	3.5	0.0	0.0	19.2	0.0	17.6
BC-6	0.1	2.7	1.8	6.5	1.1	0.4	0.0	0.0	0.0	0.0	0.3	0.0	1.7	34.6	0.1	7.1	1.5	0.0	1.3	0.0	3.0	0.0	0.0	18.5	0.0	19.3
BC-7	0.2	2.8	1.9	6.2	1.2	0.4	0.0	0.0	0.0	0.0	0.4	0.0	1.8	34.9	0.1	6.5	1.4	0.0	1.1	0.0	2.9	0.0	0.0	18.0	0.0	20.4
BC-8	0.0	2.1	1.4	2.1	3.2	0.8	0.0	0.1	0.0	0.0	0.7	0.0	0.9	23.5	0.0	13.9	2.9	0.0	0.4	0.0	1.0	0.0	0.0	21.1	0.0	26.0
BC-9	0.0	0.0	1.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.6	0.0	0.5	0.0	0.0	0.0	0.0	1.0	0.0	0.0	9.8	0.0	75.1
BHC-1	0.0	11.6	3.5	5.3	0.0	0.2	0.0	4.1	0.0	0.0	0.1	1.7	12.3	31.7	0.0	0.0	0.0	0.1	2.4	1.6	7.8	0.0	0.0	17.8	0.0	0.0
BHC-2	0.0	3.8	4.4	2.1	0.0	0.3	0.0	5.5	0.0	0.0	0.1	1.9	15.5	34.6	0.0	0.0	0.0	0.1	2.3	1.1	8.4	0.0	0.0	20.1	0.0	0.0
BHC-3	0.0	3.9	4.5	2.2	0.0	0.3	0.0	5.7	0.0	0.0	0.1	1.9	16.1	35.1	0.0	0.0	0.0	0.1	1.6	0.0	8.3	0.0	0.0	20.2	0.0	0.0
BHC-4	0.0	4.2	5.1	2.1	0.0	0.3	0.0	6.7	0.0	0.0	0.1	1.6	18.3	34.5	0.0	0.0	0.0	0.1	1.2	0.0	5.7	0.0	0.0	20.1	0.0	0.0
BHC-5	0.0	5.0	4.2	1.0	0.0	0.0	0.0	8.2	0.0	0.0	0.2	0.8	22.1	33.5	0.0	0.0	0.0	0.2	0.6	0.0	5.0	0.0	0.0	19.2	0.0	0.0
BHC-6	0.0	6.4	5.7	0.0	0.0	0.0	0.0	13.4	0.0	0.0	0.3	0.8	34.0	17.2	0.0	0.0	0.0	0.0	0.6	0.0	3.6	0.0	0.0	17.9	0.0	0.0
BHC-7	0.0	5.3	0.8	0.0	0.0	0.0	0.0	35.8	0.0	0.0	0.9	0.0	36.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	19.7	0.0	0.0
CC-1	0.0	72.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.5	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
CC-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-3	0.0	71.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.7	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0
CC-4	0.0	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0
CC-5	0.0	89.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0
CC-6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-7	0.0	99.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0
CC-8	0.0	98.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
CC-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-10	0.0	99.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
CC-11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-12	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
CC-13	0.0	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
CC-14	0.0	49.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.5	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0
CC-15	0.0	71.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-16	0.0	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
CC-17	0.0	96.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0
CC-18	0.0	60.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	38.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0
CC-19	0.0	52.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	47.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
CC-20	0.0	88.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0
CC-21	0.0	82.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
CC-22	0.0	71.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	23.7	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
CC-23	0.0	42.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
CC-24	0.0	97.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
CC-25	0.0	97.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0
CC-26	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-27	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-28	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
CC-29	0.0	95.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0
CC-30	0.7	82.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
CC-31	2.3	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
CC-32	3.3	93.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
CC-33	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
CC-34	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-35	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-36	0.5	86.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
CC-37	0.0	91.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0
CC-38	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-39	0.0	80.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	13.2	0.0	0.0	0.0	0.0	0.0	3.9	1.1	0.0
CC-40	0.0	90.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	4.1	1.8	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
CC-41	0.0	99.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
CC-42	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR-1	0.0	93.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0
CR-2	0.7	67.3	0.2	1.5	0.0	0.2	0.0	0.2	0.0	0.0	0.0	8.9	0.0	12.1	0.0	0.6	0.3	0.0	0.0	0.2	1.4	0.0	0.0	6.5	0.0	0.0
CR-3	4.5	33.2	0.5	0.1	0.0	0.0	0.0	11.9	0.3	0.0	0.0	4.6	3.3	23.2	0.0	0.0	0.0	6.5	2.1	0.0	1.6	0.0	0.0	8.0	0.0	0.1
CR-4	1.0	96.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
DB-1	0.1	68.5	0.1	0.1	0.0	0.5	0.0	0.9	0.0	0.0	0.1	0.1	4.7	7.2	0.0	0.0	0.0	13.1	0.2	0.0	0.2	0.0	0.0	4.0	0.2	0.0
DB-2	0.0	98.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
DB-3	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-4	0.0	93.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0
DB-5	0.0	93.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0
DB-6	0.1	68.9	0.1	0.1	0.0	0.5	0.0	0.9	0.0	0.0	0.2	0.1	5.0	7.7	0.0	0.0	0.0	11.8	0.2	0.0	0.2	0.0	0.0	4.0	0.2	0.0
DB-7	0.1	68.6	0.1	0.1	0.0	0.5	0.0	0.9	0.0	0.0	0.2	0.1	5.1	7.8	0.0	0.0	0.0	11.9	0.2	0.0	0.2	0.0	0.0	4.0	0.2	0.0
DB-8	0.0	94.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-9	0.0	95.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
DB-10	0.0	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0
DB-11	0.0	68.7	0.2	0.1	0.0	0.8	0.0	1.4	0.0	0.0	0.2	0.2	5.1	11.1	0.1	0.0	0.0	7.1	0.3	0.0	0.3	0.0	0.0	4.1	0.3	0.0
DB-12	0.0	70.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	23.9	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
DB-13	0.0	76.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.4	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
DB-14	0.0	86.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
DB-15	0.0	99.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
DB-16	0.0	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
DB-17	0.0	97.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0
DB-18	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-19	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-20	0.0	60.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.6	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
DB-21	0.0	32.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.5	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0
DB-22	0.0	70.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
DB-23	0.0	34.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.5	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
DB-24	0.0	69.2	0.2	0.1	0.0	1.0	0.0	1.7	0.0	0.0	0.3	0.2	4.9	13.4	0.1	0.0	0.0	3.9	0.3	0.0	0.3	0.0	0.0	3.9	0.4	0.0
DB-25	0.0	79.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	18.6	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0
DB-26	0.0	77.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	20.1	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
DB-27	0.0	82.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
DB-28	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-29	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
DB-30	0.0	64.9	0.4	0.2	0.0	1.6	0.0	2.8	0.0	0.0	0.5	0.3	8.0	14.6	0.1	0.0	0.0	1.2	0.5	0.0	0.5	0.0	0.0	4.3	0.0	0.0
DB-31	0.0	64.0	0.4	0.2	0.0	1.6	0.0	2.8	0.0	0.0	0.5	0.4	8.2	14.9	0.1	0.0	0.0	1.3	0.5	0.0	0.5	0.0	0.0	4.4	0.0	0.0
DB-32	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-33	0.0	97.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
DB-34	0.0	97.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0
DB-35	0.0	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
DB-36	0.0	96.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0
DB-37	0.0	95.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0
DB-38	0.0	91.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
DB-39	0.0	91.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
DB-40	0.0	85.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
DB-41	0.0	75.3	0.7	0.5	0.0	2.0	0.0	4.4	0.0	0.0	1.0	0.1	5.3	7.0	0.0	0.0	0.0	0.0	0.1	0.0	0.5	0.0	0.0	3.2	0.0	0.0
DB-42	0.0	96.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
DB-43	0.0	99.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
DB-44	0.0	48.8	1.7	1.2	0.0	4.9	0.0	10.8	0.0	0.0	0.3	0.3	13.0	11.6	0.0	0.0	0.0	0.0	0.3	0.0	1.3	0.0	0.0	5.9	0.0	0.0
DB-45	0.0	38.5	2.1	1.5	0.0	6.2	0.0	13.7	0.0	0.0	0.4	0.4	13.3	14.8	0.0	0.0	0.0	0.0	0.4	0.0	1.6	0.0	0.0	7.2	0.0	0.0
DB-46	0.0	60.4	0.0	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
DB-47	0.0	38.8	0.2	0.0	0.0	1.8	0.0	1.8	0.0	0.0	0.0	0.8	14.3	30.4	0.4	0.0	0.0	3.4	1.3	0.0	0.8	0.0	0.0	6.2	0.0	0.0
DB-48	0.0	31.9	0.3	0.0	0.0	2.3	0.0	2.4	0.0	0.0	0.0	1.0	10.1	37.2	0.5	0.0	0.0	4.4	1.7	0.0	1.0	0.0	0.0	7.2	0.0	0.0
DB-49	0.0	23.8	0.0	0.0	0.0	15.2	0.0	15.4	0.0	0.0	0.0	0.0	31.2	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	0.0	0.0
DB-50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.7	0.0	0.0	0.0	0.0	40.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
DB-51	0.0	18.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	12.0	48.8	1.2	0.0	0.0	3.9	4.1	0.0	2.5	0.0	0.0	7.5	0.0	0.0
DB-52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.2	74.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.9	0.0	0.0
DB-53	0.0	25.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.7	17.9	0.0	0.0	0.0	11.8	4.7	0.0	0.3	0.0	0.0	5.4	0.0	0.0
DB-54	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.5	47.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5	0.0	0.0
DB-55	0.0	53.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	26.0	0.0	0.0	0.0	13.6	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0
DB-56	0.0	59.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	28.8	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0
DB-57	0.0	88.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
DB-58	0.0	75.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0
DB-59	0.0	82.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0	0.0	0.0	0.0	5.8	6.4	0.0
DB-60	0.0	79.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-61	0.0	71.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.2	0.0	0.0	0.0	0.0	0.0	8.5	11.1	0.0
DB-62	0.0	68.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	0.0	0.0	0.0	0.0	0.0	9.2	12.0	0.0
DB-63	0.0	38.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.7	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0
DB-64	0.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.4	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
DB-65	0.1	66.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	1.8	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
DB-66	0.0	51.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	41.2	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0
DB-67	0.0	69.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.3	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
DB-68	0.1	68.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	2.2	0.0	0.0	0.0	21.9	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
DB-69	0.0	58.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-70	0.0	41.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-71	0.0	56.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	37.6	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
DB-72	0.0	46.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	46.4	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
DB-73	0.0	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	78.4	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
DB-74	0.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
DB-75	0.0	81.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.2	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
DB-76	0.0	51.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.1	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
DB-77	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
DB-78	0.0	93.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0
DB-79	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-80	0.4	77.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	4.0	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
DB-81	0.5	82.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	8.5	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
DB-82	0.0	97.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
DB-83	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-84	0.0	66.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
DB-85	0.0	62.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	35.8	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
DB-86	0.0	99.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0
DB-87	0.0	89.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0
DB-88	0.0	94.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
DB-89	1.2	66.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	26.3	0.0	0.0	0.0	0.0	0.0	4.3	0.2	0.0
DB-90	0.0	26.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	62.0	0.0	0.0	0.0	0.0	0.0	7.4	0.5	0.0
DB-91	0.0	16.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.0	49.6	0.0	0.0	0.0	0.0	0.0	26.9	2.5	0.0
DB-92	0.0	44.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.9	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
DB-93	0.0	42.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-94	0.0	35.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.7	0.0	0.0	0.0	0.0	0.0	3.7	1.1	0.0
DB-95	0.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.6	0.0	0.0	0.0	0.0	0.0	4.9	1.5	0.0
DB-96	0.0	90.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	0.0	0.0
DB-97	0.0	68.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.5	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0
DB-98	0.0	77.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1	0.0	0.0	0.0	0.0	0.0	10.9	0.0	0.0
EC-1	0.0	52.5	0.0	0.2	0.0	0.0	0.0	3.0	0.0	0.0	0.8	30.5	0.0	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
EC-2	0.0	94.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
ELR-1	0.0	78.8	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	1.7	0.3	0.0
HC-1	0.0	91.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0
HC-2	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
HC-3	0.0	93.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-4	0.0	66.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.3	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
HC-5	0.0	74.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.2	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
HC-6	0.0	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
HC-7	0.0	84.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.6	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
HC-8	0.0	21.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-9	0.0	97.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
HC-10	0.0	98.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
HC-11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-12	0.0	97.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
HC-13	0.0	96.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
HC-14	0.0	95.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0
HC-15	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-16	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-17	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
HC-18	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
HC-19	0.0	93.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0	0.0
HC-20	0.0	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0
HC-21	0.0	94.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0
HC-22	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-23	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-24	0.0	93.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0
HC-25	0.0	59.2	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.9	0.0	32.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	6.2	0.0	0.0
HC-26	0.0	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
HC-27	0.0	97.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
HC-28	0.0	96.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
HC-29	0.0	93.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0
HC-30	0.0	64.9	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.2	0.0	30.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
HC-31	0.0	99.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
HC-32	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-33	0.0	99.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
HC-34	0.0	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
HC-35	0.0	61.8	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.2	0.0	33.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0
HC-36	0.0	97.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
HC-37	0.0	90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0
HC-38	0.0	90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0
HC-39	0.0	87.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0
HC-40	0.0	83.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
HC-41	0.0	52.9	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	41.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0
HC-42	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0
HC-43	0.0	95.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
HC-44	0.0	87.4	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0
HC-45	0.0	84.2	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0
HC-46	0.0	99.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
HC-47	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-48	0.0	57.6	0.0	0.2	0.0	0.0	0.0	0.5	0.0	0.0	0.5	1.1	0.0	32.6	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0
HC-49	0.0	53.4	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0	0.5	1.3	0.0	35.6	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	7.4	0.0	0.0
HC-50	0.0	72.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.5	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0
HC-51	0.0	95.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0
HC-52	0.0	64.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.4	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
HC-53	0.0	70.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
HC-54	0.0	78.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
HC-55	0.0	96.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0
HC-56	0.0	76.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0
HC-57	0.0	36.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	0.0	0.0
HC-58	0.0	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
HC-59	0.0	89.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	0.0	0.0
HC-60	0.0	92.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-61	0.0	94.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
HC-62	0.0	34.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.5	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
HC-63	0.0	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.4	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0
HC-64	0.0	71.9	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	23.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0
HC-65	0.0	70.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	24.7	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
HC-66	0.0	66.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	28.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
HC-67	0.0	75.6	0.0	0.1	0.0	0.0	0.0	0.6	0.0	0.0	0.1	0.3	0.0	19.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
HC-68	0.0	73.9	0.0	0.1	0.0	0.0	0.0	0.7	0.0	0.0	0.1	0.3	0.0	21.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
HC-69	0.0	64.7	0.0	0.2	0.0	0.0	0.0	0.9	0.0	0.0	0.2	0.4	0.0	28.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
HC-70	0.0	97.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0
HC-71	0.0	89.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0	0.0
IC-1	0.0	0.4	1.0	5.2	0.8	0.5	0.0	1.9	0.0	0.0	0.1	3.9	0.4	51.6	0.0	3.2	5.9	0.0	0.3	0.0	2.1	0.1	0.0	22.0	0.0	0.5
IC-2	0.0	0.5	0.9	5.5	0.9	0.5	0.0	2.0	0.0	0.0	0.1	0.3	0.2	54.0	0.0	3.4	6.2	0.0	0.3	0.0	1.9	0.1	0.0	22.8	0.0	0.5
IC-3	0.0	0.5	0.8	5.9	0.9	0.5	0.0	2.2	0.0	0.0	0.1	0.3	0.2	53.1	0.0	3.7	6.6	0.0	0.1	0.0	1.6	0.1	0.0	22.8	0.0	0.6
IC-4	0.0	0.6	0.9	7.1	1.1	0.6	0.0	2.6	0.0	0.0	0.1	0.3	0.1	48.2	0.0	4.2	7.7	0.0	0.1	0.0	1.9	0.1	0.0	23.6	0.0	0.7
IC-5	0.0	0.3	0.9	5.1	1.5	0.3	0.0	3.3	0.0	0.0	0.1	0.4	0.1	44.7	0.0	5.5	9.8	0.0	0.2	0.0	0.8	0.1	0.0	25.9	0.0	1.0
IC-6	0.0	0.4	1.1	6.2	1.9	0.4	0.0	4.1	0.0	0.0	0.1	0.5	0.2	39.4	0.0	5.3	11.2	0.0	0.2	0.0	0.9	0.2	0.0	27.3	0.0	0.6
IC-7	0.0	1.7	0.2	3.3	3.2	0.4	0.0	1.2	0.0	0.0	0.3	0.0	0.0	14.1	0.0	20.2	21.5	0.0	0.4	0.0	0.2	0.0	0.0	33.2	0.0	0.0
JB-1	0.0	83.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
JB-2	0.0	98.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
JB-3	0.0	99.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
JB-4	0.0	89.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	3.4	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
JB-5	0.0	20.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.1	0.0	0.0	0.0	0.0	0.0	12.7	0.0	0.0
JB-6	0.0	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.7	0.0	0.0	0.0	0.0	0.0	18.1	0.0	0.0
JB-7	0.0	92.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	4.7	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0
JB-8	0.0	74.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
JB-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JB-10	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JB-11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JB-12	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0
JB-13	0.0	98.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
JB-14	0.0	98.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
JB-15	0.0	89.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
JB-16	0.0	89.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
JB-17	0.0	74.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
JB-18	0.0	93.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0	0.0
JB-19	0.0	96.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
JB-20	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
JB-21	0.0	93.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
JB-22	0.0	90.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
JB-23	0.0	30.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	66.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
JB-24	0.0	82.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	14.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
JB-25	0.0	92.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
JB-26	0.0	81.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
JB-27	0.0	96.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
JB-28	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
JB-29	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
JB-30	0.0	75.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
JB-31	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
JB-32	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0
JB-33	0.2	95.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0
JB-34	0.2	93.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0
JB-35	0.0	96.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
JB-36	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-1	0.1	58.7	0.1	0.8	0.0	0.3	0.0	2.6	0.4	0.0	0.9	10.3	1.5	15.4	0.0	0.0	0.1	2.5	0.1	0.0	0.2	0.0	0.0	5.1	0.0	0.7
LR-2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-3	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LR-4	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-5	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-6	0.1	56.9	0.2	0.9	0.0	0.3	0.0	2.7	0.4	0.0	1.0	11.0	1.6	16.2	0.0	0.0	0.1	1.9	0.2	0.0	0.2	0.0	0.0	5.3	0.0	0.7
LR-7	0.1	55.3	0.1	1.0	0.0	0.4	0.0	3.1	0.5	0.0	1.2	12.5	1.4	16.9	0.0	0.0	0.1	1.4	0.1	0.0	0.2	0.0	0.0	5.4	0.0	0.2
LR-8	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-10	0.1	54.8	0.2	1.0	0.0	0.4	0.0	3.1	0.5	0.0	1.2	13.1	1.5	16.8	0.0	0.0	0.1	1.2	0.1	0.0	0.2	0.0	0.0	5.5	0.0	0.2
LR-11	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
LR-12	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
LR-13	0.0	84.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0
LR-14	0.0	72.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.6	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
LR-15	0.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.9	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
LR-16	0.0	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-17	0.1	55.7	0.2	1.6	0.0	0.7	0.1	3.2	0.8	0.1	1.5	2.9	2.4	21.9	0.1	0.0	0.2	1.7	0.2	0.1	0.3	0.0	0.0	6.0	0.0	0.3
LR-18	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
LR-19	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
LR-20	0.1	54.9	0.2	1.6	0.0	0.7	0.1	3.3	0.8	0.1	1.5	3.0	2.4	22.3	0.1	0.0	0.2	1.8	0.2	0.1	0.3	0.0	0.0	6.1	0.0	0.3
LR-21	0.0	95.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
LR-22	0.0	96.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-23	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-24	0.0	96.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0
LR-25	0.0	96.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0
LR-26	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
LR-27	0.0	96.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0
LR-28	0.1	52.5	0.3	1.7	0.0	0.7	0.1	3.5	0.9	0.1	1.6	3.2	2.6	23.4	0.1	0.0	0.3	1.9	0.2	0.1	0.3	0.0	0.0	6.3	0.0	0.4
LR-29	0.1	50.9	0.3	1.8	0.0	0.8	0.1	3.8	1.0	0.1	1.6	3.5	2.8	23.2	0.1	0.0	0.3	2.1	0.2	0.1	0.4	0.0	0.0	6.6	0.0	0.4
LR-30	0.0	99.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
LR-31	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
LR-32	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-33	0.0	87.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0
LR-34	0.0	85.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0
LR-35	0.0	92.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	0.0	0.0
LR-36	0.0	98.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
LR-37	0.0	97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
LR-38	0.0	86.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0	0.0
LR-39	0.1	49.3	0.3	1.9	0.0	0.8	0.1	3.9	1.0	0.1	1.7	3.6	2.9	24.1	0.1	0.0	0.3	2.0	0.2	0.1	0.4	0.0	0.0	6.7	0.0	0.4
LR-40	0.0	47.6	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.1	5.9	0.0	0.0	0.0	3.2	3.0	0.0	0.9	0.0	0.0	8.1	0.0	0.0
LR-41	0.0	44.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.3	6.3	0.0	0.0	0.0	7.7	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0
LR-42	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	24.8	0.0	0.0	0.0	30.6	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
LR-43	0.0	33.6	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.7	6.1	0.0	0.0	0.0	3.5	3.9	0.0	1.2	0.0	0.0	10.1	0.0	0.0
LR-44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.9	22.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	13.6	0.0	0.0
LR-45	0.1	47.8	0.2	1.9	0.0	0.9	0.1	4.1	1.1	0.1	1.8	3.7	2.6	25.3	0.1	0.0	0.3	2.1	0.2	0.1	0.4	0.0	0.0	6.8	0.0	0.5
LR-46	0.0	16.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.4	4.3	0.0	0.0	0.0	29.7	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
LR-47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.0	11.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-48	0.2	44.5	0.4	2.3	0.0	0.8	0.1	5.3	1.8	0.1	1.9	2.4	4.3	21.3	0.2	0.0	0.5	2.9	0.3	0.2	0.6	0.0	0.0	9.2	0.0	0.8
LR-49	0.2	47.9	0.0	0.7	0.0	0.0	0.0	13.5	9.3	0.8	0.0	0.6	10.7	6.7	1.3	0.0	0.0	0.0	0.0	0.9	0.4	0.0	0.0	7.1	0.0	0.0
LR-50	0.2	40.8	0.0	0.8	0.0	0.0	0.0	15.5	11.2	1.0	0.0	0.7	12.4	6.8	1.5	0.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	7.4	0.0	0.0
LR-51	0.0	40.9	0.0	0.6	0.0	0.0	0.0	13.2	16.4	1.6	0.0	0.0	16.2	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.1	0.0	0.0	9.2	0.0	0.0
LR-52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.1	37.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.6	0.0	0.0	0.0	10.7	0.0	0.0
LR-53	0.2	47.6	0.3	2.6	0.0	0.8	0.2	6.4	2.1	0.1	2.3	1.6	4.2	18.8	0.1	0.0	0.5	2.9	0.0	0.1	0.0	0.0	0.0	9.1	0.0	0.0
LR-54	0.0	33.1	0.0	0.0	0.0	0.0	0.0	40.0	3.1	0.4	1.8	0.0	9.8	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	11.0	0.0	0.0
LR-55	0.0	1.4	0.0	0.0	0.0	0.0	0.0	68.3	4.9	1.1	0.0	0.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.1	0.0	0.0
LR-56	2.9	14.8	0.0	0.0	0.0	0.0	0.0	23.0	11.2	0.6	0.6	0.0	24.1	0.1	0.0	0.0	0.0	6.5	0.2	0.0	0.0	0.0	0.0	16.0	0.0	0.0
LR-57	4.6	1.2	0.0	0.0	0.0	0.0	0.0	15.9	16.1	0.7	0.0	0.0	33.1	0.1	0.0	0.0	0.0	8.3	0.3	0.0	0.0	0.0	0.0	19.7	0.0	0.0
LR-58	0.0	0.8	0.0	0.0	0.0	0.0	0.0	17.9	18.2	0.0	0.0	0.0	41.0	0.2	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	21.5	0.0	0.0
LR-59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.9	6.4	0.0	0.0	0.0	64.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LR-60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	5.2	0.0	0.0	0.0	89.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
LR-61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.1	0.0	0.0	0.0	0.0	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0
LR-62	7.7	0.0	0.0	0.0	0.0	0.0	0.0	15.5	30.3	3.7	0.0	0.0	8.6	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	27.3	0.0	0.0
LR-63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	35.4	0.0	0.0	0.0	18.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.4	0.0	0.0
LR-64	0.0	49.2	0.3	3.2	0.0	1.1	0.2	4.2	0.5	0.0	2.8	2.0	1.7	22.8	0.0	0.0	0.7	2.5	0.0	0.1	0.0	0.0	0.0	8.9	0.0	0.0
LR-65	0.0	46.5	0.0	3.9	0.0	1.5	0.3	3.4	0.6	0.0	3.9	2.6	0.8	25.5	0.0	0.0	0.9	1.1	0.0	0.1	0.0	0.0	0.0	8.8	0.0	0.0
LR-66	0.0	39.6	0.0	0.0	0.0	0.0	0.0	17.3	0.0	0.0	0.0	0.0	13.4	0.0	0.0	0.0	0.0	9.1	0.0	0.0	0.0	0.0	0.0	20.8	0.0	0.0
LR-67	0.0	26.1	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	0.0	0.0	31.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.4	0.0	0.0
LR-68	0.0	46.3	0.0	4.1	0.0	1.6	0.3	3.0	0.6	0.0	4.1	2.8	0.5	26.8	0.0	0.0	1.0	0.3	0.0	0.1	0.0	0.0	0.0	8.6	0.0	0.0
LR-69	0.0	40.5	0.0	5.0	0.0	1.8	0.4	2.5	0.7	0.0	4.6	2.3	0.6	30.2	0.0	0.0	1.2	0.0	0.0	0.1	0.0	0.0	0.0	10.2	0.0	0.0
LR-70	0.0	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0
LR-71	0.0	26.7	0.0	8.1	0.0	2.7	0.0	3.5	0.8	0.0	5.7	2.7	0.0	34.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	14.2	0.0	0.0
LR-72	0.0	25.9	0.0	8.4	0.0	2.8	0.0	3.4	0.0	0.0	5.4	2.8	0.0	35.6	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	14.1	0.0	0.0
LR-73	0.3	65.8	0.0	0.9	0.0	1.3	0.0	9.7	0.0	0.0	3.6	2.9	0.0	13.9	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
LR-74	0.0	64.9	0.0	1.0	0.0	1.5	0.0	10.6	0.0	0.0	4.0	3.2	0.0	13.5	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0
LR-75	0.0	89.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
LR-76	0.0	68.4	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	9.9	0.0	15.6	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
LR-77	0.0	64.5	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	12.0	0.0	21.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
LR-78	0.0	68.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.7	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0
LR-79	0.0	91.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	7.8	0.0	0.0
LR-80	0.0	93.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.0
LR-81	0.0	89.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7	0.0	0.0
LR-82	0.0	90.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
LR-83	0.0	73.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.9	0.0	0.0	0.0	0.0	0.0	11.5	0.0	0.0
LR-84	0.5	85.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	0.0	0.0	0.0	0.0	0.0	4.7	0.3	0.0
LR-85	0.7	83.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
LR-86	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-87	0.0	74.1	0.0	4.5	0.0	0.4	0.0	0.8	0.0	0.0	0.0	7.0	0.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
LR-88	0.0	68.4	0.0	6.7	0.0	0.7	0.0	1.3	0.0	0.0	0.0	10.6	0.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
LR-89	0.0	41.4	0.0	10.6	0.0	1.8	0.0	3.4	0.0	0.0	0.0	28.1	0.0	10.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0
LR-90	0.0	71.5	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
LR-91	0.0	1.2	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
LR-92	0.0	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0
LR-93	0.0	69.0	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0	3.3	1.4	0.0	22.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
LR-94	0.0	64.6	0.0	0.4	0.0	0.0	0.0	0.6	0.0	0.0	3.7	1.6	0.0	25.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
LR-95	0.0	56.8	0.0	0.5	0.0	0.0	0.0	0.8	0.0	0.0	4.0	2.0	0.0	32.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
LR-96	0.0	98.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
LR-97	0.0	99.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
LR-98	0.0	65.4	0.0	0.2	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	29.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0
LR-99	0.0	57.7	0.0	0.3	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
LR-100	0.0	68.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0
LR-101	0.0	56.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0
LR-102	0.0	87.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
LR-103	0.0	74.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0
LR-104	0.0	89.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
LR-105	0.0	90.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0
LR-106	0.0	98.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
LR-107	0.0	97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
LR-108	0.0	99.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
LR-109	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-110	0.0	62.1	0.0	0.2	0.0	0.0	0.0	3.9	0.0	0.0	0.2	0.1	0.0	23.1	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
LR-111	0.0	56.3	0.0	0.2	0.0	0.0	0.0	4.7	0.0	0.0	0.2	0.2	0.0	26.8	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0
LR-112	0.0	61.4	0.0	0.2	0.0	0.0	0.0	9.7	0.0	0.0	0.4	0.4	0.0	23.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
LR-113	0.0	98.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
LR-114	0.0	89.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0
LR-115	0.0	81.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	0.0	2.2	0.2	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LR-116	0.0	80.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	2.2	0.2	0.0
LR-117	0.0	79.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.7	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
LR-118	0.0	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0
LR-119	0.0	80.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
LR-120	0.0	52.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.6	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
LR-121	0.0	93.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-122	0.0	84.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0
LR-123	0.0	83.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0
LR-124	0.0	89.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	0.0	0.0
LR-125	0.0	52.9	0.0	1.3	0.0	1.0	0.0	2.4	0.0	0.0	1.7	5.6	0.0	31.6	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0
LR-126	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
LR-127	0.0	94.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0
LR-128	0.0	85.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	5.5	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0
LR-129	0.0	82.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	6.7	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
LR-130	0.0	71.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	0.0	0.0	13.3	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0
LR-131	0.0	79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	6.9	0.0	0.0	0.0	7.9	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
LR-132	0.0	49.9	0.0	1.4	0.0	1.1	0.0	2.6	0.0	0.0	1.6	6.1	0.0	33.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
LR-133	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-134	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-135	0.0	49.0	0.0	1.5	0.0	1.1	0.0	2.7	0.0	0.0	1.6	5.8	0.0	34.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
LT-1	0.0	76.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.2	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0
LT-2	0.0	11.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.4	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0
LT-3	0.0	92.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0
LT-4	0.0	91.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0	0.0
LT-5	0.0	98.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
LT-6	0.0	57.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.6	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
LT-7	0.0	40.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.8	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0
LT-8	3.5	88.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0
LT-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-10	0.3	69.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.1	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
LT-11	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
LT-12	0.4	84.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
LT-13	0.0	93.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0
LT-14	0.0	90.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	0.0	0.0
LT-15	0.0	88.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0
LT-16	0.0	83.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0
LT-17	0.0	88.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
LT-18	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
LT-19	0.0	96.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
LT-20	0.0	90.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	4.4	0.2	0.0
LT-21	0.0	90.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0
LT-22	0.0	88.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0
LT-23	0.0	80.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	0.0	0.0
LT-24	0.0	95.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0
LT-25	0.0	94.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.3	0.0
LT-26	0.0	81.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	14.2	0.0
LT-27	0.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	32.4	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
LT-28	0.0	52.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.4	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
LT-29	0.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.7	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
LT-30	0.0	22.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.1	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
LT-31	0.0	92.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.4	0.0	0.0	0.0	0.0	0.0	5.6	0.0	0.0
LT-32	0.0	93.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
LT-33	0.0	98.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
LT-34	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-35	0.0	99.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0
LT-36	0.0	99.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LT-37	0.0	96.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
LT-38	0.0	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0
LT-39	0.0	93.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-40	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-41	0.0	86.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-42	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-43	0.0	96.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	0.0
LT-44	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
LT-45	0.0	98.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0
LT-46	0.0	97.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
LT-47	0.0	98.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0
LT-48	0.0	97.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
LT-49	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-50	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-51	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-52	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-53	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-54	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-55	0.0	88.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	2.7	2.4	0.0	0.0
LT-56	0.0	83.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	0.0	0.0	0.0	0.0	1.1	4.0	0.0	0.0
LT-57	0.0	68.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.7	0.0	0.0	0.0	0.0	0.2	5.5	0.0	0.0
LT-58	0.0	87.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.9	2.5	0.0	0.0
LT-59	0.0	92.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.3	2.3	0.0	0.0
LT-60	0.0	87.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0
LT-61	0.0	77.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.7	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0
LT-62	0.0	96.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
LT-63	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-64	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-65	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MC-1	0.0	20.8	1.3	13.1	0.0	0.6	0.0	1.8	0.0	0.2	0.0	0.7	6.3	30.8	0.0	0.0	0.2	0.0	0.4	0.8	5.1	0.0	0.0	17.6	0.0	0.0
MC-2	0.0	21.7	1.4	13.6	0.0	0.7	0.0	1.9	0.0	0.2	0.1	0.7	6.5	30.1	0.0	0.0	0.2	0.0	0.4	0.8	3.9	0.0	0.0	17.8	0.0	0.0
MC-3	0.0	21.9	1.4	13.3	0.0	0.7	0.0	1.9	0.0	0.2	0.1	0.7	6.5	30.4	0.0	0.0	0.2	0.0	0.4	0.7	4.0	0.0	0.0	17.7	0.0	0.0
MC-4	0.0	28.3	1.6	7.8	0.0	0.6	0.0	2.0	0.0	0.2	0.1	0.3	7.6	33.9	0.0	0.0	0.0	0.0	0.4	0.9	2.7	0.0	0.0	13.6	0.0	0.0
MC-5	0.0	29.1	1.6	7.8	0.0	0.6	0.0	2.1	0.0	0.2	0.0	0.3	7.8	34.2	0.0	0.0	0.0	0.0	0.2	1.0	2.0	0.0	0.0	13.2	0.0	0.0
MC-6	0.0	30.7	1.7	7.8	0.0	0.5	0.0	2.2	0.0	0.3	0.0	0.3	8.1	32.8	0.0	0.0	0.0	0.0	0.2	1.0	1.6	0.0	0.0	12.8	0.0	0.0
MC-7	0.0	33.7	1.8	7.9	0.0	0.6	0.0	2.4	0.0	0.3	0.0	0.3	8.9	29.3	0.0	0.0	0.0	0.0	0.1	1.1	1.6	0.0	0.0	12.0	0.0	0.0
MC-8	0.0	37.7	1.8	2.1	0.0	0.6	0.0	2.0	0.0	0.3	0.0	0.4	10.0	31.1	0.0	0.0	0.0	0.0	0.1	1.2	1.2	0.0	0.0	11.5	0.0	0.0
MC-9	0.0	48.7	0.3	0.3	0.0	0.4	0.0	1.3	0.0	0.0	0.0	0.0	10.6	27.0	0.0	0.0	0.0	0.0	0.1	1.6	1.2	0.0	0.0	8.5	0.0	0.0
MC-10	0.0	60.3	0.4	0.2	0.0	0.5	0.0	1.7	0.0	0.0	0.0	0.0	13.4	14.2	0.0	0.0	0.0	0.0	0.1	2.0	1.2	0.0	0.0	5.9	0.0	0.0
MC-11	0.0	73.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.4	4.5	0.0	0.0	0.0	0.0	0.1	2.6	0.4	0.0	0.0	5.4	0.0	0.0
RC-1	0.1	65.8	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	3.2	11.6	0.1	0.0	0.0	6.4	0.6	0.0	0.7	0.0	0.0	4.8	0.0	5.1
RC-2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-3	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-4	0.1	64.7	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	3.3	12.0	0.1	0.0	0.0	6.6	0.6	0.0	0.8	0.0	0.0	4.9	0.0	5.3
RC-5	0.0	97.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
RC-6	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
RC-7	1.0	90.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0
RC-8	1.3	87.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0
RC-9	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
RC-10	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-11	0.1	58.9	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	4.0	14.6	0.1	0.0	0.0	7.0	0.8	0.0	0.9	0.0	0.0	5.3	0.0	6.4
RC-12	0.0	96.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
RC-13	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
RC-14	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
RC-15	0.0	97.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
RC-16	0.1	56.2	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	4.5	16.3	0.1	0.0	0.0	6.0	0.9	0.0	1.0	0.0	0.0	5.6	0.0	7.2

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
RC-17	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-18	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-19	0.0	97.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
RC-20	0.0	94.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0
RC-21	0.0	98.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0
RC-22	0.1	49.5	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	5.2	18.9	0.1	0.0	0.0	7.0	1.0	0.0	1.2	0.0	0.0	6.1	0.0	8.4
RC-23	2.1	93.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
RC-24	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-25	0.0	36.4	0.6	0.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.8	7.1	25.6	0.2	0.0	0.0	6.0	1.3	0.0	1.6	0.0	0.0	7.1	0.0	11.3
RC-26	0.0	36.2	0.6	0.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.8	7.1	25.9	0.2	0.0	0.0	5.7	1.4	0.0	1.6	0.0	0.0	7.2	0.0	11.4
RC-27	0.0	91.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-28	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-29	0.0	49.8	0.9	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.5	20.1	0.0	0.0	0.0	5.1	8.4	0.0	8.1	0.0	0.0	6.7	0.0	0.0
RC-30	0.0	18.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.1	0.0	0.0	0.0	2.9	15.6	0.0	15.8	0.0	0.0	10.7	0.0	0.0
RC-31	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0
RC-32	0.0	20.4	1.1	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	5.3	32.0	0.4	0.0	0.0	0.0	0.6	0.0	1.3	0.0	0.0	9.0	0.0	26.3
RC-33	0.0	53.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.2	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	2.8	0.0	0.0
RC-34	0.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.4	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0	0.0	3.7	0.0	0.0
RC-35	0.0	7.8	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	6.1	49.0	1.8	0.0	0.0	0.0	1.4	0.0	0.7	0.0	0.0	16.9	0.0	5.8
RC-36	0.0	10.3	0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	8.0	51.6	2.4	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	17.7	0.0	0.0
RC-37	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	70.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.6	0.0	0.0
RC-38	0.0	4.3	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	3.1	35.8	0.9	0.0	0.0	0.0	0.8	0.0	0.4	0.0	0.0	11.9	0.0	35.6
RC-39	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.5	0.0	0.0	0.0	0.0	2.1	0.0	0.1	0.0	0.0	9.7	0.0	69.6
RC-40	0.0	17.8	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	43.4	0.0	0.0	0.0	0.0	1.0	0.0	2.9	0.0	0.0	9.7	0.0	20.9
RC-41	0.0	18.1	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0	0.0	0.0	0.0	0.0	1.1	0.0	3.2	0.0	0.0	10.0	0.0	14.9
RC-42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.4	0.0	0.0	0.0	0.0	6.0	0.0	18.1	0.0	0.0	10.5	0.0	9.9
RC-43	0.0	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	11.4	24.9	0.0	0.0	0.0	11.3	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0
RC-44	0.0	26.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	5.3	6.8	46.2	0.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0	8.8	0.0	0.0
RC-45	0.0	12.8	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	6.9	8.9	54.4	0.0	0.0	0.0	7.6	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0
RC-46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.7	0.0	62.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	0.0	0.0
RC-47	0.0	65.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.5	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
RC-48	0.0	65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.6	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0
RC-49	0.0	94.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0
RC-50	0.0	96.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
RC-51	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0
RC-52	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-53	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
RC-54	0.0	97.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
RC-55	0.0	97.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
RC-56	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-57	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-58	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-59	0.0	82.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0
RC-60	0.0	99.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
RC-61	0.0	57.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.6	0.0	0.0	0.0	0.0	0.0	6.2	0.0	0.0
RC-62	0.0	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.1	0.0	0.0	0.0	0.0	0.0	7.3	0.0	0.0
RC-63	0.0	86.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
RC-64	0.0	74.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.8	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0
RC-65	0.0	89.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
RC-66	0.0	78.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-67	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0
RC-68	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T1ELR	0.0	75.8	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.0	0.1	0.0	0.0	20.8	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
T1LT-1	0.1	86.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	10.7	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
T1LT-2	0.0	69.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	26.5	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
T1LT-3	0.0	83.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	11.7	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
T1LT-4	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T1LT-5	0.2	93.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
T1LT-6	0.6	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
T1LT-7	0.0	95.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0
T1LT-8	2.9	91.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0
T1LT-9	1.8	96.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
T1LT-10	0.0	80.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.7	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
T1LT-11	0.0	85.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
T1LT-12	0.0	99.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
T1LT-13	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T1LT-14	0.0	95.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0
T1LT-15	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0
T1LT-16	0.0	97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
T1LT-17	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2ELR	0.0	74.6	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	17.2	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0
T2LT-1	0.0	71.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	21.9	0.0	0.0	0.0	0.0	0.0	3.0	0.6	0.0
T2LT-2	0.0	85.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
T2LT-3	0.0	43.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.2	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0
T2LT-4	0.0	81.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
T2LT-5	0.0	99.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-7	0.0	41.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0
T2LT-8	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.6	0.0	0.0
T2LT-9	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
T2LT-10	0.0	85.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-11	0.0	83.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-12	0.0	38.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.7	0.0	0.0	0.0	0.0	0.0	3.8	2.4	0.0
T2LT-13	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-14	0.0	61.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.3	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0
T2LT-15	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T3ELR	0.0	80.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	4.0	1.3	0.0
T4ELR	0.0	89.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.3	0.0
T5ELR	0.0	83.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0
TABC-1	0.2	16.3	2.6	2.8	0.0	1.7	0.0	1.7	0.0	0.0	0.4	4.3	3.4	28.3	0.0	0.2	1.1	0.0	4.8	1.5	13.8	0.0	0.0	15.0	0.0	1.8
TABC-2	0.2	16.7	2.7	2.7	0.0	1.8	0.0	1.7	0.0	0.0	0.4	4.4	3.3	29.0	0.0	0.2	1.1	0.0	4.9	1.5	14.2	0.0	0.0	14.9	0.0	0.3
TABC-3	0.0	18.5	3.6	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	3.6	29.2	0.1	0.0	0.6	0.0	4.2	0.0	19.3	0.0	0.0	13.8	0.0	0.0
TABC-4	0.0	36.9	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.2	0.0	0.0	0.0	0.0	4.2	0.0	20.2	0.0	0.0	13.3	0.0	0.0
TABHC-1	0.0	9.5	10.3	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	1.7	13.6	33.2	0.0	0.0	0.0	0.0	1.7	0.0	5.5	0.0	0.0	19.4	0.0	0.0
TABHC-2	0.0	15.1	4.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	1.9	21.7	21.6	0.0	0.0	0.0	0.0	2.7	0.0	6.0	0.0	0.0	19.1	0.0	0.0
TBBC-1	0.7	4.5	4.8	6.1	0.0	0.5	0.0	0.0	0.0	0.0	0.4	0.0	1.8	18.0	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	0.0	43.2
TBBC-2	0.0	5.3	5.5	7.2	0.0	0.6	0.0	0.0	0.0	0.0	0.5	0.0	2.1	13.6	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7	0.0	49.1
TBBC-3	0.0	0.0	9.7	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	8.0	34.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	20.6	0.0	25.0
TBBHC-1	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	9.5	0.0	0.0
TBBHC-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	92.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	0.0	0.0
TCBC-1	0.0	0.0	1.2	1.5	5.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.7	13.0	0.0	0.6	25.3	0.0	0.1	0.0	1.5	0.6	0.0	22.0	0.0	28.0
TCBC-2	0.0	0.0	1.2	2.3	7.8	0.4	0.0	0.3	0.0	0.0	0.0	0.0	0.3	4.8	0.0	1.0	27.9	0.0	0.1	0.0	1.0	0.9	0.0	28.5	0.0	23.5
TGLR-1	0.0	50.5	1.3	1.5	0.0	0.0	0.0	7.2	0.2	0.0	0.0	0.3	4.3	18.0	0.0	0.0	0.0	6.6	0.2	0.0	0.0	0.0	0.0	9.9	0.0	0.0
TGLR-2	0.0	51.6	1.5	1.7	0.0	0.0	0.0	6.0	0.2	0.0	0.0	0.3	4.7	20.0	0.0	0.0	0.0	3.8	0.2	0.0	0.0	0.0	0.0	9.9	0.0	0.0
TGLR-3	0.0	29.5	5.8	2.4	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.2	24.1	20.0	0.0	0.0	0.0	1.5	1.1	0.0	0.0	0.0	0.0	13.4	0.0	0.0
TGLR-4	0.0	16.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	59.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	16.9	0.0	0.0
TGLR-5	0.0	43.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	39.2	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	10.2	0.0	0.0
TGLR-6	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	66.9	0.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	16.6	0.0	0.0
TGLR-7	0.0	64.3	0.5	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.4	0.2	22.7	0.0	0.0	0.0	4.9	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0
TGLR-8	0.0	33.7	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	50.0	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0
TGLR-9	0.0	74.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
TGLR-10	0.0	80.2	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0

Appendix B: Citywide Current Zoning

ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
TGLR-11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TGLR-12	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TGLR-13	0.0	75.3	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
TGLR-14	0.0	66.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0
TGLR-15	0.0	94.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0
TGLR-16	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
TGLR-17	0.0	56.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.5	0.0	0.0	0.0	12.7	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0
TGLR-18	0.0	65.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	0.0	0.0
TGLR-19	0.0	74.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	12.4	0.0	0.0	0.0	0.0	0.0	11.6	0.0	0.0
TGLR-20	0.0	88.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0
TGLR-21	0.0	48.7	0.0	0.0	0.0	0.0	0.0	27.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0
TGLR-22	0.0	51.3	0.0	0.0	0.0	0.0	0.0	40.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0
TMFC-1	0.6	78.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.4	2.2	10.7	0.0	0.0	0.0	2.1	0.0	0.0	0.4	0.0	0.0	4.6	0.0	0.0
TMFC-2	0.6	80.8	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	2.3	9.2	0.0	0.0	0.0	2.3	0.0	0.0	0.2	0.0	0.0	4.2	0.0	0.0
TMFC-3	0.6	81.9	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	2.4	8.2	0.0	0.0	0.0	2.3	0.0	0.0	0.2	0.0	0.0	3.9	0.0	0.0
TMFC-4	0.6	82.8	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	2.4	7.3	0.0	0.0	0.0	2.4	0.0	0.0	0.2	0.0	0.0	3.7	0.0	0.0
TMFC-5	0.7	82.1	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	2.6	7.7	0.0	0.0	0.0	2.5	0.0	0.0	0.2	0.0	0.0	3.7	0.0	0.0
TMFC-6	0.0	85.8	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.8	7.1	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
TMFC-7	0.1	90.8	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
WB-1	0.0	83.9	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	11.1	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.1	2.5	0.2	0.0
WB-2	0.0	97.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0
WB-3	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0
WB-4	0.0	69.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	22.4	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	2.9	0.3	0.0
WB-5	0.0	65.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0
WB-6	0.0	48.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
WB-7	0.0	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
WB-8	0.0	98.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0
WB-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WB-10	0.0	92.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0
WB-11	0.0	90.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0	0.0
WB-12	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WB-13	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WB-14	0.0	93.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0
WB-15	0.0	89.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	5.1	0.0	0.0
WB-16	0.0	96.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.5	0.0
WB-17	0.0	91.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	5.4	0.0
WB-18	0.0	97.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.1	0.0
WB-19	0.0	96.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.7	0.0
WC-1	0.1	11.4	1.2	1.2	0.0	0.8	0.0	0.0	0.0	0.0	0.2	8.4	4.7	45.4	0.4	0.0	0.0	0.9	1.8	0.4	4.9	0.0	0.0	11.6	0.1	6.3
WC-2	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	3.1	80.6	0.0	0.0	0.0	0.0	9.4	0.0	0.0	0.0	0.0	4.1	0.0	0.0
WC-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.0	0.0	0.0	0.0	0.0	21.8	0.0	0.0	0.0	0.0	0.1	0.0	0.0
WC-4	0.1	5.8	1.4	1.4	0.0	0.9	0.0	0.0	0.0	0.0	0.2	9.6	3.6	47.1	0.5	0.0	0.0	1.0	1.5	0.5	5.7	0.0	0.0	13.1	0.1	7.3
WC-5	0.2	1.8	2.3	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	15.8	1.5	48.1	0.6	0.0	0.0	1.7	1.0	0.0	1.5	0.0	0.0	11.7	0.0	12.1
WC-6	0.3	2.1	2.9	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	18.8	0.0	43.2	0.8	0.0	0.0	2.1	0.9	0.0	1.9	0.0	0.0	10.4	0.0	14.7
WC-7	0.4	0.2	0.6	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	22.7	0.0	42.4	0.0	0.0	0.0	0.0	0.4	0.0	2.7	0.0	0.0	6.7	0.0	21.2
WC-8	0.0	0.3	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	5.0	0.0	30.5	0.0	0.0	0.0	0.0	0.9	0.0	5.7	0.0	0.0	8.7	0.0	45.4
WC-9	0.0	0.8	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.4	2.3	0.0	0.0	64.5	0.0	0.0	0.0	0.0	5.0	5.8	3.9	0.0	0.0	16.9	0.0	0.0

Appendix B: Citywide Current Zoning																									
ID	A-1	A-2	C-1	C-2	C-3	C-O	CR	I-1	I-2	M-1	O-1	PL	PUD	R-1	R-1A	R-2	R-3	RE	RM-2	RM-4	RM-6	RO	ROW	T	TC	UNC
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
WC-10	0.0	8.9	0.0	4.9	0.1	0.0	0.0	0.0	0.0	0.1	0.8	0.0	0.0	45.2	0.4	0.0	0.0	0.0	3.6	2.1	19.0	0.0	0.0	14.9	0.0	0.0
WC-11	0.0	9.7	0.0	3.8	0.1	0.0	0.0	0.0	0.0	0.1	0.6	0.0	4.9	47.5	0.2	0.0	0.0	0.0	2.5	1.4	13.3	0.0	0.0	15.8	0.0	0.0

Citywide Existing Zoning Abbreviations

A-1 - General Agricultural
A-2 - Rural Agricultural
C-1 Local Commercial
C-2 - General Commercial
C-3 - Intensive Commercial
C-O - Suburban Office Commercial
CR - Rural Commercial
I-1 - Light Industrial
I-2 - Heavy Industrial
M-1 - Restricted Industrial
O-1 - Office Industrial
PL - Park Land
PUD - Planned Unit Development
R-1 - Single Family Dwelling
R-1A - Single Family Attached Dwelling
R-2 - Two-Family Dwelling
R-3 - Multi-Family Dwelling
RE - Residential Estates
RM-2 - Low Density Apartment
RM-4 - Mobile Home Park
RM-6 - Medium Density Apartment
RO - Residence-Office
ROW - Right of Way
T - Transportation
TC - Tourist Commercial
UNC - Unclassified

Citywide Stream Abbreviations

BC - Bishop Creek
BHC - Brookhaven Creek
CC - Clear Creek
CR - Canadian River
DB - Dave Blue Creek
EC - Elm Creek
ELR - East Little River
HC - Hog Creek
IC - Imhoff Creek
JB - Jim Blue Creek
LR - Little River
LT - Lake Thunderbird
MC - Merkle Creek
RC - Rock Creek
T1ELR - Tributary 1 to East Little River
T1LT - Tributary 1 to Lake Thunderbird
T2ELR - Tributary 2 to East Little River
T2LT - Tributary 2 to Lake Thunderbird
T3ELR - Tributary 3 to East Little River
T4ELR - Tributary 4 to East Little River
T5ELR - Tributary 5 to East Little River
TABC - Tributary A to Bishop Creek
TABHC - Tributary A to Brookhaven Creek
TBBC - Tributary B to Bishop Creek
TBBHC - Tributary B to Brookhaven Creek
TCBC - Tributary C to Bishop Creek
TGLR - Tributary G to Little River
TMFC - Ten Mile Flat Creek
WB - Willow Branch
WC - Woodcrest Creek

Storm Water Master Plan
City of Norman
Cleveland County, Oklahoma

October 2009

Appendix C

Projected 2025 Land Use

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
BC-1	6.8	0.0	5.8	8.0	5.0	20.3	0.8	27.2	1.5	0.0	0.0	1.6	4.3	3.4	0.0	15.1	0.0
BC-2	8.2	0.0	2.8	8.3	5.1	15.2	0.6	30.4	1.8	0.0	0.0	2.0	4.7	4.2	0.0	16.7	0.0
BC-3	7.2	0.0	3.0	8.0	0.6	18.3	0.7	31.8	1.7	0.0	0.0	1.8	5.3	4.8	0.0	16.7	0.0
BC-4	8.9	0.0	2.2	5.8	0.2	23.0	0.9	31.2	1.3	0.0	0.0	1.7	1.1	3.9	0.0	19.9	0.0
BC-5	9.6	0.0	2.3	4.0	0.1	20.6	0.8	36.3	1.2	0.0	0.0	1.8	0.2	3.9	0.0	19.2	0.0
BC-6	9.4	0.0	2.3	3.6	0.1	22.6	0.9	35.5	1.1	0.0	0.0	2.0	0.2	4.0	0.0	18.4	0.0
BC-7	9.4	0.0	2.1	3.1	0.1	23.8	0.9	35.0	1.2	0.0	0.0	2.1	0.2	4.2	0.0	17.9	0.0
BC-8	4.0	0.0	0.9	0.4	0.2	29.6	1.0	28.0	1.0	0.0	0.0	3.7	0.0	10.1	0.0	21.1	0.0
BC-9	1.0	0.0	0.0	1.0	0.0	45.5	0.0	12.1	0.0	0.0	0.0	0.9	0.0	29.6	0.0	9.8	0.0
BHC-1	8.2	0.0	9.5	2.1	4.2	0.5	4.8	39.4	2.0	7.5	0.0	1.2	1.1	1.5	0.0	18.0	0.0
BHC-2	6.0	0.0	2.2	1.8	5.5	0.7	2.7	45.3	1.2	9.9	0.0	1.6	0.8	1.7	0.0	20.5	0.0
BHC-3	6.3	0.0	2.1	1.8	5.7	0.7	2.4	45.4	0.4	10.3	0.0	1.6	0.9	1.8	0.0	20.6	0.0
BHC-4	6.7	0.0	2.1	1.8	6.8	0.3	1.9	43.0	0.4	12.1	0.0	1.9	0.9	1.6	0.0	20.6	0.0
BHC-5	5.2	0.0	2.0	1.7	8.3	0.1	1.5	42.1	0.0	14.8	0.0	1.6	1.0	1.9	0.0	19.9	0.0
BHC-6	5.9	0.0	2.7	1.4	13.6	0.2	1.3	28.2	0.0	23.2	0.0	2.3	1.3	1.1	0.0	18.9	0.0
BHC-7	8.2	0.0	4.6	0.9	35.0	0.0	0.0	8.8	0.0	20.8	0.0	0.9	1.2	0.0	0.0	19.7	0.0
CC-1	0.0	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.9	0.0	4.6	0.0
CC-2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-3	0.0	56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.7	0.0	8.2	0.0
CC-4	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0
CC-5	0.0	73.7	0.1	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	18.0	0.0	7.6	0.0
CC-6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-7	0.0	95.2	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.8	0.0
CC-8	0.0	98.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
CC-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-10	0.0	94.4	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
CC-11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-12	0.0	92.7	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0
CC-13	0.0	95.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0
CC-14	0.0	91.9	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0
CC-15	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-16	0.0	93.9	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0
CC-17	0.0	96.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0
CC-18	0.1	56.1	4.4	0.0	0.0	0.2	0.0	38.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.8	0.0
CC-19	0.2	51.7	0.1	0.0	0.0	0.2	0.0	47.4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.0
CC-20	0.0	78.3	9.1	0.0	0.0	0.0	0.0	10.3	0.0	0.0	0.0	0.0	0.8	0.0	0.0	1.4	0.0
CC-21	0.0	81.3	0.0	0.0	0.0	0.0	0.0	15.5	0.0	0.0	0.0	0.0	1.2	0.0	0.0	2.0	0.0
CC-22	0.1	66.0	8.4	0.0	0.0	0.1	0.0	23.7	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.6	0.0
CC-23	0.1	41.6	0.3	0.0	0.0	0.0	0.0	56.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	1.1	0.0
CC-24	0.0	96.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0
CC-25	0.0	97.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0
CC-26	0.0	93.1	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-27	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-28	0.0	88.6	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
CC-29	0.0	95.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0
CC-30	0.0	76.3	8.8	0.0	0.0	0.0	0.0	12.7	0.0	0.0	0.0	0.0	0.1	0.0	0.0	2.0	0.0
CC-31	0.0	94.9	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0
CC-32	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0
CC-33	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0
CC-34	0.0	92.3	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-35	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-36	0.0	77.1	7.4	0.0	0.0	0.0	0.1	9.5	0.0	0.0	0.0	0.0	0.1	3.3	0.0	2.5	0.0
CC-37	0.0	88.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	8.1	0.0
CC-38	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CC-39	1.1	88.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	3.9	0.0
CC-40	1.8	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0
CC-41	0.0	99.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
CC-42	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CR-1	0.5	0.0	92.6	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
CR-2	2.1	0.0	35.9	0.0	0.0	1.0	44.5	9.1	0.2	0.0	0.0	0.2	0.4	0.2	0.0	6.3	0.0
CR-3	0.5	0.0	15.0	1.6	5.0	0.2	6.5	37.1	0.0	4.8	0.0	0.0	2.1	1.0	0.0	8.1	18.2
CR-4	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
DB-1	0.4	46.7	7.9	0.0	1.1	2.5	0.2	11.0	0.0	0.2	0.0	0.1	1.2	3.1	0.0	3.9	21.7
DB-2	0.0	76.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.2	0.0	0.6	0.0
DB-3	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-4	0.0	81.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	7.0	0.0
DB-5	0.0	93.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	0.0
DB-6	0.4	45.2	8.3	0.0	1.2	2.7	0.0	11.8	0.0	0.3	0.0	0.1	1.3	1.7	0.0	3.9	23.2
DB-7	0.4	45.4	8.4	0.0	1.2	2.7	0.0	11.9	0.0	0.3	0.0	0.1	1.3	1.1	0.0	4.0	23.4
DB-8	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-9	0.0	58.9	38.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0
DB-10	0.0	66.7	30.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0
DB-11	0.6	34.7	9.3	0.0	1.8	3.9	0.0	17.4	0.0	0.4	0.0	0.1	2.0	0.9	0.0	4.0	24.8
DB-12	0.0	89.8	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0
DB-13	0.0	93.5	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0
DB-14	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
DB-15	0.0	99.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
DB-16	0.0	97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0
DB-17	0.0	97.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0
DB-18	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-19	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-20	0.0	79.5	18.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0
DB-21	0.0	96.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0
DB-22	0.0	90.9	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
DB-23	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0
DB-24	0.7	24.4	9.1	0.0	2.2	4.7	0.0	20.9	0.0	0.5	0.0	0.1	2.4	1.1	0.0	3.9	29.9
DB-25	0.0	53.7	11.3	0.0	0.0	0.4	0.0	20.6	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.7	12.2
DB-26	0.0	53.5	9.0	0.0	0.0	0.4	0.0	22.3	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.3	13.2
DB-27	0.0	75.5	6.7	0.0	0.0	0.0	0.0	15.2	0.0	0.0	0.0	0.0	0.1	0.5	0.0	2.0	0.0
DB-28	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-29	0.0	45.5	5.1	0.0	0.0	1.0	0.0	40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	7.2
DB-30	0.5	5.7	7.1	0.0	3.6	7.5	0.0	26.2	0.0	0.8	0.0	0.2	4.0	1.8	0.0	4.2	38.5
DB-31	0.5	4.2	6.3	0.0	3.7	7.7	0.0	26.8	0.0	0.8	0.0	0.2	4.1	1.9	0.0	4.3	39.5
DB-32	0.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.3
DB-33	0.0	36.5	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	52.8
DB-34	0.0	30.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	67.1
DB-35	0.0	3.7	4.7	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	85.8
DB-36	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	94.6
DB-37	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	91.0
DB-38	1.1	0.4	5.0	0.0	0.0	26.9	0.0	5.9	0.0	0.0	0.0	0.0	17.0	0.0	0.0	0.7	43.0
DB-39	1.2	0.4	2.0	0.0	0.0	30.6	0.0	6.7	0.0	0.0	0.0	0.0	19.3	0.0	0.0	0.5	39.3
DB-40	1.9	0.7	0.4	0.0	0.0	48.7	0.0	10.7	0.0	0.0	0.0	0.0	30.9	0.0	0.0	0.6	6.1
DB-41	1.0	1.2	5.3	0.0	3.1	14.1	0.0	12.1	0.0	1.6	0.0	0.4	8.3	0.4	0.0	3.0	49.5
DB-42	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	94.4
DB-43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	99.1
DB-44	1.3	0.0	1.5	0.0	7.7	7.1	0.0	23.6	0.0	4.0	0.0	0.9	3.1	0.9	0.0	5.4	44.4
DB-45	1.7	0.0	0.0	0.0	6.7	9.0	0.0	30.0	0.0	5.1	0.0	1.1	3.9	0.4	0.0	6.6	35.6
DB-46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.2	0.0	30.6	0.0	0.0	0.0	0.0	0.0	4.2	0.0
DB-47	0.1	1.1	6.8	0.0	5.7	1.8	0.0	55.2	0.0	0.0	0.0	0.0	0.0	4.4	0.0	6.2	18.6
DB-48	0.2	0.0	2.5	0.0	7.5	2.4	0.0	70.0	0.0	0.0	0.0	0.0	0.0	5.8	0.0	7.2	4.3
DB-49	0.0	0.0	1.3	0.0	46.6	15.2	0.0	10.0	0.0	0.0	0.0	0.0	0.0	16.6	0.0	10.2	0.0
DB-50	0.0	0.0	0.0	0.0	97.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0
DB-51	0.0	0.0	0.0	0.0	0.0	0.3	0.0	90.2	0.0	0.0	0.0	0.0	0.0	2.1	0.0	7.5	0.0
DB-52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.8	0.0	0.0	0.0	0.0	0.0	13.2	0.0	16.0	0.0
DB-53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0
DB-54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5	0.0
DB-55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	92.6	0.0	0.0	0.0	0.0	0.0	2.5	0.0	4.0	1.0
DB-56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	2.1

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
DB-57	0.0	35.4	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	55.9
DB-58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	94.1
DB-59	6.4	22.2	9.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	56.1
DB-60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
DB-61	11.0	68.8	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	6.5
DB-62	11.9	71.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.2	7.1
DB-63	0.0	66.7	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	19.4
DB-64	0.0	59.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	36.1
DB-65	0.0	60.2	6.3	0.0	0.0	0.6	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	27.7
DB-66	0.0	86.9	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0
DB-67	0.0	96.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0
DB-68	0.0	56.0	4.0	0.0	0.0	0.7	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	33.4
DB-69	0.0	46.6	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.2
DB-70	0.0	34.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.6
DB-71	0.0	22.6	3.6	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	64.1
DB-72	0.0	20.3	1.2	0.0	0.0	0.0	0.0	8.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	4.0	66.3
DB-73	0.0	3.1	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	3.6	83.8
DB-74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	99.7
DB-75	0.0	55.2	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	38.1
DB-76	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	96.4
DB-77	0.0	58.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	34.5
DB-78	0.0	36.3	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	54.0
DB-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
DB-80	0.0	90.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	5.2
DB-81	0.0	89.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	6.6
DB-82	0.0	76.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	21.5
DB-83	0.0	58.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.8
DB-84	0.0	92.1	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0
DB-85	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
DB-86	0.0	99.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0
DB-87	0.0	80.1	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0
DB-88	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
DB-89	0.2	83.7	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4	0.0	4.2	0.0
DB-90	0.5	92.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4	0.0
DB-91	2.6	70.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.9	0.0
DB-92	0.0	63.9	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.2	0.0	1.0	0.0
DB-93	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DB-94	1.1	82.2	0.7	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8	0.0	3.7	0.0
DB-95	1.5	93.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0
DB-96	0.0	90.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9	0.0
DB-97	0.0	78.9	1.3	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	6.7	0.0
DB-98	0.0	89.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	0.0
EC-1	3.1	1.0	0.5	0.0	3.0	8.2	0.0	9.4	0.0	0.0	0.0	0.0	39.3	30.9	0.0	4.6	0.0
EC-2	0.0	46.2	9.8	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	38.7	0.0	0.0	4.5	0.0
ELR-1	2.1	55.4	10.3	0.0	0.4	0.7	0.0	14.6	0.0	0.0	0.0	0.0	13.8	1.2	0.0	1.6	0.0
HC-1	0.0	88.6	5.9	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	2.5	0.0
HC-2	0.0	87.8	0.8	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	1.1	0.0
HC-3	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-4	0.0	87.8	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0
HC-5	0.0	93.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0
HC-6	0.0	91.5	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0
HC-7	0.0	93.5	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
HC-8	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-9	0.0	91.9	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0
HC-10	0.0	95.4	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0
HC-11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-12	0.0	94.7	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
HC-13	0.0	96.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0
HC-14	0.0	95.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
HC-15	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-16	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-17	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
HC-18	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0
HC-19	0.0	93.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	0.0
HC-20	0.0	93.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0
HC-21	0.0	94.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0
HC-22	0.0	96.6	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-23	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-24	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-25	0.3	10.4	1.4	0.0	0.4	0.8	0.1	64.4	0.0	0.0	0.0	0.0	13.8	2.0	0.0	6.2	0.0
HC-26	0.0	81.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	1.1	0.0
HC-27	0.0	97.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0
HC-28	0.0	83.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	0.0	3.5	0.0
HC-29	0.0	93.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0
HC-30	0.1	24.7	1.7	0.0	0.1	0.0	0.0	68.4	0.0	0.0	0.0	0.0	0.5	0.2	0.0	4.2	0.0
HC-31	0.0	98.7	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
HC-32	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-33	0.0	96.3	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
HC-34	0.0	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
HC-35	0.1	18.8	1.1	0.0	0.1	0.0	0.0	74.6	0.0	0.0	0.0	0.0	0.6	0.2	0.0	4.5	0.0
HC-36	0.0	96.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0
HC-37	0.0	90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0
HC-38	0.0	85.3	0.4	0.0	0.0	0.0	0.0	7.7	0.0	0.0	0.0	0.0	4.7	0.0	0.0	1.9	0.0
HC-39	0.0	81.1	0.0	0.0	0.0	0.0	0.0	10.9	0.0	0.0	0.0	0.0	6.6	0.0	0.0	1.4	0.0
HC-40	0.0	83.9	0.0	0.0	0.0	0.0	0.0	14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0
HC-41	0.0	0.4	0.0	0.0	0.2	0.0	0.0	94.4	0.0	0.0	0.0	0.0	0.0	0.3	0.0	4.8	0.0
HC-42	0.0	81.4	4.9	0.0	0.0	0.0	0.0	12.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0
HC-43	0.0	82.3	0.0	0.0	0.0	0.0	0.0	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0
HC-44	1.9	63.3	1.8	0.0	0.0	0.0	0.0	28.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0
HC-45	0.8	4.5	0.0	0.0	0.0	0.0	0.0	86.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	0.0
HC-46	0.0	97.2	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0
HC-47	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-48	0.4	7.1	1.4	0.0	0.5	0.9	0.1	64.4	0.0	0.0	0.0	0.0	16.6	2.0	0.0	6.6	0.0
HC-49	0.4	3.9	0.6	0.0	0.5	1.2	0.0	75.4	0.0	0.0	0.0	0.0	9.2	1.5	0.0	7.4	0.0
HC-50	0.0	55.0	16.8	0.0	0.0	0.0	0.0	24.9	0.0	0.0	0.0	0.0	0.0	0.4	0.0	3.0	0.0
HC-51	0.0	46.1	0.0	0.0	0.0	0.0	0.0	49.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0
HC-52	0.0	67.4	1.1	0.0	0.0	0.0	0.0	14.4	0.0	0.0	0.0	0.0	14.7	0.0	0.0	2.5	0.0
HC-53	0.0	45.7	0.0	0.0	0.0	0.0	0.0	26.1	0.0	0.0	0.0	0.0	24.4	0.0	0.0	3.8	0.0
HC-54	0.0	56.9	6.0	0.0	0.0	0.0	0.0	13.7	0.0	0.0	0.0	0.0	19.7	0.0	0.0	3.7	0.0
HC-55	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.5	0.0	0.0	3.3	0.0
HC-56	0.0	62.6	4.3	0.0	0.0	0.0	0.0	19.8	0.0	0.0	0.0	0.0	9.2	0.0	0.0	4.1	0.0
HC-57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	36.7	0.0	0.0	10.3	0.0
HC-58	0.0	94.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0
HC-59	0.0	89.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.9	0.0
HC-60	0.0	97.4	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-61	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HC-62	0.0	70.6	18.8	0.0	0.0	0.0	0.1	3.9	0.0	0.0	0.0	0.0	0.0	1.2	0.0	5.5	0.0
HC-63	0.0	94.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0
HC-64	0.0	11.4	5.1	0.0	0.3	0.1	0.0	23.2	0.0	0.0	0.0	0.0	54.6	1.0	0.0	4.3	0.0
HC-65	0.0	9.1	3.1	0.0	0.3	0.1	0.0	24.7	0.0	0.0	0.0	0.0	58.2	0.0	0.0	4.6	0.0
HC-66	0.0	2.4	0.1	0.0	0.3	0.1	0.0	28.3	0.0	0.0	0.0	0.0	63.7	0.0	0.0	5.0	0.0
HC-67	0.1	30.0	3.6	0.0	0.6	0.1	0.5	19.7	0.0	0.0	0.0	0.0	39.2	2.8	0.0	3.3	0.0
HC-68	0.1	29.5	2.8	0.0	0.7	0.1	0.0	21.1	0.0	0.0	0.0	0.0	41.9	0.3	0.0	3.6	0.0
HC-69	0.2	7.5	0.1	0.0	0.9	0.2	0.0	28.9	0.0	0.0	0.0	0.0	57.1	0.4	0.0	4.6	0.0
HC-70	0.0	95.6	2.8	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.6	0.0
HC-71	0.0	84.2	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	5.1	0.0	0.0	6.5	0.0
IC-1	6.6	0.0	3.6	3.4	1.1	7.7	4.9	48.1	0.4	0.0	0.0	1.0	0.2	1.3	0.0	21.8	0.0
IC-2	6.8	0.0	1.6	3.4	1.2	8.1	3.5	50.1	0.4	0.0	0.0	1.0	0.1	1.2	0.0	22.6	0.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
IC-3	7.1	0.0	1.7	3.2	1.3	8.7	3.3	49.5	0.1	0.0	0.0	1.1	0.0	1.3	0.0	22.6	0.0
IC-4	8.5	0.0	2.0	3.5	1.5	10.2	3.1	44.9	0.1	0.0	0.0	1.3	0.0	1.6	0.0	23.3	0.0
IC-5	6.9	0.0	2.7	2.0	2.0	10.1	3.6	43.7	0.2	0.0	0.0	1.4	0.0	1.7	0.0	25.6	0.0
IC-6	8.6	0.0	2.7	1.5	2.5	10.3	3.2	40.4	0.1	0.0	0.0	1.7	0.0	2.1	0.0	26.8	0.0
IC-7	4.0	0.0	2.2	0.0	0.0	3.6	0.0	48.4	0.5	0.0	0.0	7.2	0.0	2.4	0.0	31.7	0.0
JB-1	0.0	92.9	0.5	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	2.3	0.0
JB-2	0.0	98.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
JB-3	0.0	99.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0
JB-4	0.6	82.3	8.9	0.0	0.0	0.1	0.1	3.4	0.0	0.0	0.0	0.0	0.1	1.9	0.0	2.5	0.0
JB-5	0.0	76.5	9.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	12.7	0.0
JB-6	0.0	81.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.1	0.0
JB-7	0.9	82.2	10.3	0.0	0.0	0.1	0.0	4.7	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.7	0.0
JB-8	0.0	86.2	12.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
JB-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JB-10	0.0	86.2	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JB-11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
JB-12	0.2	91.8	6.5	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.8	0.0
JB-13	0.3	94.7	3.1	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1.0	0.0
JB-14	0.6	97.2	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.6	0.0
JB-15	3.2	84.7	0.0	0.0	0.0	0.0	0.0	7.1	0.0	0.0	0.0	0.0	2.1	0.0	0.0	3.0	0.0
JB-16	1.4	80.5	7.3	0.0	0.0	0.2	0.0	8.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	2.2	0.0
JB-17	4.7	68.1	1.8	0.0	0.0	0.8	0.0	22.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	2.3	0.0
JB-18	0.0	93.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0
JB-19	0.0	96.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0
JB-20	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0
JB-21	0.0	93.1	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.5	0.0	0.0	3.8	0.0
JB-22	0.0	89.4	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	3.5	0.0
JB-23	14.4	15.3	0.0	0.0	0.0	2.3	0.0	66.4	0.0	0.0	0.0	0.0	0.5	0.0	0.0	1.0	0.0
JB-24	2.9	74.7	4.5	0.0	0.0	0.5	0.0	14.8	0.0	0.0	0.0	0.0	0.4	0.0	0.0	2.3	0.0
JB-25	0.0	82.2	9.2	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	1.0	0.0	0.0	3.7	0.0
JB-26	0.0	81.3	0.2	0.0	0.0	0.0	0.0	16.4	0.0	0.0	0.0	0.0	0.4	0.0	0.0	1.8	0.0
JB-27	0.0	89.7	6.6	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	2.2	0.0
JB-28	0.0	94.9	0.7	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.2	0.0	0.0	2.6	0.0
JB-29	0.0	95.1	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.5	0.0	0.0	1.2	0.0
JB-30	0.0	72.8	0.0	0.0	0.0	0.0	0.0	21.3	0.0	0.0	0.0	0.0	3.1	0.0	0.0	2.9	0.0
JB-31	0.0	93.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0
JB-32	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0
JB-33	0.0	89.8	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	4.8	0.0
JB-34	0.0	93.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0
JB-35	0.0	96.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0
JB-36	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-1	3.1	20.5	5.0	0.1	3.4	7.8	0.1	20.5	0.4	0.4	0.1	0.0	15.0	12.9	0.0	5.1	5.4
LR-2	0.0	87.9	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0	0.0
LR-3	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-4	0.0	86.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	0.0	0.0	0.0
LR-5	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-6	3.3	16.3	5.1	0.1	3.6	8.4	0.1	21.7	0.4	0.4	0.1	0.0	16.0	13.1	0.0	5.3	5.9
LR-7	3.7	11.8	4.9	0.1	4.1	8.9	0.1	23.5	0.4	0.5	0.2	0.1	17.9	14.3	0.0	5.4	4.0
LR-8	0.0	68.8	31.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
LR-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-10	3.9	10.9	4.7	0.1	4.2	9.3	0.1	22.7	0.4	0.5	0.2	0.1	18.2	14.9	0.0	5.5	4.2
LR-11	0.0	40.3	55.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0
LR-12	0.0	55.0	40.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0
LR-13	0.0	88.4	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	0.0
LR-14	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0
LR-15	0.0	93.3	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
LR-16	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-17	4.4	16.0	6.8	0.2	4.9	10.1	0.2	30.9	0.7	0.9	0.3	0.1	6.1	5.7	0.0	6.0	6.7
LR-18	0.0	90.3	6.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LR-19	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0
LR-20	4.5	14.9	6.4	0.2	5.0	10.3	0.2	31.5	0.7	0.9	0.3	0.1	6.2	5.8	0.1	6.1	6.8
LR-21	0.0	91.0	2.2	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	3.9
LR-22	0.0	92.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2
LR-23	0.0	94.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8
LR-24	0.0	70.7	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	25.1
LR-25	0.0	67.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	29.5
LR-26	0.0	54.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	42.3
LR-27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	96.0
LR-28	4.8	13.1	5.9	0.2	5.4	10.9	0.2	33.2	0.8	0.9	0.3	0.1	4.9	6.2	0.1	6.3	6.8
LR-29	5.2	12.3	5.5	0.2	5.8	11.9	0.2	32.9	0.8	1.0	0.3	0.1	2.8	6.8	0.1	6.6	7.5
LR-30	0.0	17.2	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	77.1
LR-31	0.0	9.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	88.6
LR-32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
LR-33	0.0	35.0	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	51.1
LR-34	0.0	13.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	80.0
LR-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	92.7
LR-36	0.0	52.5	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	41.0
LR-37	0.0	47.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	49.9
LR-38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	86.0
LR-39	5.4	11.7	5.0	0.2	6.0	12.3	0.2	34.1	0.9	1.1	0.3	0.1	2.9	7.0	0.1	6.7	5.9
LR-40	5.5	19.4	11.0	0.7	0.0	0.0	0.0	16.6	3.8	0.0	0.0	0.8	0.0	0.0	0.0	8.1	34.3
LR-41	0.0	0.1	2.8	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	83.9
LR-42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	69.6
LR-43	7.3	6.4	4.1	1.0	0.0	0.0	0.0	20.2	5.0	0.0	0.0	1.0	0.0	0.0	0.0	10.1	44.9
LR-44	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.6	18.5
LR-45	5.5	9.6	4.4	0.2	6.4	13.1	0.3	35.7	0.9	1.1	0.3	0.1	3.0	7.3	0.1	6.9	5.2
LR-46	0.0	0.0	13.3	0.0	0.0	0.7	0.0	47.9	2.8	0.0	0.0	0.0	0.0	5.7	0.0	3.0	26.6
LR-47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	92.3	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
LR-48	6.1	4.0	5.5	0.3	9.0	14.6	0.4	31.4	1.3	1.9	0.6	0.2	1.1	6.8	0.1	9.3	7.5
LR-49	0.2	0.0	1.5	0.1	26.6	18.0	0.0	34.8	0.9	7.4	0.0	0.0	0.1	1.5	1.1	7.8	0.0
LR-50	0.3	0.0	0.0	0.1	30.6	21.8	0.0	25.7	1.0	9.0	0.0	0.0	0.1	1.8	1.3	8.2	0.0
LR-51	0.0	0.0	0.0	0.0	33.9	34.5	0.0	2.6	1.7	14.5	0.0	0.0	0.2	0.1	2.1	10.5	0.0
LR-52	0.0	0.0	0.0	0.0	66.0	0.0	0.0	0.0	20.6	0.0	0.0	0.0	0.0	0.0	0.0	13.4	0.0
LR-53	6.8	4.7	5.0	0.1	10.7	15.7	0.1	30.1	1.3	2.3	0.7	0.1	1.2	5.8	0.1	9.2	6.1
LR-54	0.0	0.0	10.6	0.0	57.6	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.9	0.0
LR-55	0.0	0.0	0.0	0.0	40.9	42.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	14.0	0.0
LR-56	2.0	0.0	6.3	0.0	42.9	21.9	0.0	0.1	0.0	9.4	0.0	0.0	0.0	0.4	0.3	16.6	0.0
LR-57	3.1	0.0	0.6	0.0	35.4	24.5	0.0	0.1	0.0	14.9	0.0	0.0	0.0	0.6	0.0	20.7	0.0
LR-58	2.9	0.0	0.0	0.0	23.2	28.8	0.0	0.3	0.0	20.3	0.0	0.0	0.1	1.2	0.0	23.4	0.0
LR-59	0.0	0.0	0.0	0.0	34.4	0.0	0.0	0.0	0.0	59.6	0.0	0.0	0.0	0.0	0.0	6.1	0.0
LR-60	0.0	0.0	0.0	0.0	10.3	0.0	0.0	0.0	0.0	83.2	0.0	0.0	0.0	0.0	0.0	6.5	0.0
LR-61	0.0	0.0	0.0	0.0	32.9	0.0	0.0	0.0	0.0	47.4	0.0	0.0	0.0	0.0	0.0	19.7	0.0
LR-62	7.8	0.0	0.0	0.0	33.8	31.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.3	0.0
LR-63	17.2	0.0	0.0	0.0	0.3	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.5	0.0
LR-64	8.4	6.0	3.9	0.1	6.0	15.0	0.1	32.8	1.5	1.0	0.9	0.1	1.5	7.1	0.0	8.9	6.7
LR-65	9.9	8.3	2.6	0.0	6.0	18.7	0.1	30.5	1.1	0.2	1.2	0.0	2.0	7.3	0.0	8.8	3.3
LR-66	2.9	0.0	0.0	0.0	52.8	2.2	0.0	0.3	0.1	8.1	0.0	0.0	0.0	0.0	0.0	20.8	12.8
LR-67	7.2	0.0	0.0	0.0	39.0	5.4	0.0	0.6	0.3	20.0	0.0	0.0	0.0	0.0	0.0	27.4	0.0
LR-68	10.3	8.7	1.9	0.0	4.6	19.6	0.1	32.1	1.2	0.0	1.3	0.0	2.1	7.7	0.0	8.6	1.9
LR-69	12.2	9.2	0.8	0.0	3.8	17.9	0.2	32.8	1.4	0.0	1.6	0.0	2.6	7.1	0.0	10.2	0.5
LR-70	0.0	0.0	0.0	0.0	0.0	23.8	0.0	8.4	1.6	0.0	64.4	0.0	0.0	0.0	0.0	1.8	0.0
LR-71	12.7	11.0	0.4	0.0	4.3	8.3	0.3	34.0	1.5	0.0	0.0	0.0	1.9	10.5	0.0	14.3	0.7
LR-72	13.1	11.4	0.0	0.0	3.6	7.5	0.0	35.6	1.6	0.0	0.0	0.0	2.0	10.8	0.0	14.2	0.0
LR-73	4.1	8.0	2.4	0.0	10.9	40.2	0.0	17.3	0.3	0.0	0.0	0.0	0.0	13.1	0.0	1.3	2.4
LR-74	4.5	8.9	0.0	0.0	12.0	43.4	0.0	15.4	0.3	0.0	0.0	0.0	0.0	14.4	0.0	1.1	0.0
LR-75	0.0	0.0	0.8	0.0	0.0	12.8	0.0	84.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.3
LR-76	1.2	7.7	0.6	0.0	0.5	15.5	0.0	50.0	0.0	0.0	0.0	0.0	0.0	9.9	0.0	2.1	12.6
LR-77	1.7	10.8	0.0	0.0	0.7	12.7	0.0	60.7	0.0	0.0	0.0	0.0	0.0	12.0	0.0	1.3	0.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LR-78	0.0	0.0	24.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	70.5
LR-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	92.2
LR-80	0.0	0.0	7.4	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	6.6	78.8
LR-81	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	10.7	71.7
LR-82	0.0	0.0	12.3	0.0	0.0	41.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	42.3
LR-83	0.0	0.0	0.0	0.0	0.0	37.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	50.8
LR-84	0.5	0.3	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	4.6	86.6
LR-85	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	3.2	96.3
LR-86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
LR-87	4.9	62.5	7.4	0.0	0.8	0.2	0.0	10.7	0.0	0.0	0.0	0.0	3.6	7.0	0.0	3.0	0.0
LR-88	7.4	62.0	0.6	0.0	1.3	0.3	0.0	9.3	0.0	0.0	0.0	0.0	4.8	10.6	0.0	3.8	0.0
LR-89	12.3	38.7	0.0	0.0	3.4	0.2	0.0	12.0	0.0	0.0	0.0	0.0	0.5	28.1	0.0	4.8	0.0
LR-90	0.3	61.9	7.3	0.0	0.0	0.0	0.0	26.9	0.0	0.0	0.0	0.0	2.4	0.0	0.0	1.3	0.0
LR-91	1.1	0.2	0.0	0.0	0.0	0.0	0.0	96.8	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.9	0.0
LR-92	0.0	71.8	23.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0
LR-93	0.3	30.8	7.9	0.0	0.5	3.3	0.0	37.9	0.0	0.0	0.0	0.0	14.7	1.4	0.0	3.2	0.0
LR-94	0.4	27.5	2.6	0.0	0.6	3.7	0.0	43.2	0.0	0.0	0.0	0.0	16.7	1.6	0.0	3.7	0.0
LR-95	0.5	15.3	0.0	0.0	0.8	4.0	0.0	55.2	0.0	0.0	0.0	0.0	18.7	2.0	0.0	3.5	0.0
LR-96	0.0	61.9	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.8	0.0	0.0	1.6	0.0
LR-97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.6	0.0	0.0	0.4	0.0
LR-98	1.9	11.4	6.2	0.0	0.9	0.0	0.0	39.1	0.0	0.0	0.0	0.0	36.6	0.0	0.0	3.9	0.0
LR-99	2.4	0.1	0.0	0.0	1.1	0.0	0.0	48.2	0.0	0.0	0.0	0.0	43.8	0.0	0.0	4.4	0.0
LR-100	0.0	15.3	15.4	0.0	0.0	0.0	0.0	27.1	0.0	0.0	0.0	0.0	37.8	0.0	0.0	4.3	0.0
LR-101	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.0	0.0	0.0	0.0	0.0	56.7	0.0	0.0	5.4	0.0
LR-102	0.0	19.9	60.1	0.0	0.0	0.0	0.0	10.8	0.0	0.0	0.0	0.0	7.1	0.0	0.0	2.0	0.0
LR-103	0.0	17.1	5.4	0.0	0.0	0.0	0.0	20.7	0.0	0.0	0.0	0.0	52.0	0.0	0.0	4.8	0.0
LR-104	0.0	13.0	12.6	0.0	0.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	63.7	0.0	0.0	2.5	0.0
LR-105	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	90.6	0.0	0.0	1.9	0.0
LR-106	0.0	66.2	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	1.2	0.0
LR-107	0.0	82.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4	0.0	0.0	2.5	0.0
LR-108	0.0	83.1	16.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0
LR-109	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-110	0.2	27.8	6.4	0.0	3.9	0.2	0.0	44.1	0.0	0.0	0.0	0.0	13.2	0.2	0.0	4.2	0.0
LR-111	0.2	20.1	2.7	0.0	4.7	0.2	0.0	52.1	0.0	0.0	0.0	0.0	15.7	0.2	0.0	4.1	0.0
LR-112	0.2	0.1	0.0	0.0	9.7	0.4	0.0	72.5	0.0	0.0	0.0	0.0	12.3	0.4	0.0	4.4	0.0
LR-113	0.0	90.3	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	1.2	0.0
LR-114	0.0	96.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0
LR-115	0.2	70.9	6.0	0.0	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	3.7	6.5	0.0	2.1	0.0
LR-116	0.2	75.2	5.5	0.0	0.0	0.0	0.0	12.6	0.0	0.0	0.0	0.0	4.4	0.0	0.0	2.0	0.0
LR-117	0.0	71.2	1.9	0.0	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	6.7	0.0	0.0	1.2	0.0
LR-118	0.0	5.9	0.0	0.0	0.0	0.0	0.0	86.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.2	0.0
LR-119	0.0	89.4	2.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	2.6	0.0
LR-120	0.0	98.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
LR-121	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-122	0.0	94.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	3.3	0.0
LR-123	0.0	96.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0
LR-124	0.0	89.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	0.0
LR-125	4.7	18.0	2.0	0.0	2.7	11.0	0.0	42.6	0.3	0.0	0.0	0.0	5.8	8.1	0.0	3.3	1.3
LR-126	0.3	24.5	63.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	6.8
LR-127	1.2	58.0	20.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	14.5
LR-128	0.0	51.6	2.5	0.0	0.0	3.9	0.0	5.9	0.0	0.0	0.0	0.0	11.0	0.0	0.0	3.1	22.0
LR-129	0.0	45.9	0.0	0.0	0.0	4.8	0.0	7.2	0.0	0.0	0.0	0.0	13.4	0.0	0.0	3.5	25.2
LR-130	0.0	38.2	0.0	0.0	0.0	9.5	0.0	14.3	0.0	0.0	0.0	0.0	26.6	0.0	0.0	2.7	8.8
LR-131	0.0	7.2	0.0	0.0	0.0	4.0	0.0	11.9	0.0	0.0	0.0	0.0	42.7	0.0	0.0	2.0	32.2
LR-132	5.1	16.0	0.8	0.0	3.0	11.3	0.0	45.8	0.3	0.0	0.0	0.0	5.6	8.8	0.0	3.4	0.0
LR-133	0.0	82.9	17.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-134	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LR-135	5.3	14.9	0.0	0.0	3.0	11.6	0.0	47.1	0.3	0.0	0.0	0.0	5.8	8.6	0.0	3.4	0.0
LT-1	0.0	87.3	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	4.1	0.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LT-2	0.0	92.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	0.0
LT-3	0.0	85.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	0.0	3.9	0.0
LT-4	0.0	91.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0
LT-5	0.0	86.5	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	11.4	0.0	1.9	0.0
LT-6	0.0	74.7	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	22.9	0.0	2.3	0.0
LT-7	0.0	98.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0
LT-8	0.0	74.5	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	18.8	0.0	6.3	0.0
LT-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-10	0.0	88.9	3.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	4.1	0.0
LT-11	0.0	89.5	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	3.7	0.0
LT-12	0.0	91.9	0.3	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	3.4	0.0
LT-13	0.0	80.8	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7	0.0	5.0	0.0
LT-14	0.0	86.4	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.2	0.0
LT-15	0.0	58.8	0.1	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	30.4	0.0	8.1	0.0
LT-16	0.0	91.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	0.0
LT-17	0.0	92.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	2.4	0.0
LT-18	0.0	97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0
LT-19	0.0	96.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0
LT-20	0.2	90.8	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	4.4	0.0
LT-21	0.0	92.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	5.4	0.0
LT-22	0.0	91.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	6.0	0.0
LT-23	0.0	86.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	7.3	0.0
LT-24	0.0	95.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0
LT-25	0.3	37.4	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	56.9	0.0	5.1	0.0
LT-26	14.2	72.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	0.0	4.5	0.0
LT-27	0.0	94.9	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	2.0	0.0
LT-28	0.0	98.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0
LT-29	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
LT-30	0.0	97.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0
LT-31	0.0	85.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	4.7	0.0
LT-32	0.0	95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0
LT-33	0.0	48.7	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	49.3	0.0	1.6	0.0
LT-34	0.0	96.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0
LT-35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.4	0.0	0.6	0.0
LT-36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.9	0.0	0.1	0.0
LT-37	0.0	85.3	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2	0.0	1.5	0.0
LT-38	0.0	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0
LT-39	0.0	98.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
LT-40	0.0	83.9	0.2	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	15.2	0.0	0.0	0.0
LT-41	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-42	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-43	0.0	87.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.2	0.0	1.6	0.0
LT-44	0.0	96.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0
LT-45	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
LT-46	0.0	89.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	2.4	0.0
LT-47	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
LT-48	0.0	97.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0
LT-49	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-50	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-51	0.0	86.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.8	0.0	0.0	0.0
LT-52	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-53	0.0	79.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5	0.0	0.0	0.0
LT-54	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-55	0.0	84.4	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	0.0	2.4	0.0
LT-56	0.0	96.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0
LT-57	0.0	94.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0
LT-58	0.0	87.4	0.0	0.0	0.0	2.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	7.1	0.0	2.5	0.0
LT-59	0.0	97.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0
LT-60	0.0	99.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
LT-61	0.0	98.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0
LT-62	0.0	96.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0
LT-63	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LT-64	0.0	91.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0	0.0
LT-65	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MC-1	14.3	0.0	1.8	2.6	9.4	10.6	1.3	25.5	1.1	5.5	0.0	2.5	0.7	4.5	2.1	18.1	0.0
MC-2	14.9	0.0	0.9	2.3	9.8	11.1	1.1	24.8	0.9	5.8	0.0	2.6	0.7	4.7	2.2	18.3	0.0
MC-3	14.7	0.0	0.7	2.3	9.9	11.2	1.1	25.0	0.9	5.8	0.0	2.7	0.7	4.7	2.2	18.2	0.0
MC-4	9.4	0.0	0.8	1.9	12.7	13.9	1.5	26.1	1.0	7.5	0.0	2.1	0.2	5.9	2.8	14.2	0.0
MC-5	9.6	0.0	0.7	1.5	13.1	14.3	1.4	26.1	1.0	7.7	0.0	1.5	0.2	6.1	2.9	13.8	0.0
MC-6	9.7	0.0	0.7	1.6	13.8	14.8	1.3	24.7	1.1	8.1	0.0	1.1	0.2	6.4	3.1	13.4	0.0
MC-7	9.9	0.0	0.7	1.5	15.2	15.2	1.4	21.5	1.2	8.9	0.0	1.2	0.2	7.0	3.4	12.8	0.0
MC-8	4.5	0.0	0.5	1.1	16.4	17.1	1.4	22.6	1.3	10.0	0.0	1.3	0.1	7.9	3.8	12.2	0.0
MC-9	0.6	0.0	0.1	1.1	21.1	22.0	1.6	16.8	1.7	10.6	0.0	0.4	0.0	9.7	4.9	9.3	0.0
MC-10	0.6	0.0	0.0	1.2	25.4	27.4	1.3	4.4	2.1	13.5	0.0	0.5	0.0	10.5	6.2	7.0	0.0
MC-11	0.0	0.0	0.0	0.4	32.0	31.9	0.0	4.5	2.7	13.4	0.0	0.0	0.0	0.5	7.8	6.8	0.0
RC-1	0.6	47.8	6.3	0.1	0.0	5.3	0.0	9.5	0.2	0.0	0.0	0.0	2.0	2.1	0.0	4.7	21.1
RC-2	0.0	93.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	0.0	0.0	0.0
RC-3	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-4	0.6	47.3	6.1	0.1	0.0	5.5	0.0	9.9	0.3	0.0	0.0	0.0	2.1	1.4	0.0	4.8	21.9
RC-5	0.0	94.6	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
RC-6	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0
RC-7	0.0	94.5	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0
RC-8	0.0	95.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0
RC-9	0.0	97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0
RC-10	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-11	0.7	38.6	5.5	0.2	0.0	6.7	0.0	12.0	0.3	0.0	0.0	0.0	2.5	1.7	0.0	5.2	26.5
RC-12	0.0	94.8	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0
RC-13	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0
RC-14	0.0	97.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
RC-15	0.0	97.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0
RC-16	0.8	33.7	4.2	0.2	0.0	7.4	0.0	13.4	0.3	0.0	0.0	0.0	2.8	1.9	0.0	5.5	29.6
RC-17	0.0	94.1	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-18	0.0	99.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-19	0.0	80.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	15.9
RC-20	0.0	63.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	31.8
RC-21	0.0	20.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	77.8
RC-22	0.9	27.6	3.8	0.2	0.0	8.7	0.0	15.6	0.4	0.0	0.0	0.0	3.3	2.2	0.0	5.9	31.3
RC-23	0.0	73.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	24.5
RC-24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
RC-25	1.3	14.4	4.1	0.3	0.0	11.7	0.0	21.0	0.5	0.0	0.0	0.0	4.5	3.0	0.0	7.1	31.9
RC-26	1.3	13.9	3.8	0.3	0.0	11.8	0.0	21.2	0.5	0.0	0.0	0.0	4.5	3.0	0.0	7.1	32.2
RC-27	0.0	38.2	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.7
RC-28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
RC-29	0.0	7.0	0.1	0.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.5	0.9	0.0	6.7	68.8
RC-30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.4	0.0	0.0	0.0	0.0	0.9	1.7	0.0	10.7	55.3
RC-31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.8	0.0	0.0	0.0	0.0	0.0	5.4	0.0	14.3	4.6
RC-32	3.0	5.9	6.0	0.7	0.0	26.4	0.0	25.3	1.2	0.0	0.0	0.0	9.0	2.4	0.0	8.9	11.1
RC-33	0.0	8.9	2.1	0.0	0.0	0.1	0.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	78.1
RC-34	0.0	0.0	0.0	0.0	0.0	0.2	0.0	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	81.4
RC-35	5.8	0.0	1.6	2.9	0.0	5.9	0.0	51.9	0.0	0.0	0.0	0.0	11.1	4.3	0.0	16.5	0.0
RC-36	7.7	0.0	0.0	3.8	0.0	1.7	0.0	55.5	0.0	0.0	0.0	0.0	12.7	1.4	0.0	17.2	0.0
RC-37	0.0	0.0	0.0	1.9	0.0	0.0	0.0	53.8	0.0	0.0	0.0	0.0	30.7	0.0	0.0	13.6	0.0
RC-38	3.9	0.0	1.2	1.5	0.0	35.7	0.0	35.3	0.0	0.0	0.0	0.0	5.9	4.8	0.0	11.7	0.0
RC-39	0.0	0.0	0.0	0.0	0.0	69.6	0.0	20.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	9.7	0.0
RC-40	4.3	0.0	3.2	0.0	0.0	20.5	0.0	29.0	4.9	0.0	0.0	0.0	22.9	0.2	0.0	9.6	5.3
RC-41	4.8	0.0	0.1	0.0	0.0	17.6	0.0	32.1	5.5	0.0	0.0	0.0	24.1	0.2	0.0	10.0	5.7
RC-42	0.0	0.0	0.0	0.0	0.0	9.9	0.0	36.7	31.1	0.0	0.0	0.0	11.8	0.0	0.0	10.5	0.0
RC-43	0.0	20.2	0.4	0.0	0.0	1.0	0.0	21.6	0.0	0.0	0.0	0.0	1.4	4.9	0.0	6.0	44.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
RC-44	0.0	6.3	0.0	0.0	0.0	1.9	0.0	40.1	0.0	0.0	0.0	0.0	0.9	9.1	0.0	8.8	32.9
RC-45	0.0	0.0	0.0	0.0	0.0	2.0	0.0	47.6	0.0	0.0	0.0	0.0	1.1	10.7	0.0	9.3	29.3
RC-46	0.0	0.0	0.0	0.0	0.0	8.9	0.0	42.4	0.0	0.0	0.0	0.0	0.0	34.7	0.0	13.9	0.0
RC-47	0.0	39.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	56.7
RC-48	0.0	35.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	61.6
RC-49	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	92.7
RC-50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	96.4
RC-51	0.0	67.7	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	28.8
RC-52	0.0	52.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.8
RC-53	0.0	64.9	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	30.4
RC-54	0.0	63.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	33.4
RC-55	0.0	51.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	45.5
RC-56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
RC-57	0.0	91.8	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-58	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-59	0.0	91.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0
RC-60	0.0	99.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
RC-61	0.0	82.7	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0
RC-62	0.0	92.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	0.0
RC-63	0.0	86.5	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
RC-64	0.0	97.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0
RC-65	0.0	81.5	16.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0
RC-66	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RC-67	0.0	70.8	21.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	2.6	0.0
RC-68	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T1ELR	0.1	30.3	3.1	0.0	0.4	0.1	0.0	20.8	0.0	0.0	0.0	0.0	45.0	0.0	0.0	0.2	0.0
T1LT-1	0.0	87.7	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	2.8	0.0
T1LT-2	0.0	83.0	13.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0
T1LT-3	0.0	82.4	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0
T1LT-4	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T1LT-5	0.0	97.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0
T1LT-6	0.0	97.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0
T1LT-7	0.0	95.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0
T1LT-8	0.0	94.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	0.0
T1LT-9	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
T1LT-10	0.0	99.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
T1LT-11	0.0	99.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
T1LT-12	0.0	99.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
T1LT-13	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T1LT-14	0.0	95.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0
T1LT-15	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0
T1LT-16	0.0	87.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	2.2	0.0
T1LT-17	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2ELR	4.3	60.7	11.1	0.0	0.6	0.0	0.0	17.2	0.0	0.0	0.0	0.0	4.6	0.0	0.0	1.5	0.0
T2LT-1	0.6	90.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0	3.0	0.0
T2LT-2	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0
T2LT-3	0.0	93.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0
T2LT-4	0.0	96.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.0
T2LT-5	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-6	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-7	0.0	90.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.0
T2LT-8	0.0	88.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.5	0.0
T2LT-9	0.0	98.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
T2LT-10	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-11	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-12	2.4	93.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0
T2LT-13	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T2LT-14	0.0	98.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0
T2LT-15	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C: Citywide Projected 2025 Landuse

ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
T3ELR	1.3	77.5	4.6	0.0	0.0	11.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	4.0	0.0
T4ELR	0.4	81.1	6.9	0.0	0.0	0.1	0.0	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
T5ELR	0.0	79.7	0.0	0.0	0.0	0.0	0.0	18.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0
TABC-1	6.2	0.0	3.0	12.9	1.6	7.4	0.2	43.0	2.8	0.0	0.0	2.6	3.0	2.2	0.0	15.0	0.0
TABC-2	6.2	0.0	2.7	13.1	1.7	7.6	0.2	44.1	2.8	0.0	0.0	2.7	1.9	2.2	0.0	14.9	0.0
TABC-3	6.3	0.0	1.7	19.1	0.0	13.2	0.1	36.9	3.5	0.0	0.0	0.9	2.3	2.0	0.0	13.8	0.0
TABC-4	3.1	0.0	0.0	14.5	0.0	34.4	0.0	24.6	6.2	0.0	0.0	3.1	0.0	0.8	0.0	13.3	0.0
TABHC-1	9.6	0.0	3.3	0.0	6.0	0.4	1.3	55.1	0.0	0.0	0.0	0.0	2.1	2.7	0.0	19.5	0.0
TABHC-2	3.2	0.0	5.1	0.0	9.5	0.7	0.0	55.4	0.0	0.0	0.0	0.0	3.4	3.5	0.0	19.2	0.0
TBBC-1	12.8	0.0	3.2	0.0	0.0	47.1	2.0	20.3	0.0	0.0	0.0	1.6	0.0	0.0	0.0	13.0	0.0
TBBC-2	15.0	0.0	2.8	0.0	0.0	49.9	1.3	16.6	0.0	0.0	0.0	1.9	0.0	0.0	0.0	12.4	0.0
TBBC-3	19.9	0.0	0.0	0.1	0.0	25.0	0.0	34.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.6	0.0
TBBHC-1	0.0	0.0	0.0	2.3	0.0	0.0	0.7	0.6	0.0	74.7	0.0	6.6	0.4	0.0	0.0	14.6	0.0
TBBHC-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.8	0.0	0.0	0.0	0.0	0.0	13.2	0.0
TCBC-1	6.0	0.0	1.9	8.0	0.4	31.3	1.2	20.3	0.4	0.0	0.0	1.7	3.1	4.5	0.0	21.2	0.0
TCBC-2	8.7	0.0	1.5	5.8	0.6	25.3	1.0	20.7	0.0	0.0	0.0	2.7	0.0	6.8	0.0	26.9	0.0
TGLR-1	5.2	0.0	2.8	0.3	6.9	6.3	0.0	44.0	2.9	3.5	0.0	0.4	0.4	7.5	0.0	10.0	10.0
TGLR-2	5.8	0.0	0.9	0.4	4.2	6.7	0.0	48.8	3.2	3.9	0.0	0.4	0.5	8.3	0.0	9.9	7.1
TGLR-3	20.6	0.0	0.1	2.0	2.0	13.4	0.0	22.4	0.0	0.0	0.0	2.2	2.3	19.6	0.0	13.4	2.1
TGLR-4	0.0	0.0	0.0	0.0	0.0	3.1	0.0	55.2	0.0	0.0	0.0	0.3	6.3	9.2	0.0	16.9	9.0
TGLR-5	0.3	0.0	0.0	0.0	0.0	3.1	0.0	34.0	0.0	0.0	0.0	0.0	0.5	47.2	0.0	10.2	4.7
TGLR-6	0.0	0.0	0.0	0.0	0.0	4.0	0.0	59.2	0.0	0.0	0.0	0.0	0.8	11.2	0.0	16.6	8.2
TGLR-7	1.1	0.0	0.0	0.0	1.2	3.7	0.0	62.3	4.4	5.4	0.0	0.0	0.0	6.5	0.0	5.9	9.3
TGLR-8	0.8	0.0	0.0	0.0	0.0	0.9	0.0	79.4	2.1	0.0	0.0	0.0	0.0	0.9	0.0	6.4	9.4
TGLR-9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	1.6
TGLR-10	0.0	0.0	0.0	0.0	2.3	4.8	0.0	83.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.5
TGLR-11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TGLR-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TGLR-13	0.0	0.0	0.0	0.0	8.0	23.7	0.0	63.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	2.2
TGLR-14	0.0	0.0	0.0	0.0	0.0	0.3	0.0	94.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0
TGLR-15	0.0	0.0	0.0	0.0	0.0	1.4	0.0	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0
TGLR-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0
TGLR-17	4.9	0.0	0.0	0.0	0.0	5.5	0.0	53.9	0.1	8.7	0.0	0.0	0.0	6.5	0.0	7.6	12.7
TGLR-18	9.0	0.0	0.0	0.0	0.0	10.0	0.0	64.2	0.0	3.0	0.0	0.0	0.0	5.9	0.0	7.9	0.0
TGLR-19	1.3	0.0	0.0	0.0	1.7	3.4	0.0	0.8	10.6	42.4	0.0	0.0	0.0	4.5	0.0	11.6	23.7
TGLR-20	5.7	0.0	0.0	0.0	7.2	14.5	0.0	3.3	0.0	59.1	0.0	0.0	0.0	5.8	0.0	4.5	0.0
TGLR-21	0.0	0.0	3.1	0.0	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	57.2
TGLR-22	0.0	0.0	0.0	0.0	47.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	44.1
TMFC-1	1.3	0.0	62.5	0.1	0.4	0.4	0.2	19.8	0.1	0.0	0.0	0.0	0.3	0.3	0.0	4.5	10.1
TMFC-2	1.3	0.0	63.7	0.0	0.5	0.2	0.2	18.7	0.1	0.0	0.0	0.0	0.2	0.3	0.0	4.1	10.7
TMFC-3	1.4	0.0	64.4	0.0	0.5	0.2	0.2	18.0	0.1	0.0	0.0	0.0	0.2	0.3	0.0	3.9	11.0
TMFC-4	1.4	0.0	65.0	0.0	0.5	0.2	0.2	17.4	0.1	0.0	0.0	0.0	0.0	0.3	0.0	3.6	11.3
TMFC-5	1.5	0.0	63.2	0.0	0.5	0.2	0.2	18.3	0.1	0.0	0.0	0.0	0.0	0.3	0.0	3.7	11.9
TMFC-6	1.9	0.0	60.9	0.0	0.7	0.3	0.1	17.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	2.9	15.5
TMFC-7	0.0	0.0	54.3	0.0	0.5	0.1	0.0	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	20.9
WB-1	0.2	71.2	3.2	0.0	0.0	0.0	0.0	11.8	0.0	0.0	0.0	0.0	8.2	2.9	0.0	2.5	0.0
WB-2	0.0	83.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.4	0.0	2.3	0.0
WB-3	0.0	95.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0
WB-4	0.5	54.3	2.5	0.0	0.0	0.0	0.0	23.8	0.0	0.0	0.0	0.0	16.0	0.0	0.0	2.9	0.0
WB-5	0.0	39.9	1.3	0.0	0.0	0.0	0.0	33.5	0.0	0.0	0.0	0.0	22.5	0.0	0.0	2.8	0.0
WB-6	0.0	16.2	0.0	0.0	0.0	0.0	0.0	51.7	0.0	0.0	0.0	0.0	28.5	0.0	0.0	3.6	0.0
WB-7	0.0	87.4	4.6	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	2.8	0.0	0.0	2.2	0.0
WB-8	0.0	94.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0
WB-9	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WB-10	0.0	84.2	2.3	0.0	0.0	0.0	0.0	5.6	0.0	0.0	0.0	0.0	5.0	0.0	0.0	2.9	0.0
WB-11	0.0	90.8	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0
WB-12	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WB-13	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WB-14	0.0	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0

Appendix C: Citywide Projected 2025 Landuse																	
ID	Commercial	Country Residential	Floodplain	High Density Residential	Industrial	Institutional	Lake	Low Density Residential	Medium Density Residential	Mixed Use	North Loop	Office	Open Space	Park	Right of Way	Transportation	Very Low Density Residential
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
WB-15	0.0	94.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.0
WB-16	0.0	95.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	2.4	0.0
WB-17	0.0	94.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0
WB-18	0.0	86.5	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	1.1	0.0
WB-19	0.0	98.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0
WC-1	2.9	0.0	3.4	2.4	0.0	11.5	3.1	46.2	1.6	0.0	0.0	0.9	0.8	15.5	0.0	11.7	0.0
WC-2	0.0	0.0	1.8	0.0	0.0	0.0	0.0	82.5	10.1	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0
WC-3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	78.0	21.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
WC-4	3.4	0.0	2.0	2.7	0.0	13.2	2.8	42.1	1.0	0.0	0.0	1.0	1.0	17.6	0.0	13.1	0.0
WC-5	2.0	0.0	2.5	0.4	0.0	12.0	1.5	37.0	0.8	0.0	0.0	1.3	1.4	29.2	0.0	11.8	0.0
WC-6	2.4	0.0	2.0	0.5	0.0	14.7	1.1	30.6	1.0	0.0	0.0	1.4	0.7	35.1	0.0	10.4	0.0
WC-7	0.1	0.0	1.5	0.8	0.0	20.0	1.1	21.0	1.5	0.0	0.0	1.9	0.6	44.7	0.0	6.7	0.0
WC-8	0.0	0.0	0.0	1.7	0.0	9.3	0.0	20.8	3.2	0.0	0.0	4.1	1.3	50.9	0.0	8.7	0.0
WC-9	0.3	0.0	0.0	0.2	0.5	22.5	0.0	51.4	6.0	0.0	0.0	2.3	0.0	0.0	0.0	16.9	0.0
WC-10	6.1	0.0	0.0	9.1	0.2	22.5	5.9	38.5	2.1	0.0	0.0	0.8	0.0	0.0	0.0	14.8	0.0
WC-11	4.7	0.0	0.1	6.7	0.1	16.6	4.1	49.5	1.5	0.0	0.0	0.6	0.3	0.0	0.0	15.8	0.0

Citywide Stream Abbreviations

BC - Bishop Creek
BHC - Brookhaven Creek
CC - Clear Creek
CR - Canadian River
DB - Dave Blue Creek
EC - Elm Creek
ELR - East Little River
HC - Hog Creek
IC - Imhoff Creek
JB - Jim Blue Creek
LR - Little River
LT - Lake Thunderbird
MC - Merkle Creek
RC - Rock Creek
T1ELR - Tributary 1 to East Little River
T1LT - Tributary 1 to Lake Thunderbird
T2ELR - Tributary 2 to East Little River
T2LT - Tributary 2 to Lake Thunderbird
T3ELR - Tributary 3 to East Little River
T4ELR - Tributary 4 to East Little River
T5ELR - Tributary 5 to East Little River
TABC - Tributary A to Bishop Creek
TABHC - Tributary A to Brookhaven Creek
TBBC - Tributary B to Bishop Creek
TBBHC - Tributary B to Brookhaven Creek
TCBC - Tributary C to Bishop Creek
TGLR - Tributary G to Little River
TMFC - Ten Mile Flat Creek
WB - Willow Branch
WC - Woodcrest Creek

Storm Water Master Plan
City of Norman
Cleveland County, Oklahoma

October 2009

Appendix D

Reach Level Assessment Forms

Note: The assessment forms in this appendix are provided in the following watershed order:

1. Bishop Creek Mainstem
2. Tributary A to Bishop Creek
3. Tributary B to Bishop Creek
4. Tributary C to Bishop Creek
5. Brookhaven Creek Mainstem
6. Tributary A to Brookhaven Creek
7. Tributary B to Brookhaven Creek
8. Imhoff Creek
9. Little River
10. Tributary G to Little River
11. Woodcrest Creek (Little River)
12. Merkle Creek
13. Rock Creek Mainstem
14. Tributary A to Rock Creek
15. Tributary B to Rock Creek
16. Tributary C to Rock Creek
17. Tributary D to Rock Creek
18. Ten Mile Flat Creek

Reach Level Assessment **RCH**

SURVEY REACH ID: BC-1	**WTRSHD/SUBSHD:** **BISHOP CREEK**	**DATE:** 11/8/2007	**ASSESSED BY:** **PM/GG**

START **TIME:** 8 :10 **AM**/PM **LMK:** _____	*END* **TIME:** ___:___AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS ☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-15 (ft)
RT bank 10-15 (ft)
Width: Bottom 30-40 (ft)
Top 60 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.	
5	4	3 2 1	

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **60/80** + Buffer/Floodplain: **59/80** = **Total** Survey Reach **119/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BC-2	**WTRSHD/SUBSHD:** **BISHOP CREEK**	**DATE:** 11/8/2007	**ASSESSED BY:** **PM/GG**

START **TIME:** 8 :49 **AM**/PM **LMK:** _____	*END* **TIME:** ___:___AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☒ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☒ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☒ Sand (gritty) ☒ Boulder (>10")
☐ Gravel (0.1-2.5") ☒ Bed rock (Shale)

WATER CLARITY ☒ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM
(Evidence of)
☒ Fish ☐ Beaver ☐ Deer
☐ Snails ☒ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☒ Downcutting	☐ Bed scour
☒ Widening	☒ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-12 (ft)
RT bank 10-12 (ft)
Width: Bottom 40 (ft)
Top 60 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **48/80** + Buffer/Floodplain: **45/80** = **Total** Survey Reach **93/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BC-3	WTRSHD/SUBSHD: BISHOP CREEK	DATE: 11/8/2007	ASSESSED BY: PM/GG

START TIME: 9 :05 AM/PM LMK: _____	END TIME: ___:___AM/PM LMK: _____	GPS ID:
LAT ___°_____'_____" LONG ___°_____'_____"	LAT ___°_____'_____" LONG ___°_____'_____"	
DESCRIPTION:	DESCRIPTION:	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Unknown	☐ Downcutting	☐ Bed scour	
	☐ Widening	☐ Bank failure	
	☐ Headcutting	☐ Bank scour	
	☐ Aggrading	☐ Slope failure	
	☐ Sed. deposition	☐ Channelized	

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-12 (ft)
RT bank 10-12 (ft)
Width: Bottom 20-25 (ft)
Top 30-35 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2 1	

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **29/80** + Buffer/Floodplain: **38/80** = **Total** Survey Reach **67/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BC-4	WTRSHD/SUBSHD: BISHOP CREEK	DATE: 11/8/2007	ASSESSED BY: PM/GG

START TIME: 11 :05 AM/PM LMK: _____	END TIME: ___:___AM/PM LMK: _____	GPS ID:
LAT ___°_____'_____" LONG ___°_____'_____"	LAT ___°_____'_____" LONG ___°_____'_____"	
DESCRIPTION:	DESCRIPTION:	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other: Apartment Complex

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS ☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 12-15 (ft)
RT bank 12-15 (ft)
Width: Bottom 25 (ft)
Top 40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **47/80** + Buffer/Floodplain: **36/80** = **Total** Survey Reach **83/160**

Reach Level Assessment **RCH**

Survey Reach ID: BC-5	**Wtrshd/Subshd:** Bishop Creek	**Date:** 11/8/2007	**Assessed by:** TGC/JL

Start **Time:** 10 :00 AM/PM **LMK:** _____	*End* **Time:** 10 :40 AM/PM **LMK:** _____	**GPS ID:**
Lat ___°_____'_____" **Long** ___°_____'_____"	**Lat** ___°_____'_____" **Long** ___°_____'_____"	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics ☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 5-10 (ft)
RT bank 5-10 (ft)
Width: Bottom 10-15 (ft)
Top 30-35 (ft)

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **55/80** + Buffer/Floodplain: **53/80** = **Total** Survey Reach **108/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BC-6	**WTRSHD/SUBSHD:** BISHOP CREEK	**DATE:** 11/8/2007	**ASSESSED BY:** TGC/JL

START **TIME:** 10 :45 AM/PM **LMK:** _____	*END* **TIME:** 11 :15 AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Unknown	☐ Downcutting
	☐ Widening
	☐ Headcutting
	☐ Aggrading
	☐ Sed. deposition
	☐ Bed scour
	☐ Bank failure
	☐ Bank scour
	☐ Slope failure
	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 15-20 (ft)
RT bank 15-20 (ft)
Width: Bottom 10-15 (ft)
Top 30-40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.	
5	4	3 2 1	

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **58/80** + Buffer/Floodplain: **50/80** = **Total** Survey Reach **108/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BC-7	**WTRSHD/SUBSHD:** BISHOP CREEK	**DATE:** 11/8/2007	**ASSESSED BY:** TGC/JL

START **TIME:** 11 :15 AM/PM **LMK:** _____	*END* **TIME:** _:__AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 5-15 (ft)
RT bank 5-15 (ft)
Width: Bottom 10-15 (ft)
Top 30-40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **51/80** + Buffer/Floodplain: **51/80** = **Total** Survey Reach **102/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BC-8	**WTRSHD/SUBSHD:** BISHOP CREEK	**DATE:** 11/8/2007	**ASSESSED BY:** TGC/JL

START	*END*	**GPS ID:**
TIME: 1 :30 AM/PM **LMK:** _____	**TIME:** 2 : 30 AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 3-15 (ft)
RT bank 3-15 (ft)
Width: Bottom 5-15 (ft)
Top 5-15 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4 **3** 2 1		

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
10	Left Bank 10 9	8 7 6	5 4 3	2 1 0
10	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **56/80** + Buffer/Floodplain: **49/80** = **Total** Survey Reach **105/160**

Reach Level Assessment **RCH**

Survey Reach ID: TABC-1	**Wtrshd/Subshd:** Trib A-Bishop Creek	**Date:** 11/8/2007	**Assessed by:** PM/GG

Start **Time:** 10 : 15 AM/PM **LMK:** _____	*End* **Time:** : AM/PM **LMK:** _____	**GPS ID:**
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐ 25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

Channel Dimensions *(Facing downstream)*
Height: LT bank 10-12 (ft)
RT bank 10-12 (ft)
Width: Bottom 10 (ft)
Top 20 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **54/80** + Buffer/Floodplain: **33/80** = **Total** Survey Reach **87/160**

Reach Level Assessment **RCH**

Survey Reach ID: TABC-2	**Wtrshd/Subshd:** Trib A-Bishop Creek	**Date:** 11/8/2007	**Assessed by:** PM/GG

Start **Time:** 1 : 05 AM/PM **LMK:** _____	*End* **Time:** : AM/PM **LMK:** _____	**GPS ID:**
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics ☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 8-10 (ft)
RT bank 8-10 (ft)
Width: Bottom 6-10 (ft)
Top 15-20 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 **3** 2	1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **47/80** + Buffer/Floodplain: **41/80** = **Total** Survey Reach **88/160**

Reach Level Assessment **RCH**

Survey Reach ID: TABC-3	**Wtrshd/Subshd:** Trib A-Bishop Creek	**Date:** 11/8/2007	**Assessed by:** PM/GG

Start **Time:** 3 : 40 AM/PM **LMK:** _____	*End* **Time:** : AM/PM **LMK:** _____	**GPS ID:**
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other: Apartment Complex

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 6-8 (ft)
RT bank 6-8 (ft)
Width: Bottom 8 (ft)
Top 12-15 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **45/80** + Buffer/Floodplain: **31/80** = **Total** Survey Reach **76/160**

Reach Level Assessment **RCH**

Survey Reach ID: TBBC-1	**Wtrshd/Subshd:** Trib B-Bishop Creek	**Date:** 11/8/2007	**Assessed by:** PM/GG

Start **Time:** 2 : 30 AM/PM **LMK:** _____	*End* **Time:** : AM/PM **LMK:** _____	**GPS ID:**
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐ 25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics ☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 2-5 (ft)
RT bank 2-5 (ft)
Width: Bottom 5-10 (ft)
Top 10-15 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **60/80** + Buffer/Floodplain: **43/80** = **Total** Survey Reach **103/160**

Reach Level Assessment **RCH**

Survey Reach ID: TBBC-2	**Wtrshd/Subshd:** Trib B-Bishop Creek	**Date:** 11/8/2007	**Assessed by:** TGC/JL

Start **Time:** 3 : 15 AM/PM **LMK:** _____	*End* **Time:** : AM/PM **LMK:** _____	**GPS ID:**
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐ 25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics

☐ Unknown	☐ Downcutting	☐ Bed scour
	☐ Widening	☐ Bank failure
	☐ Headcutting	☐ Bank scour
	☐ Aggrading	☐ Slope failure
	☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 1-3 (ft)
RT bank 1-3 (ft)
Width: Bottom 2-4 (ft)
Top 2-4 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **54/80** + Buffer/Floodplain: **45/80** = **Total** Survey Reach **99/160**

Reach Level Assessment **RCH**

Survey Reach ID: TCBC-1	**Wtrshd/Subshd:** Trib C-Bishop Creek	**Date:** 11/8/2007	**Assessed by:** TGC/DA

Start **Time:** 8 : 00 AM/PM **LMK:** _____	*End* **Time:** 9 : 00 AM/PM **LMK:** _____	**GPS ID:**
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐ 25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

Channel Dimensions *(Facing downstream)*
Height: LT bank 5-10 (ft)
RT bank 5-10 (ft)
Width: Bottom 10 (ft)
Top 30-35 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.	
5	4	3	2 1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **45/80** + Buffer/Floodplain: **47/80** = **Total** Survey Reach **92/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BHC-1	**WTRSHD/SUBSHD:** BROOKHAVEN CREEK	**DATE:** 11/6/2007	**ASSESSED BY:** PM/GG

START	*END*	**GPS ID:**
TIME: 4 : 00 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☒ Suburban/Res ☒ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☒ 75-100%

DOMINANT SUBSTRATE - UNKNOWN
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☒ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☒ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 6-8 (ft)
RT bank 6-8 (ft)
Width: Bottom 15-20 (ft)
Top 30-40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4	3 2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **61/80** + Buffer/Floodplain: **68/80** = **Total** Survey Reach **129/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BHC-2	**WTRSHD/SUBSHD:** BROOKHAVEN CREEK	**DATE:** 11/6/2007	**ASSESSED BY:** PM/GG

START **TIME:** 7 : 45 AM/PM **LMK:** _____	*END* **TIME:** _ : ___ AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 6-8 (ft)
RT bank 6-8 (ft)
Width: Bottom 15-20 (ft)
Top 20-30 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.		**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.		**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3	2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
2	Left Bank 10 9	8 7 6	5 4 3	2 1 0
2	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **28/80** + Buffer/Floodplain: **33/80** = **Total** Survey Reach **61/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BHC-3	WTRSHD/SUBSHD: BROOKHAVEN CREEK	DATE: 11/6/2007	ASSESSED BY: PM/GG

START TIME: 4 : 25 AM/PM LMK: _____	END TIME: _ : ___ AM/PM LMK: _____	GPS ID:
LAT ___° _____' _____" LONG ___° _____' _____"	LAT ___° _____' _____" LONG ___° _____' _____"	
DESCRIPTION:	DESCRIPTION:	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH: ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE - UNKNOWN (PONDING)
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM: Attached: ☐ none ☐ some ☐ lots; Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM: *(Evidence of)* ☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS ☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 20 (ft); RT bank 20 (ft)
Width: Bottom 15-20 (ft); Top 30-40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4	3	2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

REPORTED TO AUTHORITIES ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **37/80** + Buffer/Floodplain: **27/80** = **Total** Survey Reach **64/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BHC-4	**WTRSHD/SUBSHD:** BROOKHAVEN CREEK	**DATE:** 11/6/2007	**ASSESSED BY:** PM/GG

START	*END*	**GPS ID:**
TIME: _:__AM/PM **LMK:** _____	**TIME:** _:___AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other: Apartment Complex

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 3-5 (ft)
RT bank 3-5 (ft)
Width: Bottom 8-10 (ft)
Top 12-15 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **44/80** + Buffer/Floodplain: **34/80** = **Total** Survey Reach **78/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BHC-5	**WTRSHD/SUBSHD:** BROOKHAVEN CREEK	**DATE:** 11/6/2007	**ASSESSED BY:** PM/GG

START **TIME:** _:__AM/PM **LMK:** _____	*END* **TIME:** _:___AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☒ Commercial ☒ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☒ 75-100%

DOMINANT SUBSTRATE
☒ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☒ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☒ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☒ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☒ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 2-4 (ft)
RT bank 2-4 (ft)
Width: Bottom 4-6 (ft)
Top 8-10 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **60/80** + Buffer/Floodplain: **52/80** = **Total** Survey Reach **112/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: BHC-6	**WTRSHD/SUBSHD:** BROOKHAVEN CREEK	**DATE:** 11/6/2007	**ASSESSED BY:** PM/GG

START **TIME:** _:__AM/PM **LMK:** _____	*END* **TIME:** _:___AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☒ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☒ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☒ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☒ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☒ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 2-4 (ft)
RT bank 2-4 (ft)
Width: Bottom 2-4 (ft)
Top 10-15 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4	3	2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
10	Left Bank 10 9	8 7 6	5 4 3	2 1 0
10	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
1	Left Bank 10 9	8 7 6	5 4 3	2 1 0
1	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **50/80** + Buffer/Floodplain: **18/80** = **Total** Survey Reach **68/160**

Reach Level Assessment **RCH**

Survey Reach ID: TABHC-1	**Wtrshd/Subshd:** Trib A - Brookhaven Creek	**Date:** 11/6/2007	**Assessed by:** PM/GG

Start **Time:** __:__AM/PM **LMK:** _____	*End* **Time:** __:__AM/PM **LMK:** _____	**GPS ID:**
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐ 25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

Channel Dimensions *(Facing downstream)*
Height: LT bank 2-3 (ft)
RT bank 2-3 (ft)
Width: Bottom 3-5 (ft)
Top 5-8 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
3	Left Bank 10 9	8 7 6	5 4 3	2 1 0
3	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **41/80** + Buffer/Floodplain: **20/80** = **Total** Survey Reach **61/160**

Reach Level Assessment **RCH**

Survey Reach ID: TBBHC-1	**Wtrshd/Subshd:** Trib B - Brookhaven Creek	**Date:** 11/6/2007	**Assessed by:** PM/GG

Start **Time:** _:__AM/PM **LMK:** _____
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "
Description:

End **Time:** _:___AM/PM **LMK:** _____
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "
Description:

GPS ID:

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other: Apartment Complex

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐ 25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream *(Evidence of)* ☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics
☐ Unknown
☐ Downcutting ☐ Widening ☐ Headcutting ☐ Aggrading ☐ Sed. deposition
☐ Bed scour ☐ Bank failure ☐ Bank scour ☐ Slope failure ☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 6-8 (ft)
RT bank 6-8 (ft)
Width: Bottom 2-3 (ft)
Top 10-15 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
1	Left Bank 10 9	8 7 6	5 4 3	2 1 0
1	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **45/80** + Buffer/Floodplain: **16/80** = **Total** Survey Reach **61/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: IC-1	WTRSHD/SUBSHD: IMHOFF CREEK	DATE: 11/6/2007	ASSESSED BY: PM/GG

START	END	GPS ID:
TIME: 7 : 57 AM/PM LMK: _____	TIME: _ : ___ AM/PM LMK: _____	
LAT ___° _____' _____" LONG ___° _____' _____"	LAT ___° _____' _____" LONG ___° _____' _____"	
DESCRIPTION:	DESCRIPTION:	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☑ Suburban/Res ☐ Forested ☐ Institutional ☑ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH
☐ 0-25% ☐ 50%-75%
☑ 25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☑ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐ Turbid *(suspended matter)*
☑ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☑ none ☐ some ☐ lots
Floating: ☑ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM
(Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☑ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☑ Widening	☑ Bank failure
☐ Headcutting	☑ Bank scour
☐ Aggrading	☐ Slope failure
☑ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-12 (ft)
RT bank 10-12 (ft)
Width: Bottom 25-30 (ft)
Top 34-40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4	3	2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☑ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **53/80** + Buffer/Floodplain: **54/80** = **Total** Survey Reach **107/160**

Reach Level Assessment **RCH**

Survey Reach ID: IC-2	**Wtrshd/Subshd:** Imhoff Creek	**Date:** 11/6/2007	**Assessed by:** PM/GG

Start **Time:** 8 : 25 AM/PM **LMK:** _____	*End* **Time:** _ : ___ AM/PM **LMK:** _____	**GPS ID:**
Lat ___°_____'_____" **Long** ___°_____'_____"	**Lat** ___°_____'_____" **Long** ___°_____'_____"	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

Dominant Substrate –Unknown (Ponding)
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics ☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 6-10 (ft)
RT bank 6-10 (ft)
Width: Bottom 25-30 (ft)
Top 40-50 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4 **3** 2 1		

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
3	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **41/80** + Buffer/Floodplain: **28/80** = **Total** Survey Reach **69/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: IC-3	**WTRSHD/SUBSHD:** IMHOFF CREEK	**DATE:** 11/6/2007	**ASSESSED BY:** PM/GG

START **TIME:** 9 : 05 AM/PM **LMK:** _____
LAT ___° _____' _____" **LONG** ___° _____' _____"
DESCRIPTION:

END **TIME:** _ : ___ AM/PM **LMK:** _____
LAT ___° _____' _____" **LONG** ___° _____' _____"
DESCRIPTION:

GPS ID:

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 25-50 % ☐ 50%-75% ☐ 75-100%

DOMINANT SUBSTRATE - ARTICULATED BLOCK
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)* ☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 8-10 (ft)
RT bank 8-10 (ft)
Width: Bottom 10-12 (ft)
Top 25-30 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2 1	

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
2	Left Bank 10 9	8 7 6	5 4 3	2 1 0
2	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
10	Left Bank 10 9	8 7 6	5 4 3	2 1 0
10	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **31/80** + Buffer/Floodplain: **25/80** = **Total** Survey Reach **56/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: IC-4	**WTRSHD/SUBSHD:** IMHOFF CREEK	**DATE:** 11/6/2007	**ASSESSED BY:** PM/GG

START **TIME:** :__AM/PM **LMK:** _____	*END* **TIME:** :__AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 4 (ft)
RT bank 4 (ft)
Width: Bottom 20 (ft)
Top 10 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 **3** 2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
10	Left Bank 10 9	8 7 6	5 4 3	2 1 0
10	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **55/80** + Buffer/Floodplain: **26/80** = **Total** Survey Reach **81/160**

Reach Level Assessment **RCH**

Survey Reach ID: IC-5	**Wtrshd/Subshd:** Imhoff Creek	**Date:** 11/6/2007	**Assessed by:** PM/GG

Start **Time:** __:__ AM/PM **LMK:** _____	*End* **Time:** __:__ AM/PM **LMK:** _____	**GPS ID:**
Lat ___°_____'_____" **Long** ___°_____'_____"	**Lat** ___°_____'_____" **Long** ___°_____'_____"	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics
☐ Unknown
☐ Downcutting ☐ Bed scour
☐ Widening ☐ Bank failure
☐ Headcutting ☐ Bank scour
☐ Aggrading ☐ Slope failure
☐ Sed. deposition ☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 2-4 (ft)
RT bank 2-4 (ft)
Width: Bottom 2-3 (ft)
Top 8-10 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 **3** 2	1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
10	Left Bank 10 9	8 7 6	5 4 3	2 1 0
10	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **52/80** + Buffer/Floodplain: **30/80** = **Total** Survey Reach **82/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: IC-6	**WTRSHD/SUBSHD:** IMHOFF CREEK	**DATE:** 11/6/2007	**ASSESSED BY:** PM/GG

START **TIME:** __:__ AM/PM **LMK:** _____	*END* **TIME:** __:__ AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐ 25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 5 (ft)
RT bank 5 (ft)
Width: Bottom 10 (ft)
Top 10 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4 3	2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
10	Left Bank 10 9	8 7 6	5 4 3	2 1 0
10	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **52/80** + Buffer/Floodplain: **29/80** = **Total** Survey Reach **81/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: LR-45	**WTRSHD/SUBSHD:** LITTLE RIVER	**DATE:** 11/7/2007	**ASSESSED BY:** PM/GG/TGC

START	*END*	**GPS ID:**
TIME: 8 : 30 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☒ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☒ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☒ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☒ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☒ Fish ☐ Beaver ☒ Deer ☐ Snails ☒ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☒ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS ☐ Unknown

☒ Downcutting	☐ Bed scour
☒ Widening	☒ Bank failure
☐ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 20-25 (ft)
RT bank 20-25 (ft)
Width: Bottom 30 (ft)
Top 50-60 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4	3	2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
3	Left Bank 10 9	8 7 6	5 4 3	2 1 0
3	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
3	Left Bank 10 9	8 7 6	5 4 3	2 1 0
3	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **35/80** + Buffer/Floodplain: **56/80** = **Total** Survey Reach **91/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: LR-48	**WTRSHD/SUBSHD:** LITTLE RIVER	**DATE:** 11/7/2007	**ASSESSED BY:** PM/GG/TGC

START	*END*	**GPS ID:**
TIME: 9 : 00 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☒ Crop ☒ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☒ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)* ☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)* ☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☒ none ☐ some ☐ lots Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of) ☒ Fish ☐ Beaver ☒ Deer ☐ Snails ☒ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☒ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS ☐ Unknown

☒ Downcutting	☐ Bed scour
☒ Widening	☒ Bank failure
☐ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-15 (ft)
RT bank 10-15 (ft)
Width: Bottom 20(ft)
Top 40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **42/80** + Buffer/Floodplain: **59/80** = **Total** Survey Reach **101/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: LR-53	**WTRSHD/SUBSHD:** LITTLE RIVER	**DATE:** 11/7/2007	**ASSESSED BY:** PM/GG/TGC

START	*END*	**GPS ID:**
TIME: 9 : 20 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☒ Crop ☒ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☒ Cobble (2.5 –10")
☒ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☒ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☒ Fish ☐ Beaver ☒ Deer ☐ Snails ☒ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☒ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS ☐ Unknown

☒ Downcutting	☐ Bed scour
☒ Widening	☒ Bank failure
☐ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☒ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*

Height:	LT bank	15-20 (ft)
	RT bank	15-20 (ft)
Width:	Bottom	20-30 (ft)
	Top	40-45 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.	
5	4	3	2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
3	Left Bank 10 9	8 7 6	5 4 3	2 1 0
3	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **39/80** + Buffer/Floodplain: **57/80** = **Total** Survey Reach **96/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: LR-64	**WTRSHD/SUBSHD:** LITTLE RIVER	**DATE:** 11/7/2007	**ASSESSED BY:** PM/GG/TGC

START	*END*	**GPS ID:**
TIME: 9 : 40 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☒ Crop ☒ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☒ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☒ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM
Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM
(Evidence of)
☒ Fish ☐ Beaver ☒ Deer ☐ Snails ☒ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☒ Downcutting	☒ Bed scour
☒ Widening	☒ Bank failure
☒ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-15 (ft)
RT bank 10-15 (ft)
Width: Bottom 20(ft)
Top 30-40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.	
5	4	3	2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **43/80** + Buffer/Floodplain: **54/80** = **Total** Survey Reach **97/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: LR-65	**WTRSHD/SUBSHD:** LITTLE RIVER	**DATE:** 11/7/2007	**ASSESSED BY:** PM/GG/TGC

START	*END*	**GPS ID:**
TIME: 10 : 00 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☒ Crop ☒ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☒ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☒ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☒ Fish ☐ Beaver ☒ Deer ☐ Snails ☒ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☒ Downcutting	☐ Bed scour
☒ Widening	☒ Bank failure
☐ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 15 (ft)
RT bank 15 (ft)
Width: Bottom 30(ft)
Top 50 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **45/80** + Buffer/Floodplain: **55/80** = **Total** Survey Reach **100/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: LR-68	**WTRSHD/SUBSHD:** LITTLE RIVER	**DATE:** 11/7/2007	**ASSESSED BY:** PM/GG/TGC

START	*END*	**GPS ID:**
TIME: 10 : 20 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☒ Crop ☒ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☒ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☒ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☒ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☒ Fish ☐ Beaver ☐ Deer ☐ Snails ☒ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Unknown	
☐ Downcutting	☐ Bed scour
☐ Widening	☒ Bank failure
☐ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 5-10 (ft)
RT bank 5-10 (ft)
Width: Bottom 20 (ft)
Top 40 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **63/80** + Buffer/Floodplain: **54/80** = **Total** Survey Reach **117/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: LR-69	**WTRSHD/SUBSHD:** LITTLE RIVER	**DATE:** 11/7/2007	**ASSESSED BY:** PM/GG/TGC

START	*END*	**GPS ID:**
TIME: 10 : 40 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 5-10 (ft)
RT bank 5-10 (ft)
Width: Bottom 10 (ft)
Top 25 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2 1	

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **68/80** + Buffer/Floodplain: **55/80** = **Total** Survey Reach **123/160**

Reach Level Assessment **RCH**

Survey Reach ID: TGLR-1	**Wtrshd/Subshd:** Trib G - Little River	**Date:** 11/7/2007	**Assessed by:** PM/GG/TGC

Start	*End*	**GPS ID:**
Time: 10 : 55 AM/PM **LMK:** _____	**Time:** _ : ___ AM/PM **LMK:** _____	
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☒ Suburban/Res ☒ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☒ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☒ 25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☒ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

Wildlife in or Around Stream *(Evidence of)*
☐ Fish ☐ Beaver ☒ Deer ☐ Snails ☒ Other:

Stream Shading (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics ☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☒ Bank failure
☐ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 5-10 (ft)
RT bank 5-10 (ft)
Width: Bottom 8-10 (ft)
Top 15-20 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☒ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **61/80** + Buffer/Floodplain: **57/80** = **Total** Survey Reach **118/160**

Reach Level Assessment **RCH**

Survey Reach ID: TGLR-2	**Wtrshd/Subshd:** Trib G - Little River	**Date:** 11/7/2007	**Assessed by:** PM/GG/TGC

Start	*End*	**GPS ID:**
Time: 11 : 05 AM/PM **LMK:** _____	**Time:** _ : ___ AM/PM **LMK:** _____	
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other: Construction

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 8-10 (ft)
RT bank 8-10 (ft)
Width: Bottom 30 (ft)
Top 50 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: 47/80 + Buffer/Floodplain: 42/80 = **Total** Survey Reach 89/160

Reach Level Assessment **RCH**

Survey Reach ID: TGLR-7	**Wtrshd/Subshd:** Trib G - Little River	**Date:** 11/7/2007	**Assessed by:** PM/GG/TGC

Start	*End*	**GPS ID:**
Time: 11 : 20 AM/PM **LMK:** _____	**Time:** _ : ___ AM/PM **LMK:** _____	
Lat ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	**Lat** ___ ° _____ ' _____ " **Long** ___ ° _____ ' _____ "	
Description:	**Description:**	

Rain in last 24 hours ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

Present conditions ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

Surrounding land use: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

Average Conditions *(check applicable)*

Base Flow as % Channel Width ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

Dominant Substrate
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

Water Clarity ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

Aquatic Plants in Stream Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

Wildlife in or Around Stream (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

Stream Shading (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

Channel Dynamics
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

Channel Dimensions *(Facing downstream)*
Height: LT bank 2-6 (ft)
RT bank 2-6 (ft)
Width: Bottom 5-10 (ft)
Top 25 (ft)

Reach Accessibility

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

Reach Sketch and Site Impact Tracking

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

Notes: *(biggest problem you see in survey reach)*

***Reported* to authorities** ☐ Yes ☐ No

Overall Stream Condition

	Optimal	Suboptimal	Marginal	Poor
In-stream Habitat *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Vegetative Protection *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Bank Erosion (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
1	Left Bank 10 9	8 7 6	5 4 3	2 1 0
1	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Connection	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Overall Buffer and Floodplain Condition

	Optimal	Suboptimal	Marginal	Poor
Vegetated Buffer Width	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Floodplain Vegetation	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Habitat	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Floodplain Encroach-ment	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **54/80** + Buffer/Floodplain: **56/80** = **Total** Survey Reach **110/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: WC-1	**WTRSHD/SUBSHD:** WOODCREST CREEK	**DATE:** 11/5/2007	**ASSESSED BY:** PM/GG/TGC

START **TIME:** 3 : 10 AM/PM **LMK:** _____	*END* **TIME:** _ : __ AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-15 (ft)
RT bank 10-15 (ft)
Width: Bottom 10-15 (ft)
Top 50-60 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
10	Left Bank 10 9	8 7 6	5 4 3	2 1 0
10	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **41/80** + Buffer/Floodplain: **64/80** = **Total** Survey Reach **105/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: WC-4	**WTRSHD/SUBSHD:** WOODCREST CREEK	**DATE:** 11/5/2007	**ASSESSED BY:** PM/GG/TGC

START **TIME:** 2 : 49 AM/PM **LMK:** _____	*END* **TIME:** _ : __ AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☒ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☒ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☒ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☒ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☒ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☒ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☒ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☒ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-15 (ft)
RT bank 10-15 (ft)
Width: Bottom 8-10 (ft)
Top 50-60 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.	
5	4	3 2 1	

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **48/80** + Buffer/Floodplain: **55/80** = **Total** Survey Reach **103/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: WC-5	**WTRSHD/SUBSHD:** WOODCREST CREEK	**DATE:** 11/5/2007	**ASSESSED BY:** PM/GG/TGC

START **TIME:** 4 : 10 AM/PM **LMK:** _____	*END* **TIME:** _ : __ AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)* **No Base Flow**

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS
☐ Unknown

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 3-7 (ft)
RT bank 3-7 (ft)
Width: Bottom 8 (ft)
Top 10-12 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4	3 2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
4	Left Bank 10 9	8 7 6	5 4 3	2 1 0
4	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **49/80** + Buffer/Floodplain: **43/80** = **Total** Survey Reach **92/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: WC-6	**WTRSHD/SUBSHD:** WOODCREST CREEK	**DATE:** 11/5/2007	**ASSESSED BY:** PM/GG/TGC

START **TIME:** 4 : 20 AM/PM **LMK:** _____	*END* **TIME:** _ : __ AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☒ Suburban/Res ☒ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☒ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☒ Sand (gritty) ☐ Boulder (>10")
☒ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☒ Other *(chemicals, dyes)* **No Base Flow**

AQUATIC PLANTS IN STREAM Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS ☐ Unknown

☒ Downcutting	☐ Bed scour
☒ Widening	☒ Bank failure
☐ Headcutting	☒ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 6-8 (ft)
RT bank 6-8 (ft)
Width: Bottom 10-12 (ft)
Top 20-25 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4	3 2 1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **46/80** + Buffer/Floodplain: **38/80** = **Total** Survey Reach **84/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: WC-7	**WTRSHD/SUBSHD:** WOODCREST CREEK	**DATE:** 11/5/2007	**ASSESSED BY:** PM/GG/TGC

START **TIME:** 4 : 35 AM/PM **LMK:** _____	*END* **TIME:** _ : __ AM/PM **LMK:** _____	**GPS ID:**
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☒ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☒ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☒ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☒ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☒ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☒ none ☐ some ☐ lots
Floating: ☒ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☒ Other:

STREAM SHADING (water surface)
☒ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☒ Downcutting	☐ Bed scour
☒ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 4-6 (ft)
RT bank 4-6 (ft)
Width: Bottom 8-10 (ft)
Top 12-14 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5	4 3 2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☒ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **46/80** + Buffer/Floodplain: **61/80** = **Total** Survey Reach **107/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: MC-1	WTRSHD/SUBSHD: MERKLE CREEK	DATE: 11/5/2007	ASSESSED BY: TGC/BA

START	END	GPS ID:
TIME: 4 : 45 AM/PM LMK: _____	TIME: _ : ___ AM/PM LMK: _____	
LAT ___°_____'_____" LONG ___°_____'_____"	LAT ___°_____'_____" LONG ___°_____'_____"	
DESCRIPTION:	DESCRIPTION:	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☑ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☑ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☑ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☑ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☑ none ☐ some ☐ lots
Floating: ☑ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☑ Fish ☐ Beaver ☑ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☑ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☑ Downcutting	☐ Bed scour
☑ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 25-30 (ft)
RT bank 2-30 (ft)
Width: Bottom 20-25 (ft)
Top 60-70 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.	
5	4 3 2	1	

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☑ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
9	Left Bank 10 9	8 7 6	5 4 3	2 1 0
9	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **50/80** + Buffer/Floodplain: **59/80** = **Total** Survey Reach **109/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: MC-2	**WTRSHD/SUBSHD:** MERKLE CREEK	**DATE:** 11/5/2007	**ASSESSED BY:** TGC/BA

START	*END*	**GPS ID:**
TIME: 5 : 15 AM/PM **LMK:** _____	**TIME:** _ : ___ AM/PM **LMK:** _____	
LAT ___°_____'_____" **LONG** ___°_____'_____"	**LAT** ___°_____'_____" **LONG** ___°_____'_____"	
DESCRIPTION:	**DESCRIPTION:**	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐ Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM *(Evidence of)*
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

☐ Unknown

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 15-20 (ft)
RT bank 15-20 (ft)
Width: Bottom 20-25 (ft)
Top 20-25 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4	3 2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
6	Left Bank 10 9	8 7 6	5 4 3	2 1 0
6	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
5	Left Bank 10 9	8 7 6	5 4 3	2 1 0
5	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **44/80** + Buffer/Floodplain: **54/80** = **Total** Survey Reach **98/160**

Reach Level Assessment **RCH**

SURVEY REACH ID: MC-3	WTRSHD/SUBSHD: MERKLE CREEK	DATE: 11/5/2007	ASSESSED BY: TGC/BA

START	END	GPS ID:
TIME: 5 : 30 AM/PM LMK: _____	TIME: _ : ___ AM/PM LMK: _____	
LAT ___°_____'_____" LONG ___°_____'_____"	LAT ___°_____'_____" LONG ___°_____'_____"	
DESCRIPTION:	DESCRIPTION:	

RAIN IN LAST 24 HOURS ☐ Heavy rain ☐ Steady rain ☐ None ☐ Intermittent ☐ Trace

PRESENT CONDITIONS ☐ Heavy rain ☐ Steady rain ☐ Intermittent ☐ Clear ☐ Trace ☐ Overcast ☐ Partly cloudy

SURROUNDING LAND USE: ☐ Industrial ☐ Commercial ☐ Urban/Residential ☐ Suburban/Res ☐ Forested ☐ Institutional ☐ Golf course ☐ Park ☐ Crop ☐ Pasture ☐ Other:

AVERAGE CONDITIONS *(check applicable)*

BASE FLOW AS % CHANNEL WIDTH ☐ 0-25% ☐ 50%-75% ☐25-50 % ☐ 75-100%

DOMINANT SUBSTRATE
☐ Silt/clay (fine or slick) ☐ Cobble (2.5 –10")
☐ Sand (gritty) ☐ Boulder (>10")
☐ Gravel (0.1-2.5") ☐ Bed rock

WATER CLARITY ☐ Clear ☐Turbid *(suspended matter)*
☐ Stained *(clear, naturally colored)* ☐ Opaque *(milky)*
☐ Other *(chemicals, dyes)*

AQUATIC PLANTS IN STREAM Attached: ☐ none ☐ some ☐ lots
Floating: ☐ none ☐ some ☐ lots

WILDLIFE IN OR AROUND STREAM (Evidence of)
☐ Fish ☐ Beaver ☐ Deer ☐ Snails ☐ Other:

STREAM SHADING (water surface)
☐ Mostly shaded (≥75% coverage)
☐ Halfway (≥50%)
☐ Partially shaded (≥25%)
☐ Unshaded (< 25%)

CHANNEL DYNAMICS

☐ Unknown	
☐ Downcutting	☐ Bed scour
☐ Widening	☐ Bank failure
☐ Headcutting	☐ Bank scour
☐ Aggrading	☐ Slope failure
☐ Sed. deposition	☐ Channelized

CHANNEL DIMENSIONS *(FACING DOWNSTREAM)*
Height: LT bank 10-15 (ft)
RT bank 10-15 (ft)
Width: Bottom 30 (ft)
Top 60 (ft)

REACH ACCESSIBILITY

Good: Open area in public ownership, sufficient room to stockpile materials, easy stream channel access for heavy equipment using existing roads or trails.	**Fair**: Forested or developed area adjacent to stream. Access requires tree removal or impact to landscaped areas. Stockpile areas small or distant from stream.	**Difficult.** Must cross wetland, steep slope, or sensitive areas to get to stream. Few areas to stockpile available and/or located a great distance from stream. Specialized heavy equipment required.
5 4	3 2	1

REACH SKETCH AND SITE IMPACT TRACKING

Simple planar sketch of survey reach. Track locations and IDs for all site impacts within the survey reach (OT, ER, IB,SC, UT, TR, MI) as well as any additional features deemed appropriate. Indicate direction of flow

NOTES: *(biggest problem you see in survey reach)*

***REPORTED* TO AUTHORITIES** ☐ YES ☐ NO

OVERALL STREAM CONDITION

	Optimal	Suboptimal	Marginal	Poor
IN-STREAM HABITAT *(May modify criteria based on appropriate habitat regime)*	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
VEGETATIVE PROTECTION *(score each bank, determine sides by facing downstream)*	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
BANK EROSION (facing downstream)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Grade and width stable; isolated areas of bank failure/erosion; likely caused by a pipe outfall, local scour, impaired riparian vegetation or adjacent use.	Past downcutting evident, active stream widening, banks actively eroding at a moderate rate; no threat to property or infrastructure	Active downcutting; tall banks on both sides of the stream eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.
7	Left Bank 10 9	8 7 6	5 4 3	2 1 0
7	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN CONNECTION	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) able to enter floodplain. Stream not deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.	High flows (greater than bankfull) **not** able to enter floodplain. Stream deeply entrenched.
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

OVERALL BUFFER AND FLOODPLAIN CONDITION

	Optimal	Suboptimal	Marginal	Poor
VEGETATED BUFFER WIDTH	Width of buffer zone >50 feet; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, crops) have not impacted zone.	Width of buffer zone 25-50 feet; human activities have impacted zone only minimally.	Width of buffer zone 10-25 feet; human activities have impacted zone a great deal.	Width of buffer zone <10 feet: little or no riparian vegetation due to human activities.
8	Left Bank 10 9	8 7 6	5 4 3	2 1 0
8	Right Bank 10 9	8 7 6	5 4 3	2 1 0
FLOODPLAIN VEGETATION	Predominant floodplain vegetation type is mature forest	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is shrub or old field	Predominant floodplain vegetation type is turf or crop land
13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN HABITAT	Even mix of wetland and non-wetland habitats, evidence of standing/ponded water	Even mix of wetland and non-wetland habitats, no evidence of standing/ponded water	Either all wetland or all non-wetland habitat, evidence of standing/ponded water	Either all wetland or all non-wetland habitat, no evidence of standing/ponded water
9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
FLOODPLAIN ENCROACH-MENT	No evidence of floodplain encroachment in the form of fill material, land development, or manmade structures	Minor floodplain encroachment in the form of fill material, land development, or manmade structures, but not effecting floodplain function	Moderate floodplain encroachment in the form of filling, land development, or manmade structures, some effect on floodplain function	Significant floodplain encroachment (i.e. fill material, land development, or man-made structures). Significant effect on floodplain function
16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Sub Total In-stream: **58/80** + Buffer/Floodplain: **54/80** = **Total** Survey Reach **112/160**