Storm Water Master Plan

City of Norman
Cleveland County,
Oklahoma

Public Meeting
February 21, 2008

PBS&J® HALFF VIEUX, INC. LEMKE LAND SURVEYING

Presentation Overview

- Introductions
- Presentation Format
- Key Project Work Elements
  - » Storm Water Phase II
  - » Funding Solutions
  - » Watershed/Stream Assessments
  - » Rainfall & Runoff Analyses
  - » Greenbelt Master Plan
- Status
- Questions & Comments

PBS&J® HALFF VIEUX, INC. SLS LEMKE LAND SURVEYING

Project Approach – Key Issues: The City's Vision

- Build consensus and support
- Address storm water challenges and greenbelt opportunities
- Comply with storm water quality requirements (Phase II)
- Define funding solutions

Project Team Meetings and Coordination

- Develop partnerships
- Continuous communication
- SWMP Committee meetings
- Storm water regulatory compliance meetings
- Open Public Meetings

Storm Water Quality Compliance Program

Michael Bloom, P.E., CFM, BCEE
PBS&J

Storm Water Requirements/Goals

- Protect Lake Thunderbird and streams
- Reduce pollution in storm water runoff
- Comply with Clean Water Act

Program Components

- Public Education and Outreach
- Public Involvement/Participation
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water
- Post-Construction Storm Water
- Good Housekeeping Municipal Operations

Timeline

- Completed
  - » Oklahoma DEQ issues permit in 2005
  - » City applies for permit 2005
  - » City begins program implementation 2005
  - » Program review 2007-2008:
    - —Recommended activities
    - —Cost estimate
- Planned
  - » Permit renewal required in 2009
  - » Implement next permit program 2010-2015

Public Education and Outreach

- REQUIREMENT:
  - » Educate public about impacts and what can be done to reduce storm water pollution
- EXISTING:
  - » Household hazardous waste collection
  - » Storm drain marking, complaint hotline, earth day booth, blue ribbon week, zoo keepers, ECAB
- NEW:
  - » School programs, yard care brochures, auto salvage yard brochure

Public Involvement

- REQUIREMENTS:
  - Comply with State/Local notice requirements
  - Involve developers, construction companies, environmental groups, etc.
- EXISTING:
  - Storm drain marking, website, Lake Thunderbird sweep, Greenbelt Commission, Blue Thumb
- NEW:
  - Volunteer water quality monitoring

Illicit Discharge Detection & Elimination

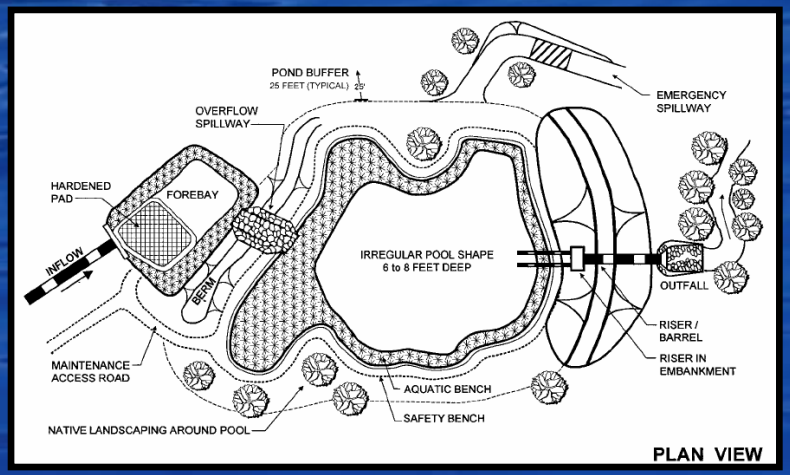
- REQUIREMENTS:
  - » Map outfalls and receiving streams
  - » Program of detection and elimination of discharges
  - » Prohibit illegal dumping
  - » Inform public
- EXISTING:
  - » Legal authority (ordinance)
  - » Compliant hotline
  - » Household hazardous waste collection
- NEW:
  - » Develop detection plan, map outfalls and receiving streams
  - » Inspect outfalls, enforce ordinance

Construction Site Runoff

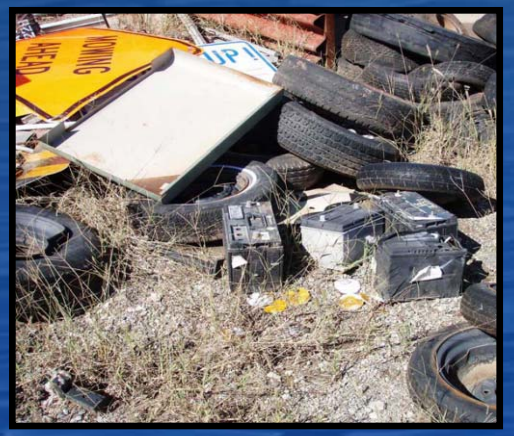
- REQUIREMENTS:
  - Control pollutant runoff from active construction sites larger than 1 acre.
- EXISTING:
  - Ordinance, earth change permit, plan reviews, building permit erosion controls
  - Site inspections and enforcement
- NEW:
  - Construction stakeholder group
  - Erosion control manual
  - Erosion control demonstration

New Development and Redevelopment

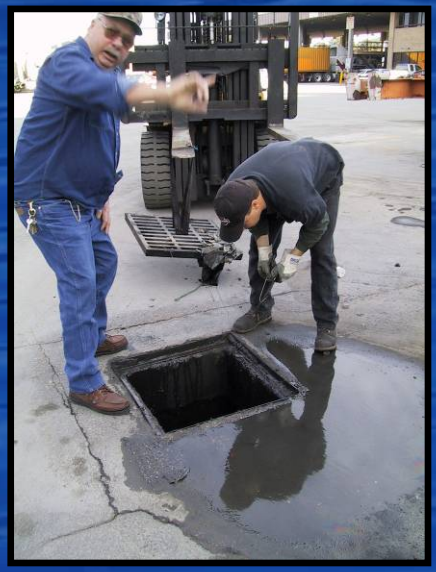
- REQUIREMENTS:
  - Impose permanent controls on runoff from newly developed land
  - Determine controls to be used and long term O&M policies during five year start up implementation
- EXISTING:
  - Zoning, voluntary developer actions, open space requirements
- NEW:
  - Adopt ordinance to address post-construction runoff
  - Determine O&M policies (private – public)
  - Adopt criteria manual for controls
  - Developers stakeholders group
  - Inspect permanent controls
  - Long-term operation & maintenance



Pollution Prevention & Good Housekeeping for Municipal Operations



- REQUIREMENTS:
  - Employee training, standard operating procedures to avoid pollution
- EXISTING:
  - Street sweeping, mowing, litter pickup, spill response on roads, pesticide - herbicide management
- NEW:
  - City facility inspections, update employee training, update SOP's for city activities, additional street sweeping, enhanced spill response program for city sites



Estimated Program Costs

SUMMARY OF ALL COSTS (ROUNDED)	FIRST PERMIT CYCLE				
MINIMUM CONTROL MEASURES	2006	2007	2008	2009	2010
MCM-1 - PUBLIC EDUCATION AND OUTREACH	$ 108,000	$ 106,000	$ 112,000	$ 109,000	$ 108,000
MCM-2 - PUBLIC PARTICIPATION AND INVOLVEMENT	$ 11,000	$ 21,000	$ 21,000	$ 11,000	$ 11,000
MCM-3 - ILLICIT DISCHARGE DETECTION AND ELIMINATION	$ 16,000	$ 10,000	$ 12,000	$ 17,000	$ 17,000
MCM-4 - CONSTRUCTION SITE RUNOFF CONTROL	$ 91,000	$ 80,000	$ 80,000	$ 80,000	$ 80,000
MCM-5 - POST CONSTRUCTION RUNOFF CONTROLS	$ -	$ -	$ -	$ -	$ 98,000
MCM-6 - GOOD HOUSEKEEPING IN MUNICIPAL OPERATIONS	$ 375,000	$ 181,000	$ 181,000	$ 181,000	$ 181,000
ADMINISTRATIVE COSTS (Annual Reporting, etc.)	$ 88,000	$ 56,000	$ 56,000	$ 56,000	$ 67,000
EXISTING COSTS:	***$ 678,000***	***$ 444,000***	***$ 446,000***	***$ 434,000***	***$ 436,000***
NEW COSTS:	***$ 10,000***	***$ 10,000***	***$ 16,000***	***$ 21,000***	***$ 127,000***
PHASE II COMPLIANCE TOTAL COSTS:	**$ 688,000**	**$ 453,000**	**$ 462,000**	**$ 455,000**	**$ 563,000**
PHASE II COMPLIANCE TOTAL COSTS (w/ 5% annual inflation):	***$ 688,000***	***$ 453,000***	***$ 485,000***	***$ 501,000***	***$ 651,000***

Estimated Program Costs

SUMMARY OF ALL COSTS (ROUNDED)	SECOND PERMIT CYCLE				
MINIMUM CONTROL MEASURES	2011	2012	2013	2014	2015
MCM-1 - PUBLIC EDUCATION AND OUTREACH	$ 108,000	$ 106,000	$ 116,000	$ 113,000	$ 116,000
MCM-2 - PUBLIC PARTICIPATION AND INVOLVEMENT	$ 15,000	$ 15,000	$ 20,000	$ 20,000	$ 20,000
MCM-3 - ILLICIT DISCHARGE DETECTION AND ELIMINATION	$ 28,000	$ 28,000	$ 28,000	$ 28,000	$ 28,000
MCM-4 - CONSTRUCTION SITE RUNOFF CONTROL	$ 109,000	$ 85,000	$ 82,000	$ 85,000	$ 82,000
MCM-5 - POST CONSTRUCTION RUNOFF CONTROLS	$ 60,000	$ 13,000	$ 14,000	$ 14,000	$ 15,000
MCM-6 - GOOD HOUSEKEEPING IN MUNICIPAL OPERATIONS	$ 191,000	$ 269,000	$ 637,000	$ 755,000	$ 984,000
ADMINISTRATIVE COSTS (Annual Reporting, etc.)	$ 96,000	$ 71,000	$ 100,000	$ 73,000	$ 84,000
EXISTING COSTS:	***$ 466,000***	***$ 525,000***	***$ 527,000***	***$ 525,000***	***$ 527,000***
NEW COSTS:	***$ 141,000***	***$ 62,000***	***$ 469,000***	***$ 563,000***	***$ 801,000***
PHASE II COMPLIANCE TOTAL COSTS:	$ 607,000	$ 587,000	$ 996,000	$ 1,088,000	$ 1,328,000
PHASE II COMPLIANCE TOTAL COSTS (w/ 5% annual inflation):	***$ 738,000***	***$ 749,000***	***$ 1,335,000***	***$ 1,531,000***	***$ 1,963,000***

Next Steps – Storm Water Quality

- Continue existing implementation actions
- Continue reporting to DEQ
- Refine new activities and programs after completion of “Storm Water Master Plan”
- Update storm water quality plan and renew permit with DEQ
- Implement 2010-2015 programs

Storm Water Quality Compliance Program

QUESTIONS AND COMMENTS

Lake Thunderbird Sunset

Storm Water Financing

John German, P.E.
PBS&J

Storm Water Funding Options

- Funding Options
  - Storm water utility
  - General obligation bonds
  - Revenue bonds
  - Land development fees
  - General Fund revenues

Storm Water Funding – Drainage Utility

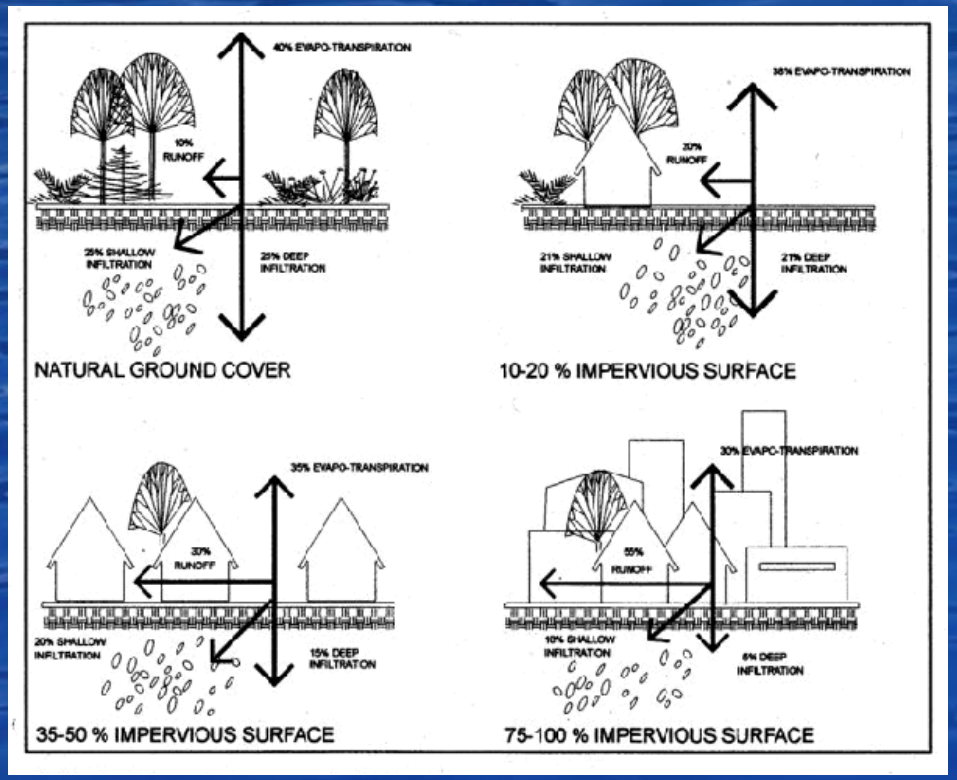
- Concept
  - A user pays for a benefit
  - User is any piece of developed property
  - Benefit:
    - Connection to the storm water management system
    - Various storm water management services
    - Improved water quality in streams and lakes

Storm Water Funding

- Conduct needs assessment:
  What is desired *level of service*?
  - Master planning elements
  - Phase II compliance and selected goals
  - Floodplain management
  - Source water protection (drinking water supply)
  - Capital improvements
- Estimated costs and revenue requirements:
  How much will this cost?
  - Administrative, regulatory and planning activities
  - Infrastructure design, construction, operation, and maintenance
  - Equipment and consumables

Storm Water Funding

- Evaluate alternative rate structures:
  How much will specific properties pay?
  - » Determine rate base [types of properties to be charged] such as: commercial, residential, industrial
  - » Determine credits to be offered (if any)
    - — Location, imperviousness, use of onsite controls
  - » Frequent approach:
    - — Average single-family residential lot is used to define an equivalent residential unit (ERU)
    - — ERU's used to define rates for other land use types



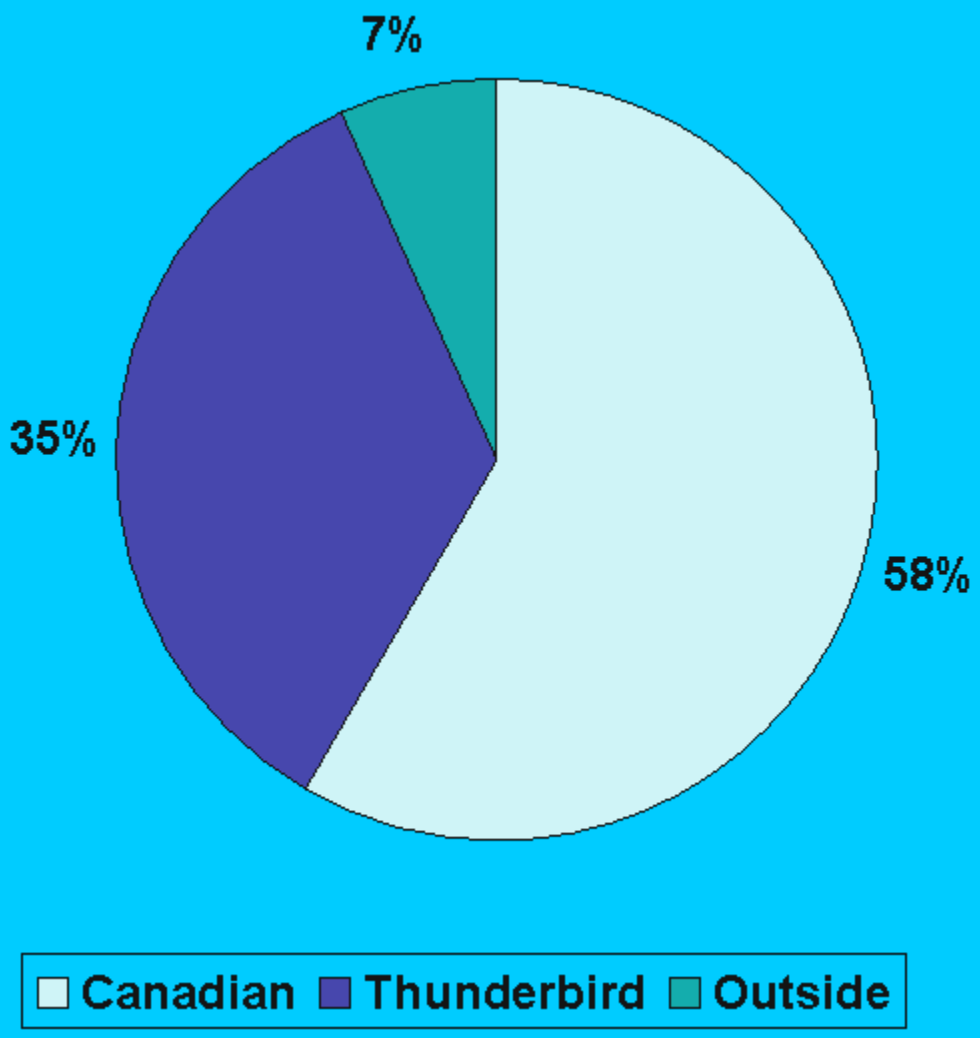
Steps Taken

- Financial
  - Met with City staff to begin stormwater budget
  - Budget to include
    - MS4 costs
    - City O&M
    - Capital costs (equipment, facilities, etc.)
    - Capital Improvements
    - Parks & trails

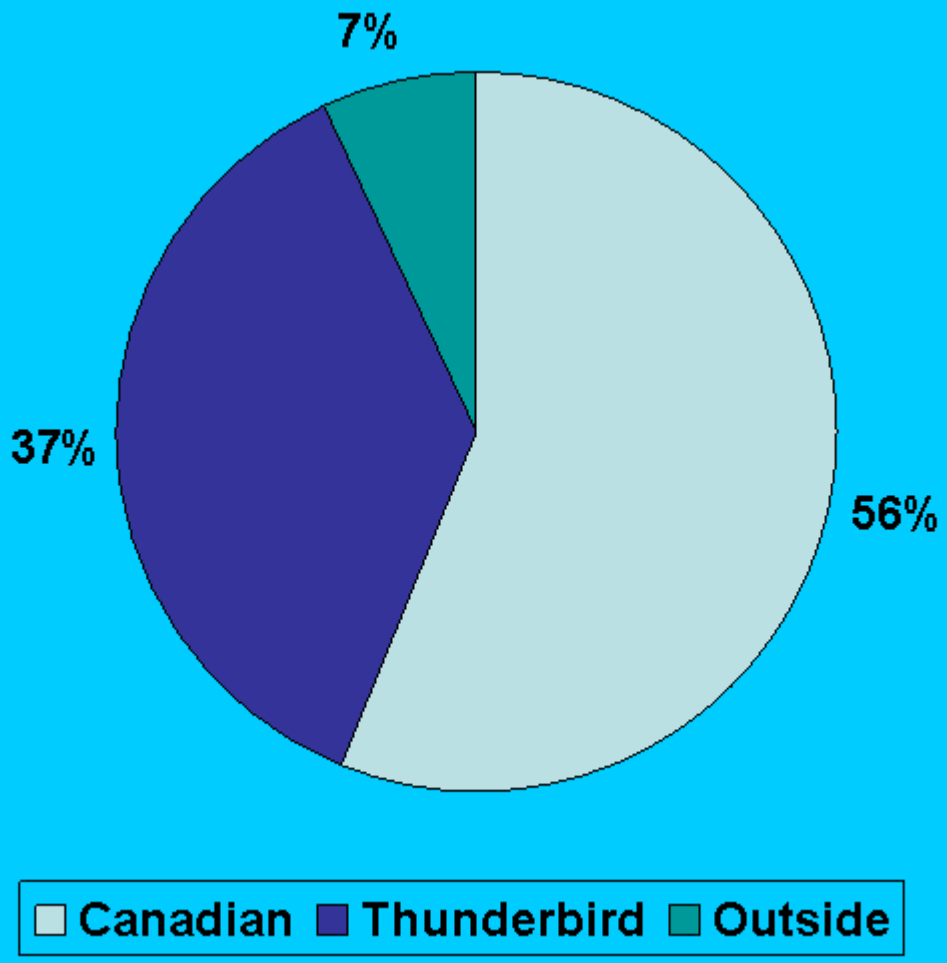
Steps Taken

- Impervious surface data
  - 39,851 parcels – 22% total impervious cover
  - Extracted at highest data level
    - 25 zoning codes
    - 18 basins draining to:
      - Lake Thunderbird
      - South Canadian River in Norman
      - South Canadian below Lake Thunderbird (Outside)

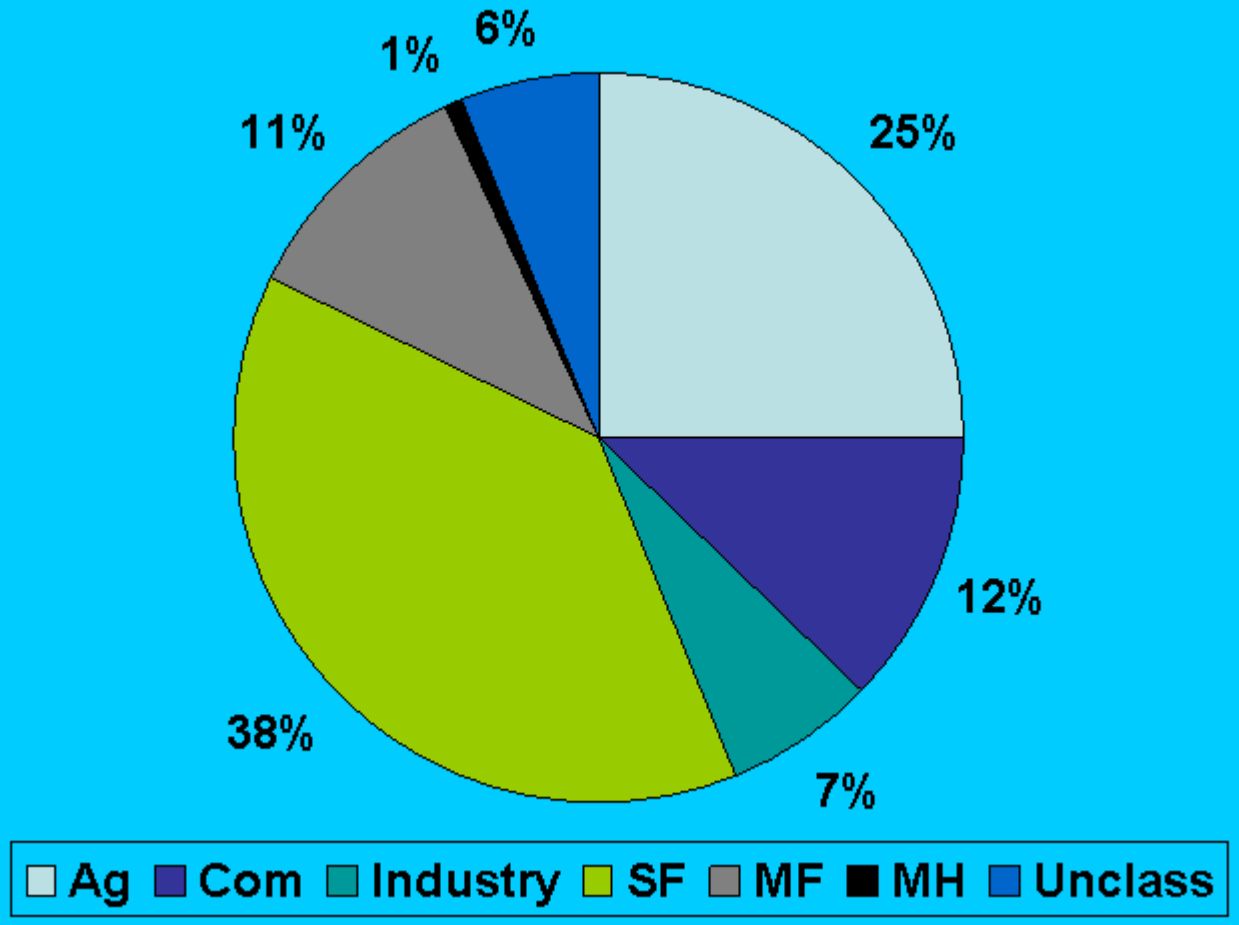
Parcel Distribution by Drainage Area



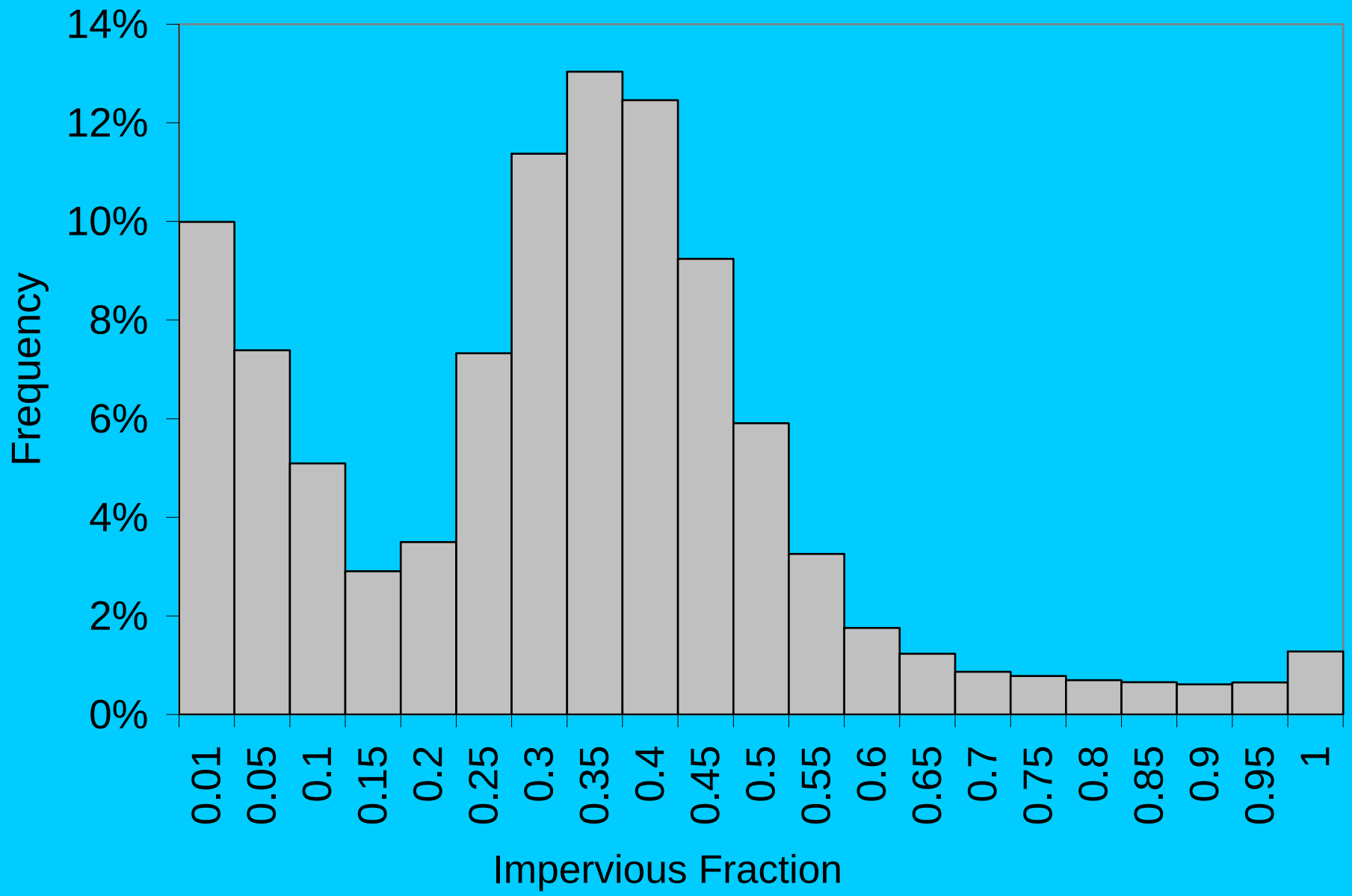
Impervious Cover Distribution



Impervious Cover By Zoning Codes



Impervious Cover – All Parcels



Next Steps

- Aggregate zoning codes into single family, multi-family, etc.
  - Isolate University of Oklahoma parcels
  - Review unclassified parcels
- Analyze impervious area by zoning and drainage basin
- Finalize operations & MS4 budgets
- Determine user rates and rate alternatives
- Present rate alternatives at next meeting

Storm Water Financing

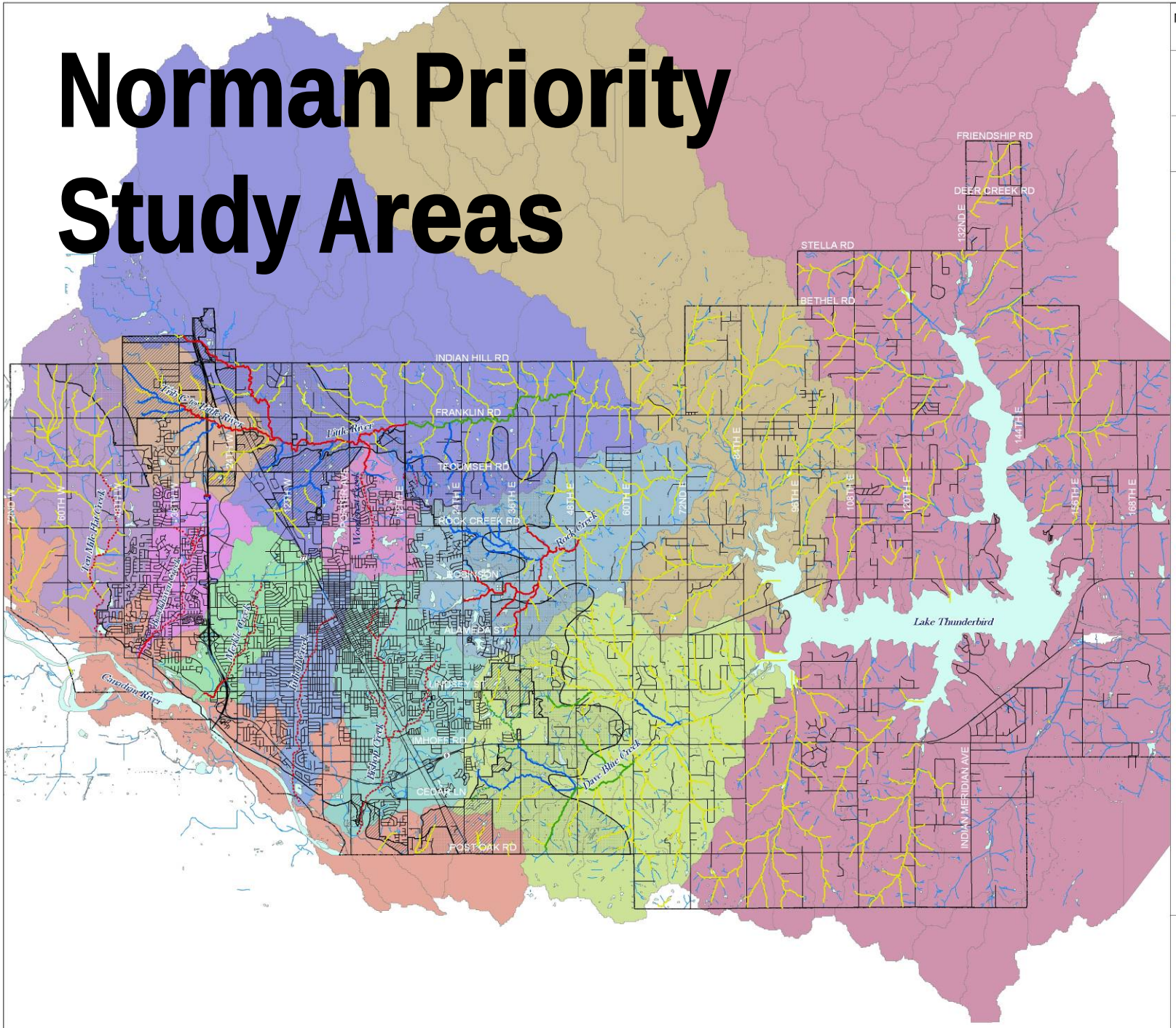
QUESTIONS & COMMENTS

Lake Thunderbird Sunset

Watershed / Stream Assessment and Rainfall / Runoff Analyses

Duke Altman, PE, CFM, BCEE
PBS&J

Norman Priority Study Areas



Norman Storm Water Master Plan
Priority Study Areas

City of Norman
201 West Gray, Bldg. A
Norman, OK 73069

PBSJ 6504 Bridge Point Parkway, Suite 200
Austin, TX 78730
512.327.6840 Fax: 512.327.2543

Legend

Study Streams
- New Detailed (L1)
- Existing Detailed (L2)
- Future Detailed (L3)
- Stream Planning Corridor (L4)
- Alt. A - Detailed
- Alt. A - Existing Detailed

Development Category
- Current Urban
- Future Urban
- Northern Loop
- Suburban Residential
- City_Boundary
- Roads
- Base Drainage Layer

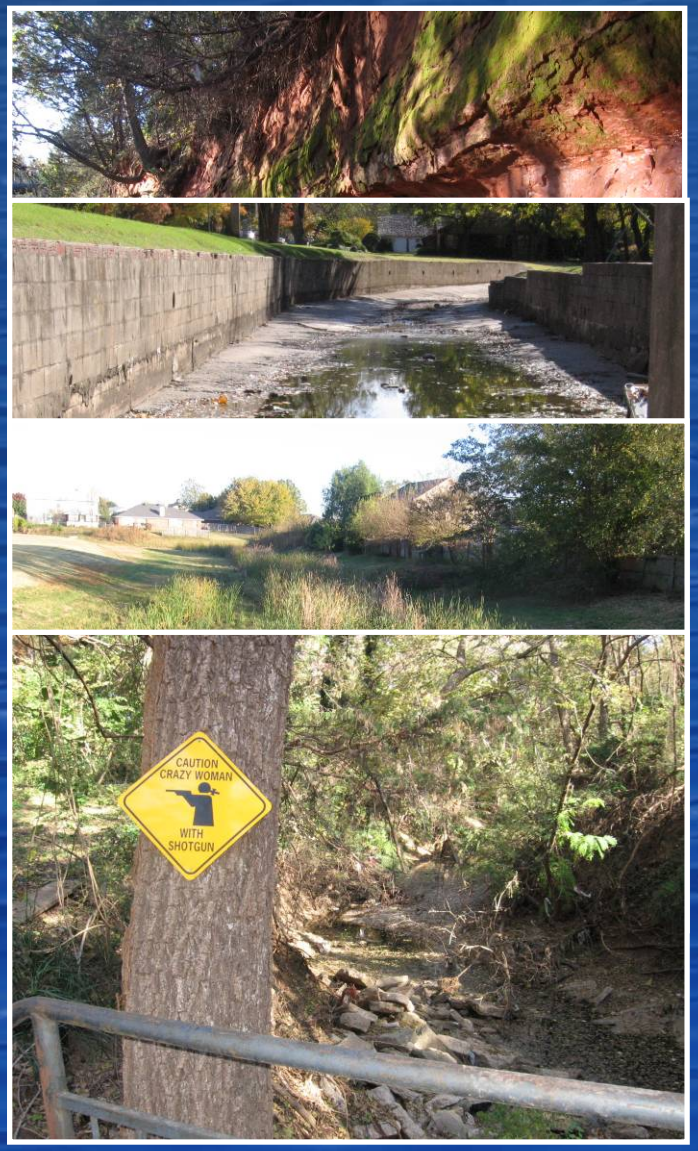
Watershed
- Bishop Creek
- Brookhaven Creek
- Canadian River Tribs
- Dave Blue Creek
- Imhoff Creek
- Lake Thunderbird
- Little River
- Lower Little River
- Merkle Creek
- Rock Creek
- Ten Mile Flat Creek
- Trib G to Little River
- Woodcrest Creek

N

0 1,500 3,000 6,000 9,000 12,000 Feet

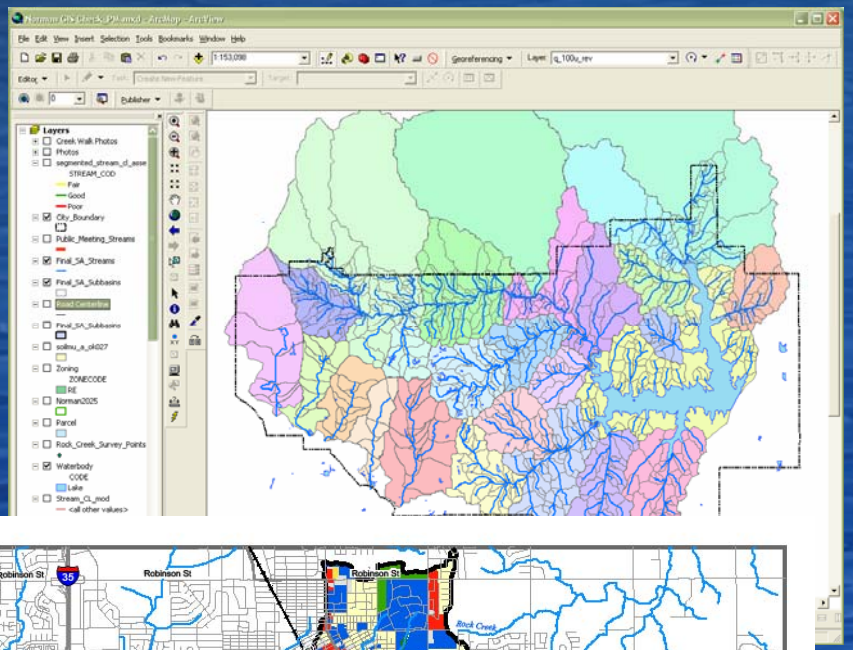
Integrated Watershed & Stream Assessments

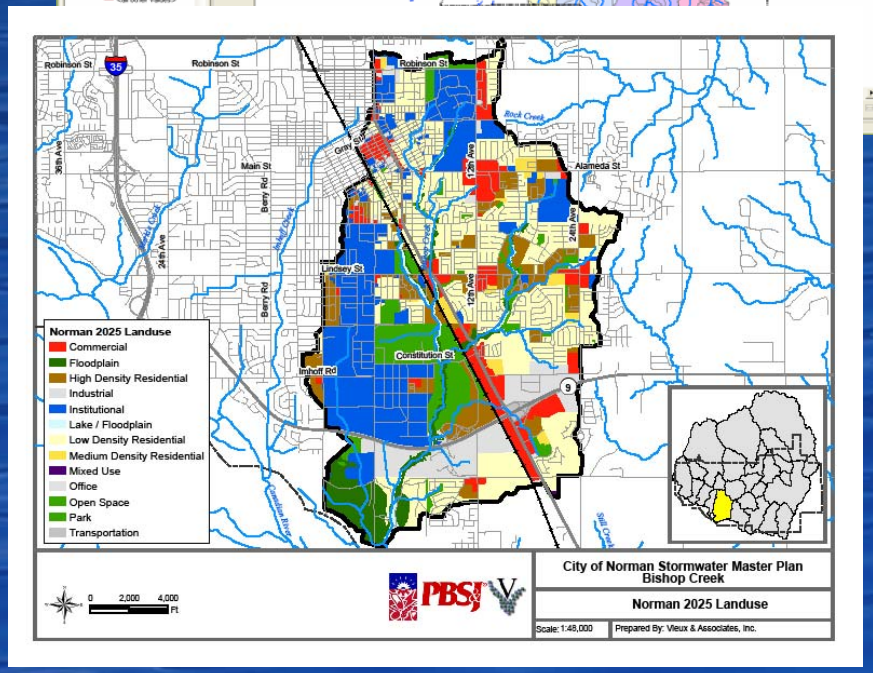
- Assess existing watershed conditions
- Stream corridor assessment
  - » Creek walks
  - » Individual reach characteristics
- Document in GIS/database



Watershed Assessments

- Sub-watershed delineations and inventory to assist in future planning
- Assess and document existing watershed conditions
  - » Topography, drainage patterns, land use, soils, etc.
  - » Database development





Watershed Assessments

Attributes of Final_SA_Subbasins

Shape *	OBJECTID	NAME	Perim_ft	Area_sqft	Det_Pond	FLDZONE	Channel_TY	SW_Outfall	FP_Veget	Study_Ty	CumArea	Area	NextDownID	EROSIV_AWM
Polygon	199	RC-38	17624.13105	14015207.5161	2	X	Natural	2	Suboptimal	Detailed	720.596669	321.743605	RC-32	0.380363
Polygon	200	RC-27	8966.1713	3156417.0507	0	X	Natural	0	Optimal	Enhanced Approximate	108.498551	72.461075	RC-26	0.381548
Polygon	201	RC-10	5830.411873	1642682.40991	0						37.710648	37.710648	RC-9	0.38012
Polygon	202	LT-15	6549.745099	2288919.33473	0	X	Natural	0	Optimal	Approximate	91.633292	52.546147	-1	0.222868
Polygon	203	LT-25	6021.850963	1584004.03829	0	X	Natural	0	Optimal	Enhanced Approximate	36.363584	36.363584	-1	0.24
Polygon	204	T1LT-3	18463.730782	15277506.3651	0	A	Natural	0	Marginal	Enhanced Approximate	387.016769	350.721884	T1LT-2	0.230732
Polygon	205	RC-39	6003.052391	1475353.72561	0						33.869326	33.869326	RC-38	0.452391
Polygon	206	T1LT-8	5919.038946	1614650.2315	0	X	Natural	0	Suboptimal	Approximate	77.995396	37.067121	T1LT-6	0.29708
Polygon	207	RC-20	12280.819006	5760373.14173	0	X	Natural	0	Optimal	Approximate	176.259336	132.239442	RC-19	0.380306
Polygon	208	T1LT-2	18915.110374	16679112.5409	0	A	Natural	0	Suboptimal	Enhanced Approximate	769.914975	382.898205	T1LT-1	0.237819
Polygon	210	RC-32	22334.085779	11013168.4092	0	X	Natural	0	Optimal	Detailed	1471.386273	252.826546	RC-26	0.372769
Polygon	211	RC-42	6705.486722	2562238.49548	0						58.820667	58.820667	RC-41	0.401589
Polygon	212	T1LT-6	17719.579221	12614454.1584	0	X	Natural	0	Suboptimal	Approximate	408.381831	289.586862	T1LT-5	0.23676
Polygon	213	LT-16	5726.755936	1702642.84429	0						39.087145	39.087145	LT-15	0.238013
Polygon	214	LT-27	10017.365429	4880528.42812	0	X	Natural	0	Optimal	Enhanced Approximate	372.363953	112.041068	-1	0.239892
Polygon	215	T1LT-9	5463.498564	1782842.81557	0						40.928276	40.928276	T1LT-8	0.231959
Polygon	216	LT-26	8993.748334	4429833.28073	0	X	Natural	0	Optimal	Enhanced Approximate	101.694572	101.694572	-1	0.24
Polygon	217	RC-26	10922.901193	3885096.25301	0	A	Natural	0	Optimal	Enhanced Approximate	3389.647576	89.189181	RC-25	0.314072
Polygon	218	LT-35	6648.534837	2759013.29406	0	X	Natural	0	Optimal	Enhanced Approximate	63.337977	63.337977	-1	0.235784
Polygon	219	RC-41	16250.081183	12031921.2585	0	X	Natural	0	Marginal	Enhanced Approximate	335.034467	276.2138	RC-40	0.389571
Polygon	220	LT-31	11027.212011	6005772.80999	0	X	Natural	0	Optimal	Enhanced Approximate	182.40505	137.873021	-1	0.24
Polygon	221	RC-23	11772.582016	7462150.8216	1	X	Natural	0	Suboptimal	Approximate	212.363705	171.306726	RC-22	0.381573
Polygon	222	LT-36	7919.497498	3018356.94743	0	X	Natural	0	Optimal	Enhanced Approximate	69.291664	69.291664	-1	0.237086
Polygon	223	WC-8	15420.411541	11662328.7396	6						267.729157	267.729157	WC-7	0.43006
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Polygon	227	LT-33	11976.168389	7391437.38896	0	X	Natural	0	Optimal	Enhanced Approximate	217.947862	169.683375	-1	0.23526
Polygon	228	WC-9	10905.705105	6535739.01708	1						150.039322	150.039322	WC-10	0.486797

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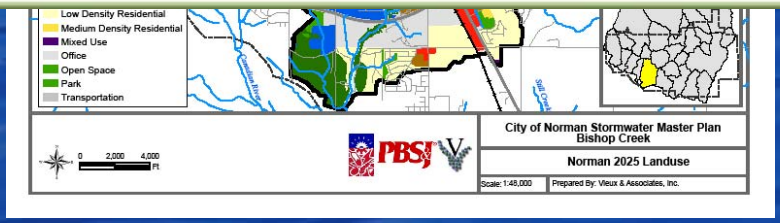
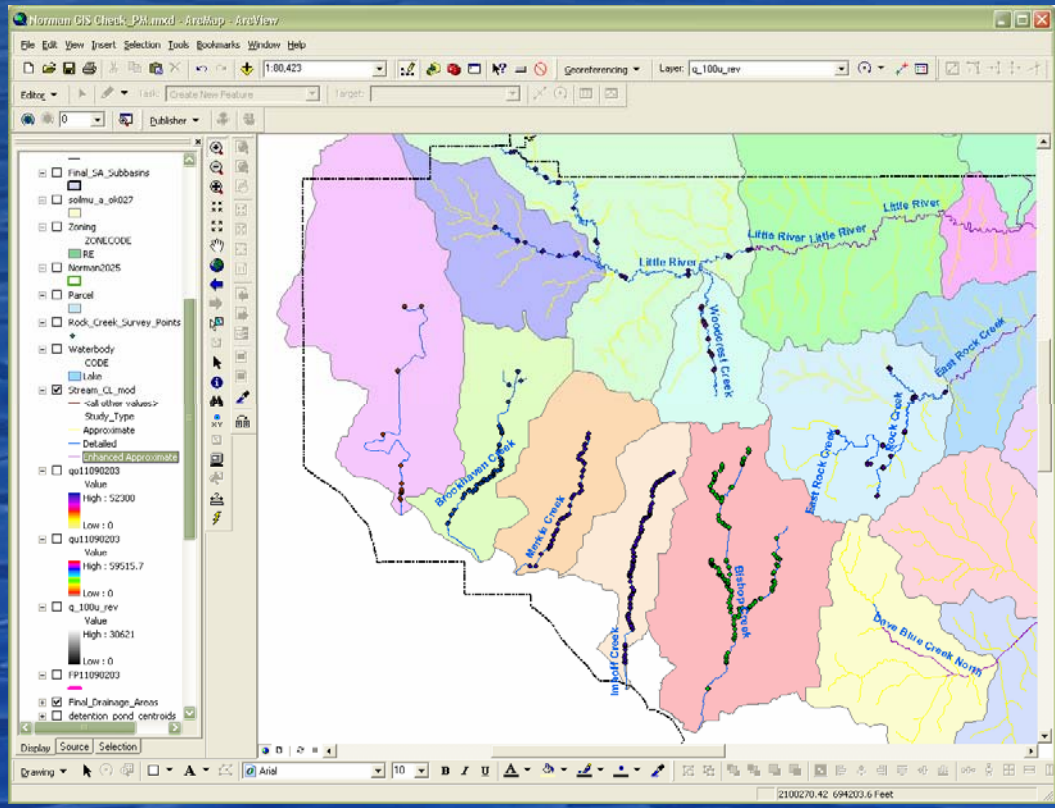
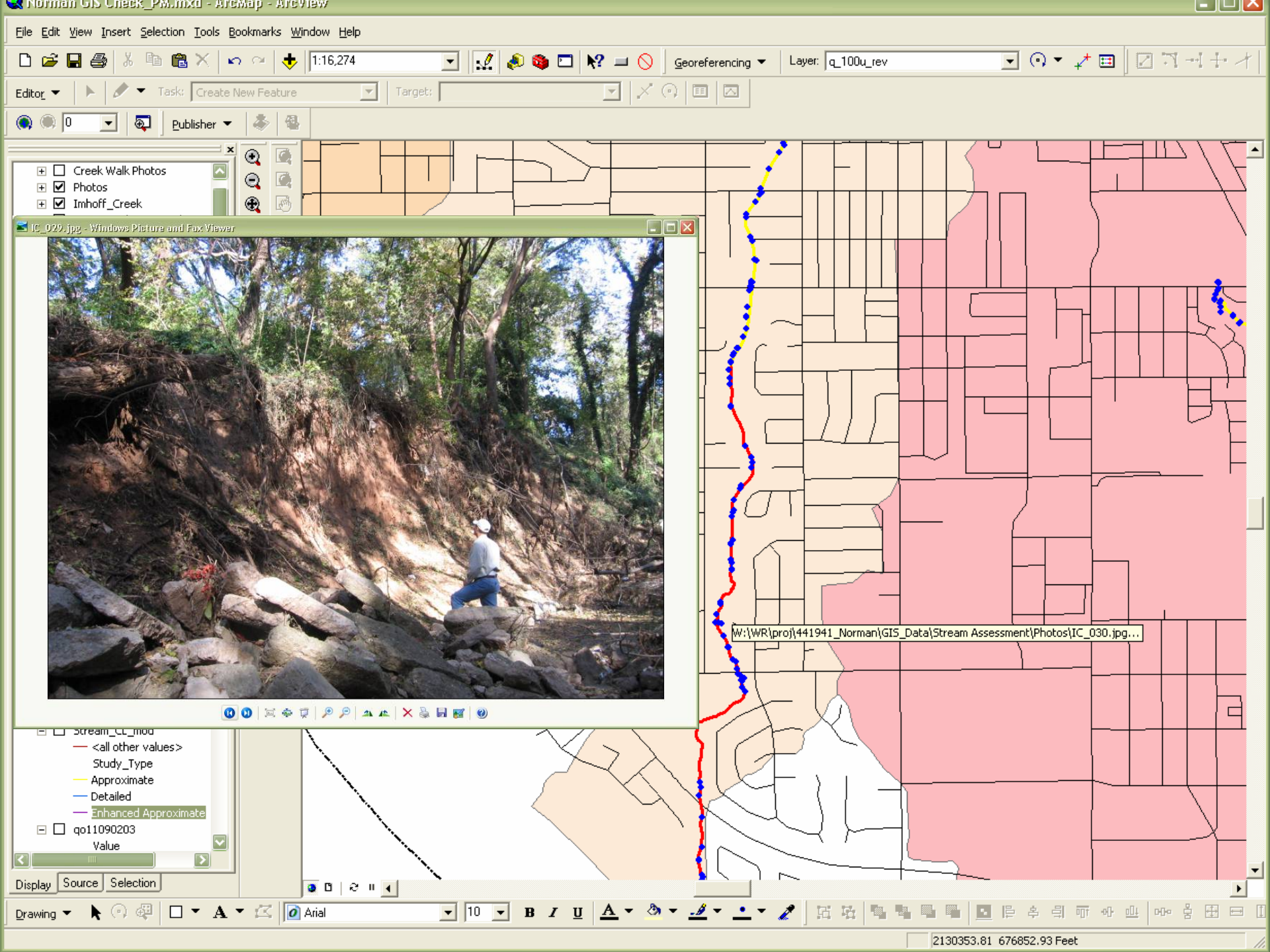


Stream Corridor Assessments

- Creek walks for Level 1 & 2 streams
- Unified Stream Assessment – Reach Level Assessment
- Evaluate bed and bank stability, riparian habitat, vegetation, adjacent landuse, and watershed/floodplain connectivity
- Creek walk photos viewed on desktop (geo-referencing)

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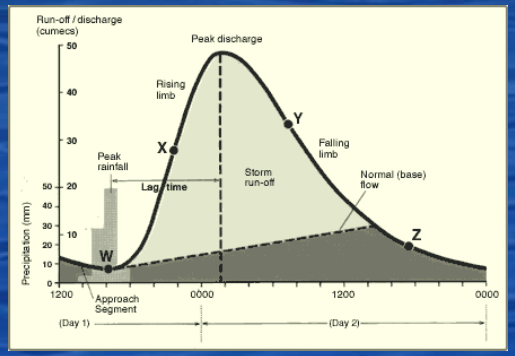
2130353.81 676852.93 Feet

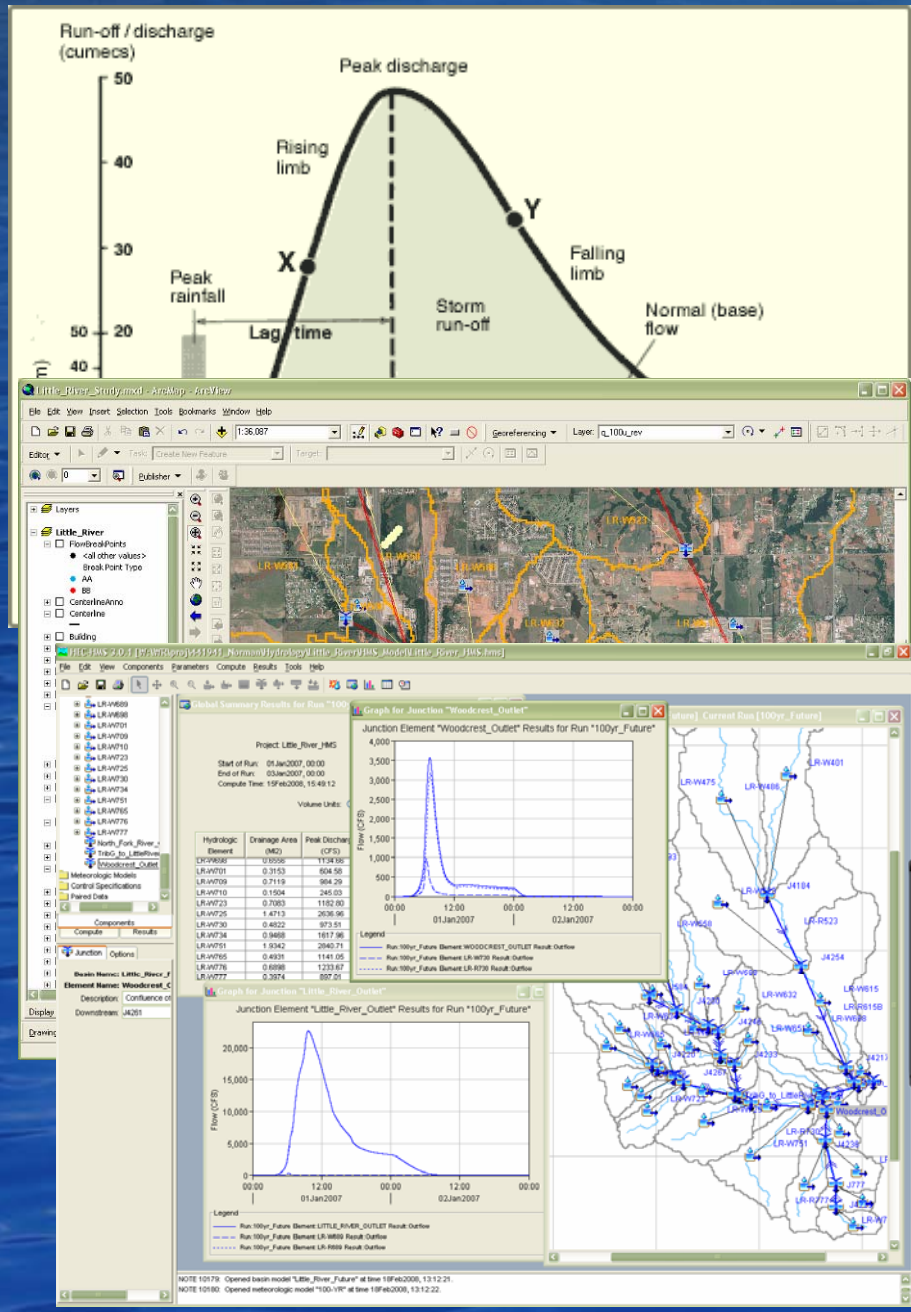
Rainfall / Runoff Analyses

- Hydrology = how much
- Hydraulics = how high, fast, wide
- Level 1 & 2 streams – Detailed H&H
- Level 3 & 4 streams – Stream Planning Corridors
- Existing and future (Norman 2025) development
- *Goal: Identify storm water problem areas for solutions development*



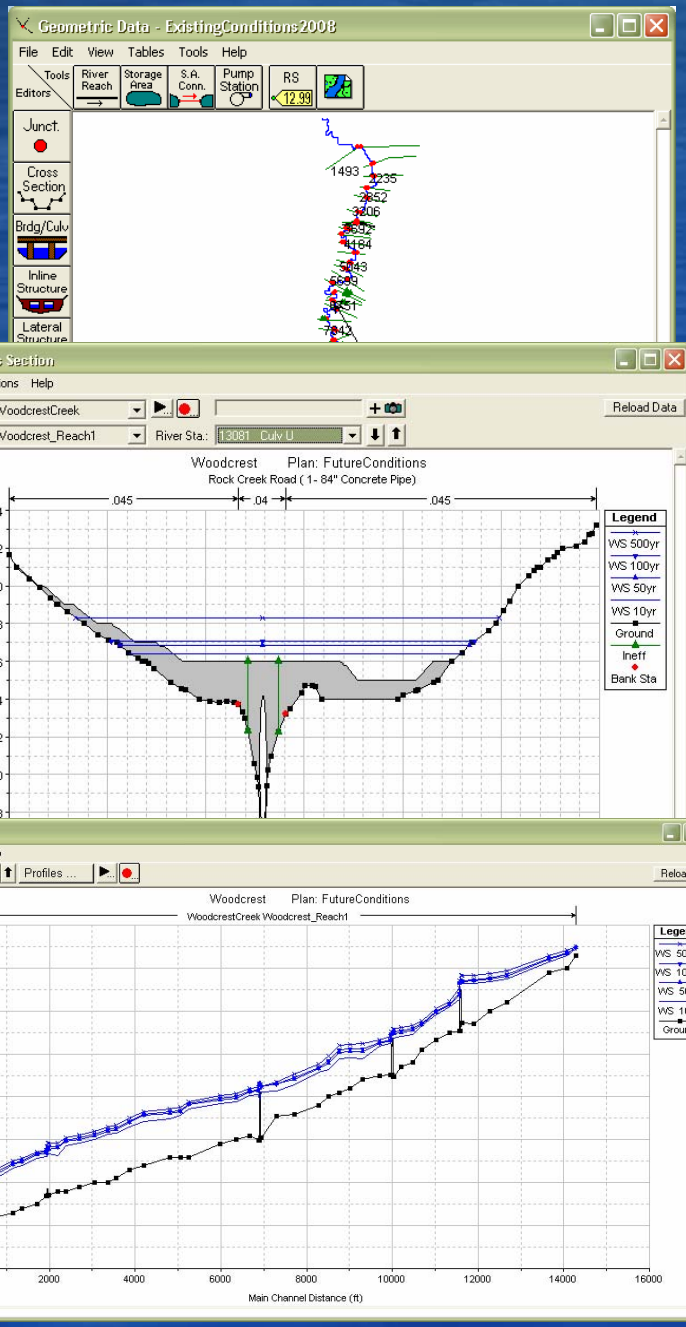
Hydrologic Analyses

- Determine peak flows at key locations
- Existing and future (Norman 2025 + platting) development conditions



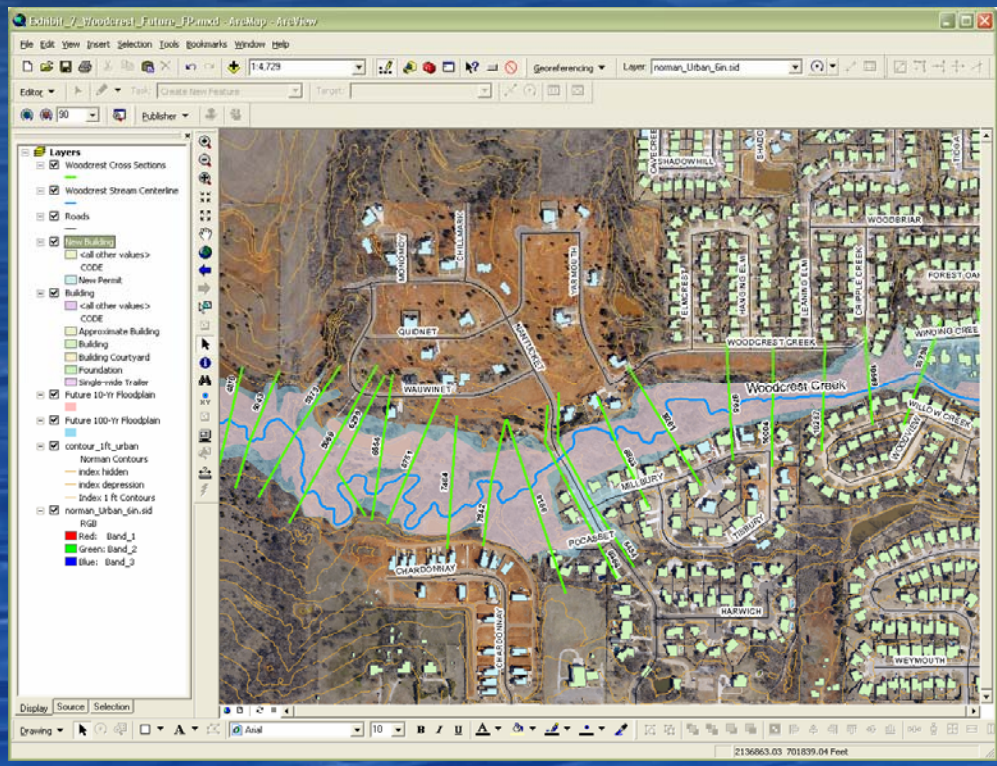
Hydraulic Analyses

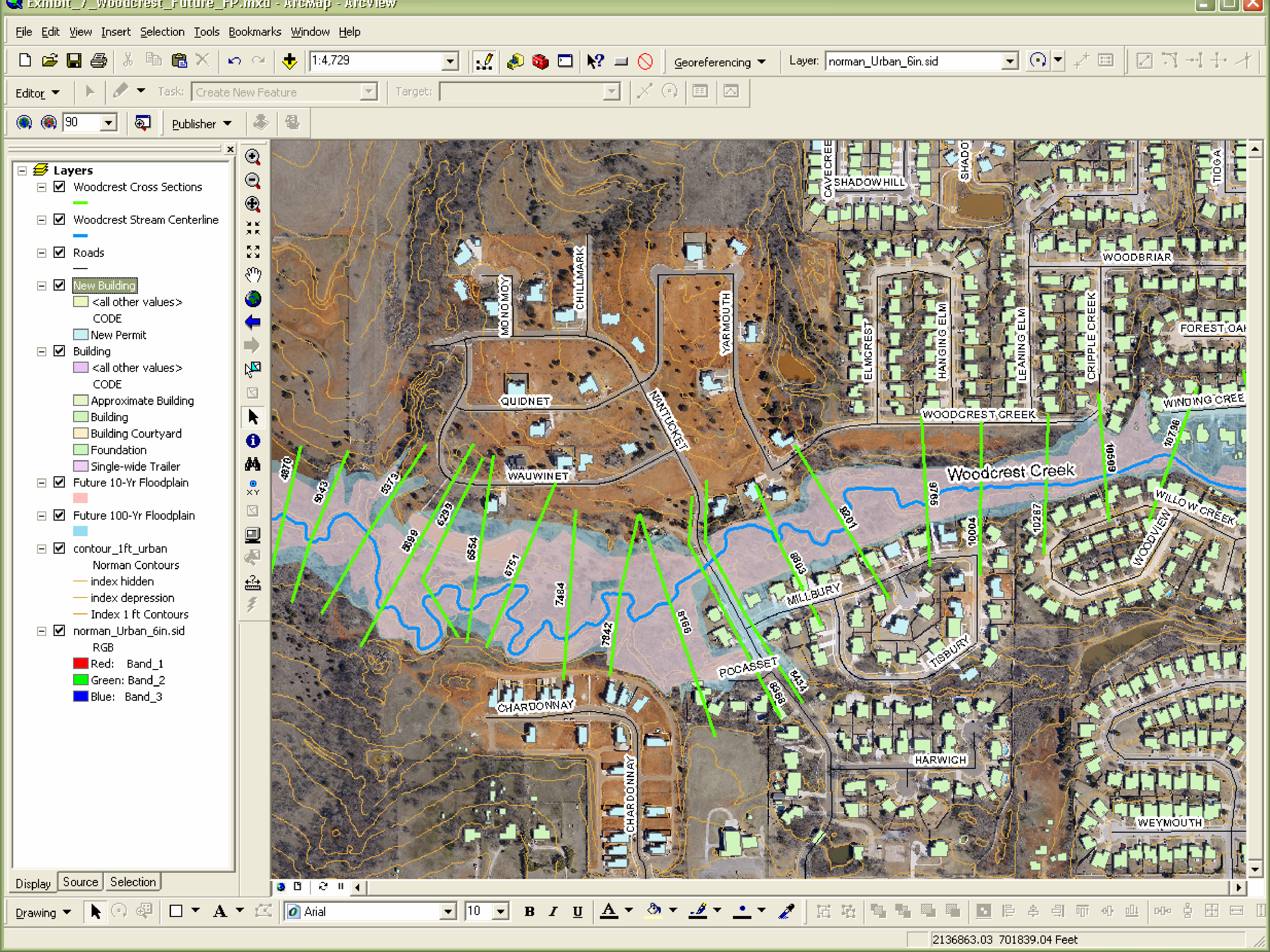
- HEC-RAS and Geo-RAS programs
- Hydraulic Data
  - » Channel Geometry – 1 ft. (urban) and 2 ft. (rural) LiDAR topography
  - » Roughness Coefficients – Field visits and high resolution aerials
  - » Structure Survey – Road culvert and bridge structures
  - » Peak Flows – 10-, 50-, 100-, and 500-year flows from detailed hydrologic models



Hydraulic Analyses

- 47 stream miles of detailed hydraulics
- Channel cross section layout in ArcGIS
- ArcMap plot of floodplain boundaries
- ***Goal:***
  - » ***Determining storm water problems***
  - » ***Developing alternative integrated storm water solutions***

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Publisher
Layers
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Woodcrest Stream Centerline
Roads
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CODE
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Building
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CODE
Approximate Building
Building
Building Courtyard
Foundation
Single-wide Trailer
Future 10-Yr Floodplain
Future 100-Yr Floodplain
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Norman Contours
index hidden
index depression
Index 1 ft Contours
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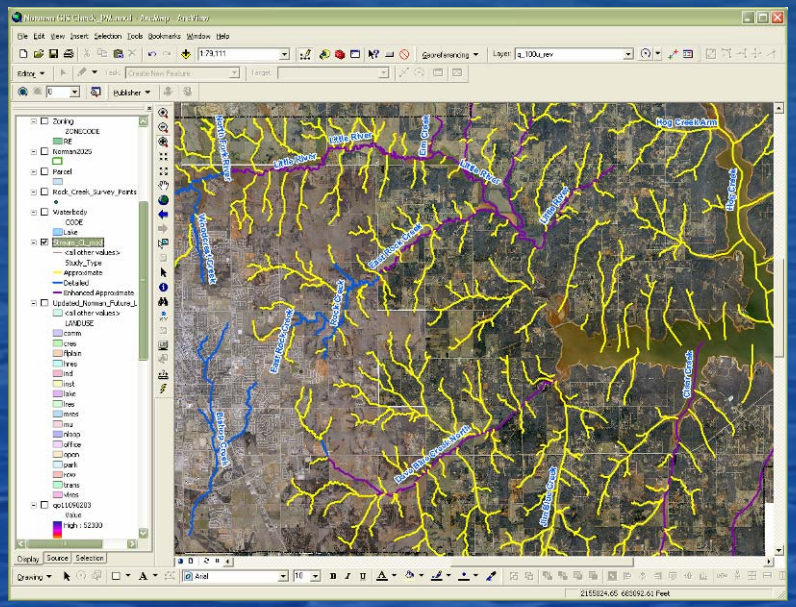
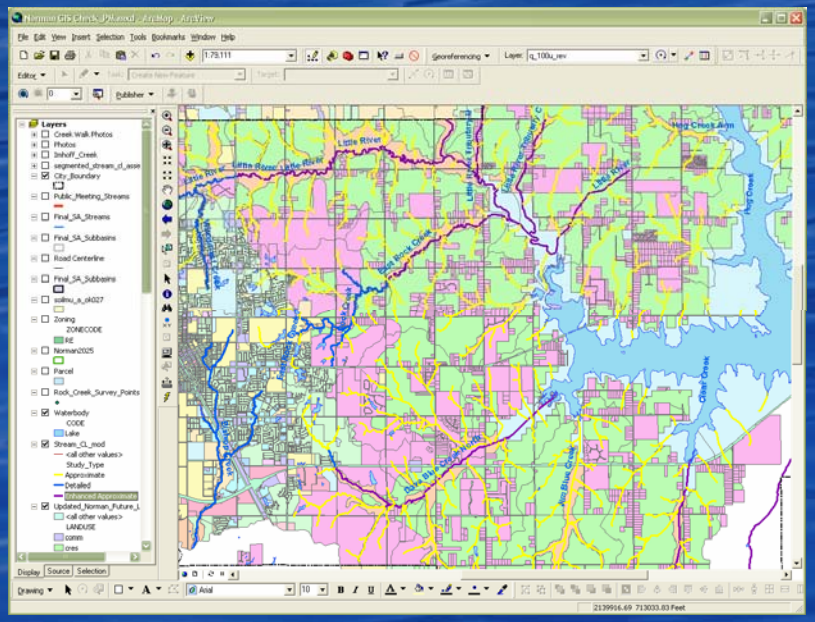
Green: Band_2
Blue: Band_3
Display
Source
Selection
CAVECREE
SHADOWHILL
SHADO
TIOGA
WOODBRIAR
FOREST OAK
CHILLMARK
MONOMOY
YARMOUTH
ELMCREST
HANGING ELM
LEANING ELM
CRIPPLE CREEK
QUIDNET
NANTUCKET
WOODCREST CREEK
WINDING CREE
WAUWINET
Woodcrest Creek
WILLOW CREEK
WOODVIEW
MILLBURY
TISBURY
POCASSET
CHARDONNAY
HARWICH
WEYMOUTH
4870
9043
5373
6299
5899
6554
6751
7484
7842
8616
8201
8803
8434
8968
9765
10004
10287
10509
10796
Drawing
Arial
10
2136863.03 701839.04 Feet

Stream Planning Corridors

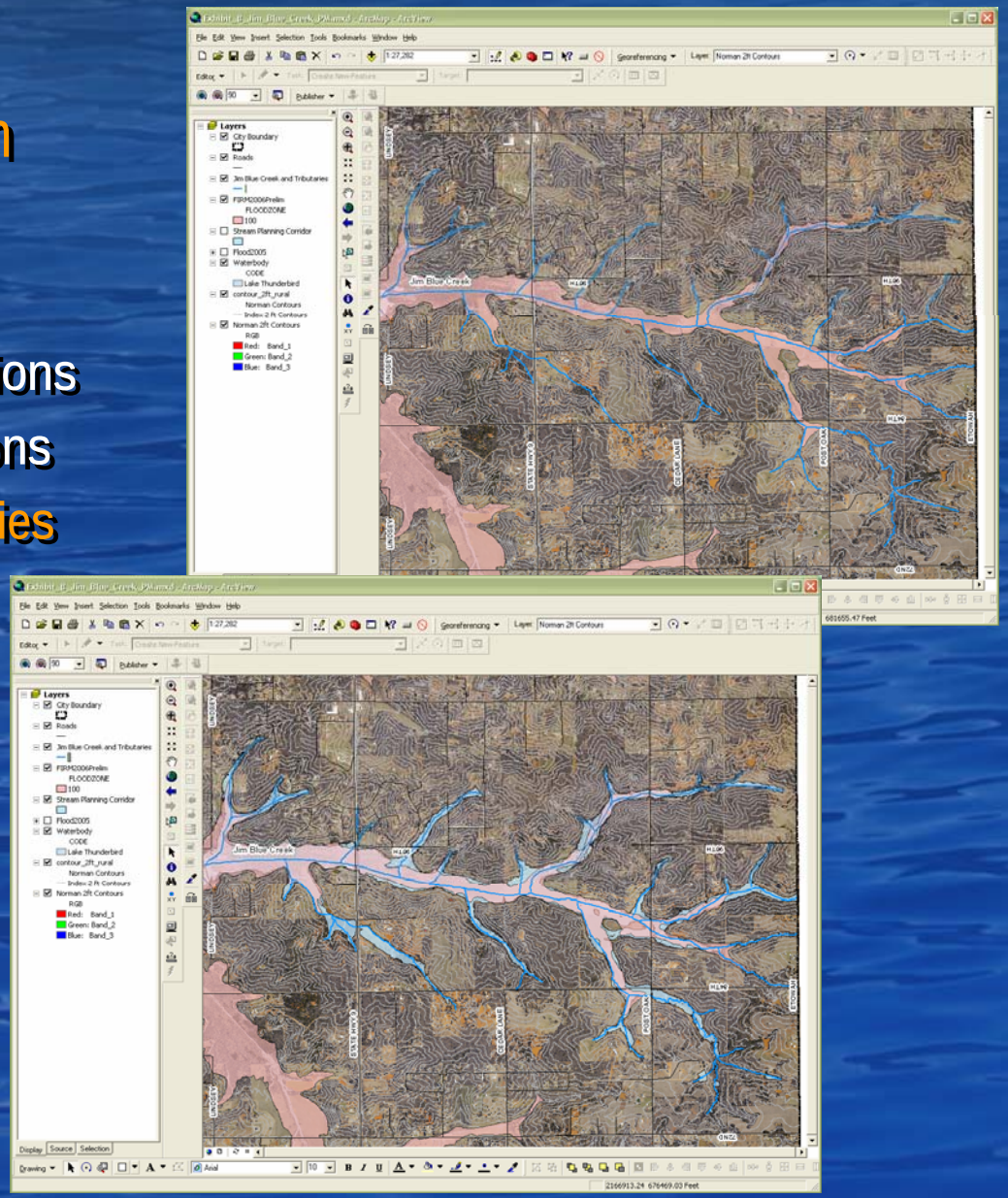
- Level 3 & 4 streams - 277 miles of Stream Planning Corridors
- Corridor defined by the 100-year future condition floodplain plus a buffer strip
- Streams draining greater than 40 acres
- Future development planning
- Provides for:
  - » Storm water conveyance
  - » Water quality benefits
  - » Riparian habitat
  - » Greenbelt/trails opportunities

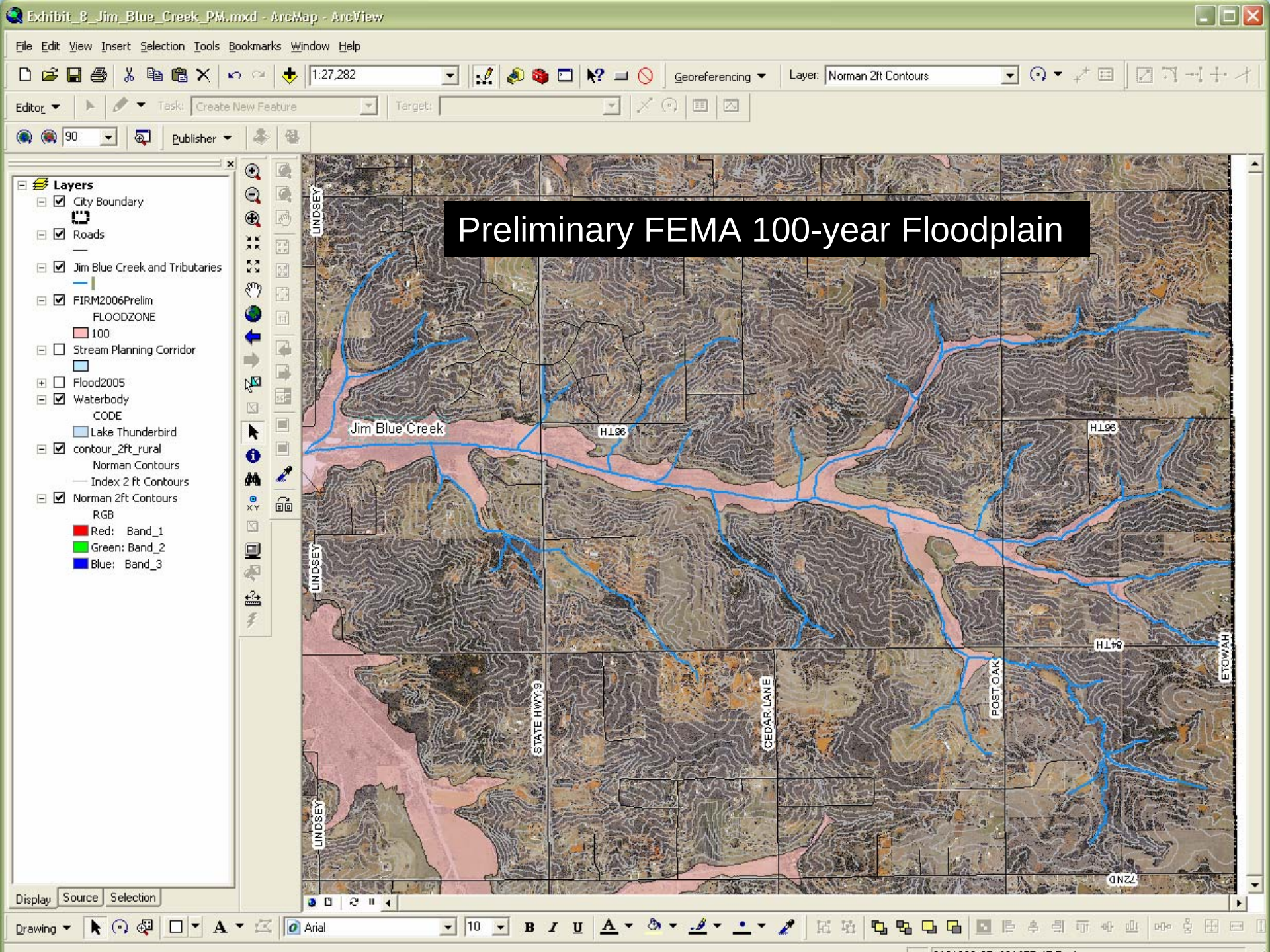




Stream Planning Corridor

- Rapid Floodplain Delineation (RFD)
  - » Calculates peak discharges
  - » Generates channel cross sections
  - » Performs backwater calculations
  - » Delineates floodplain boundaries
- Floodplain buffer strip

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City Boundary
Roads
Jim Blue Creek and Tributaries
FIRM2006Prelim
FLOODZONE
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Stream Planning Corridor
Flood2005
Waterbody
CODE
Lake Thunderbird
contour_2ft_rural
Norman Contours
Index 2 ft Contours
Norman 2ft Contours
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Display
Source
Selection
Preliminary FEMA 100-year Floodplain
Jim Blue Creek
LINDSEY
98TH
84TH
STATE HWY 9
CEDAR LANE
POST OAK
ETOWAH
72ND
Drawing
Arial
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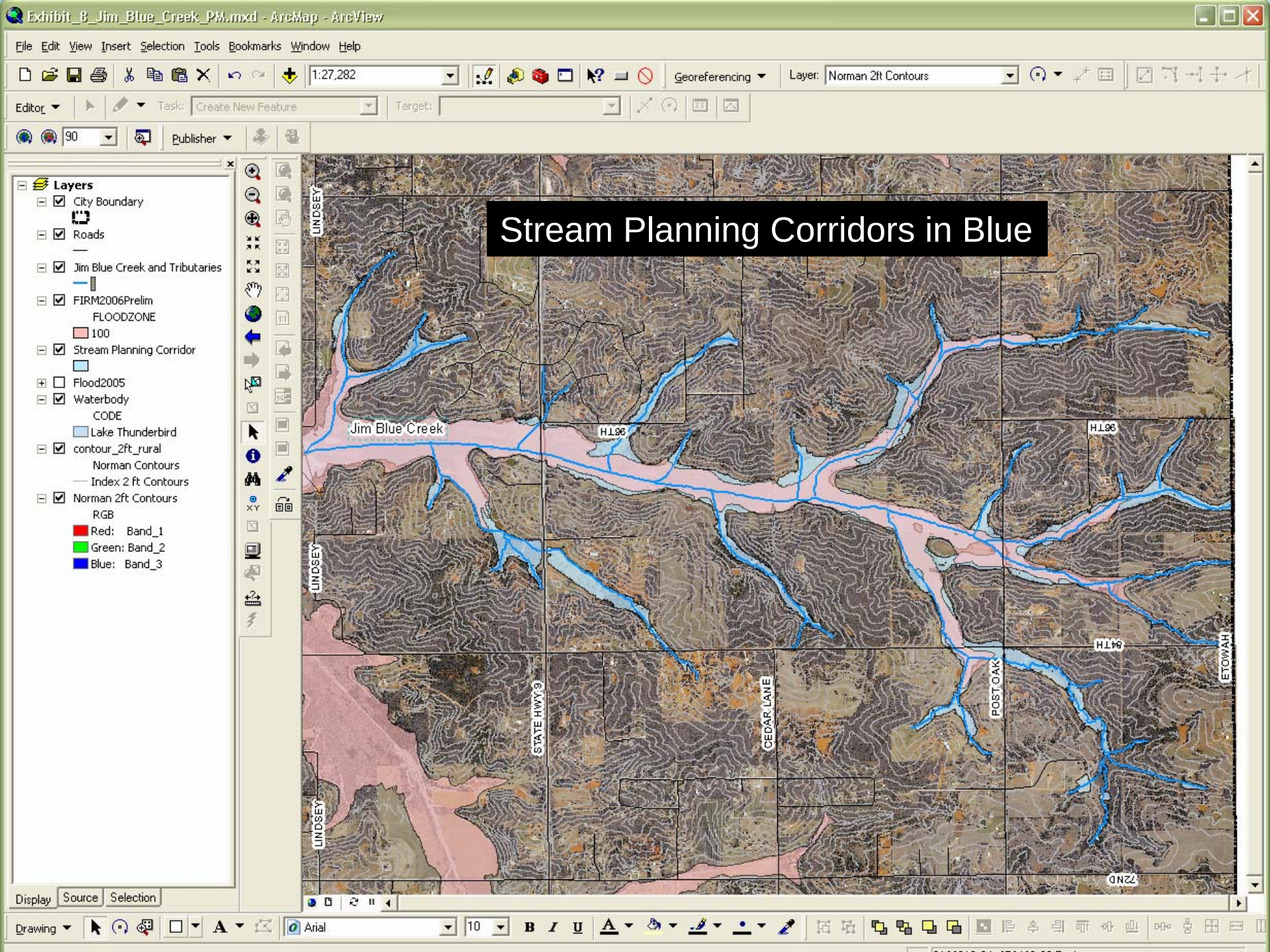
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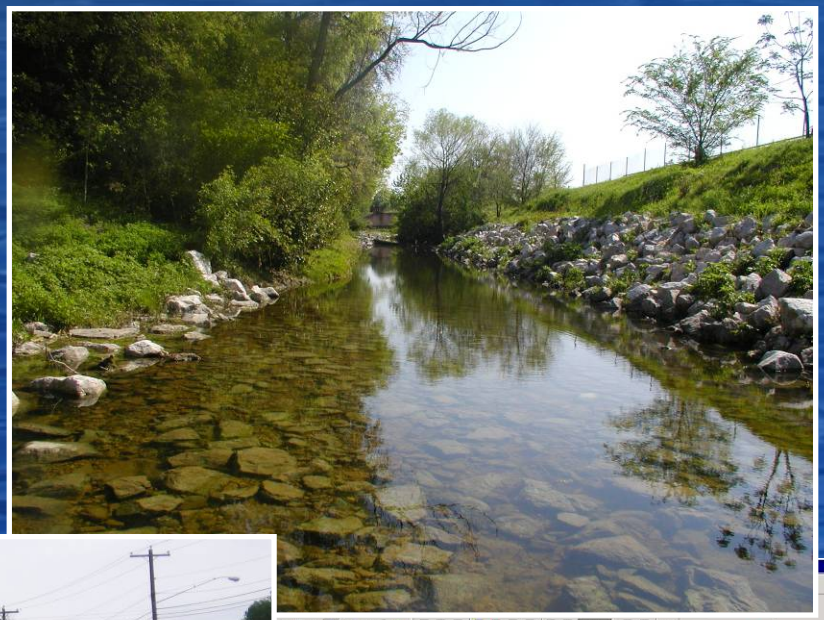
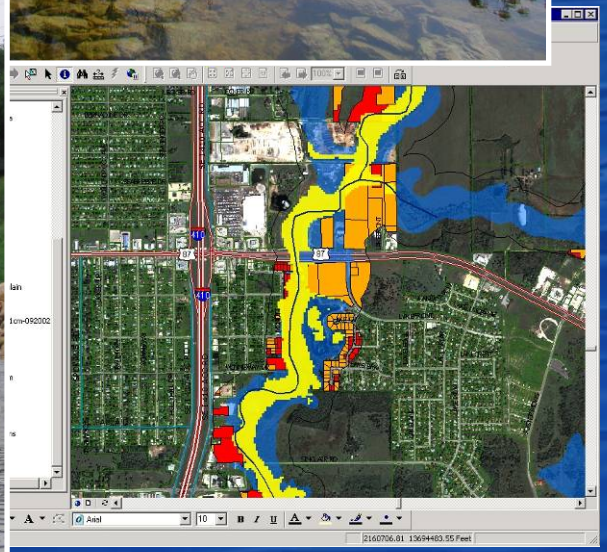
Georeferencing
Layer: Norman 2ft Contours
Editor
Task: Create New Feature
Target:
Publisher
Layers
City Boundary
Roads
Jim Blue Creek and Tributaries
FIRM2006Prelim
FLOODZONE
100
Stream Planning Corridor
Flood2005
Waterbody
CODE
Lake Thunderbird
contour_2ft_rural
Norman Contours
Index 2 ft Contours
Norman 2ft Contours
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
Display
Source
Selection
Stream Planning Corridors in Blue
Jim Blue Creek
LINDSEY
98TH
84TH
STATE HWY 9
CEDAR LANE
POST OAK
ETOWAH
72ND
Drawing
Arial
10

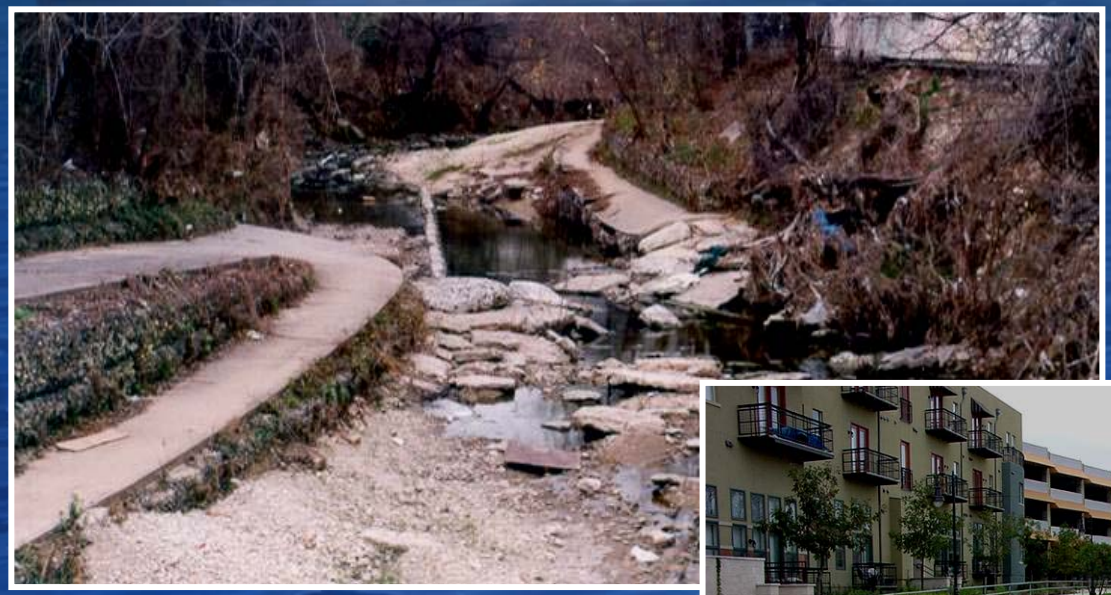
Identify Watershed Problems and Opportunities

- Flooding
- Erosion / stream stability
- Storm water quality
- Water supply protection
- Recreation

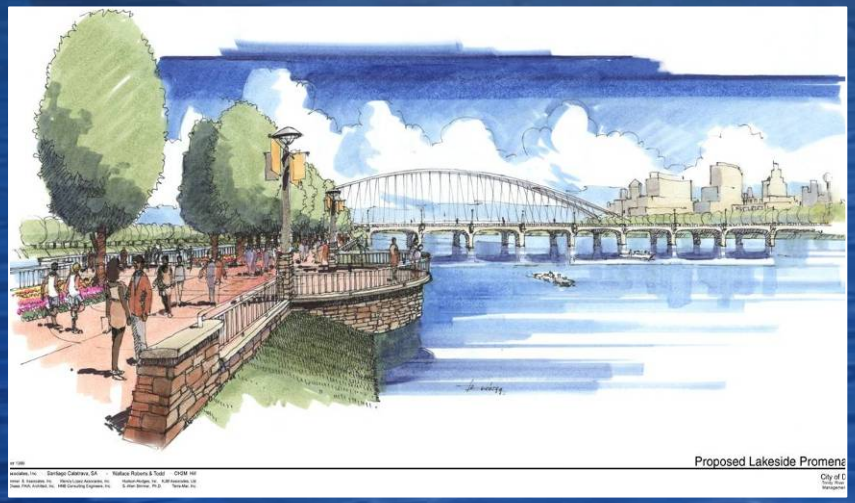


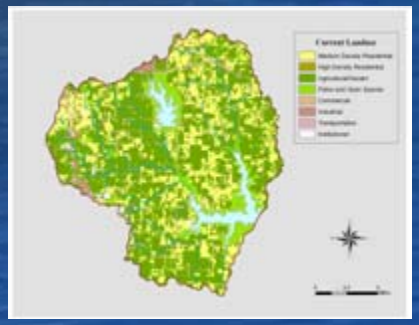


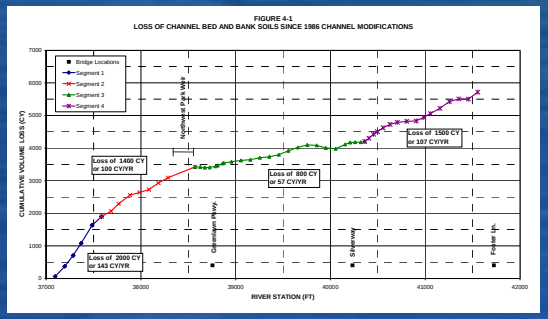
Integrated Solutions

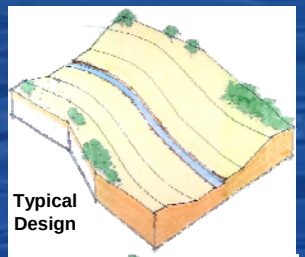


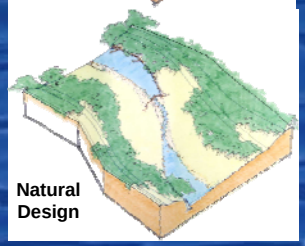
Integrated Solutions

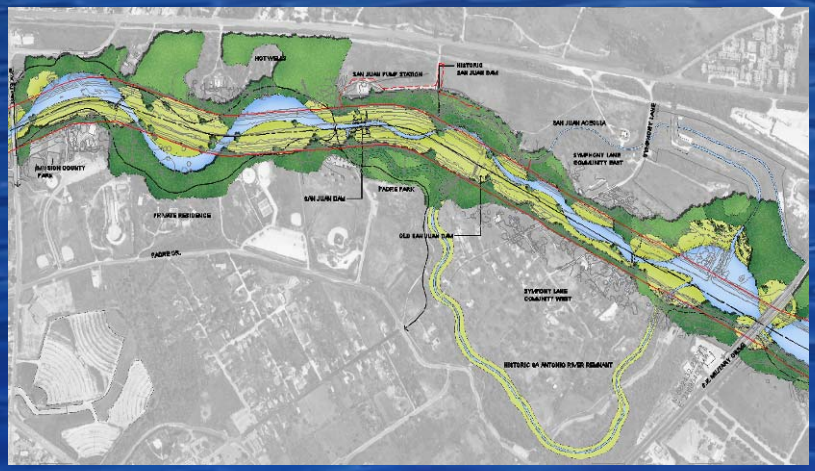


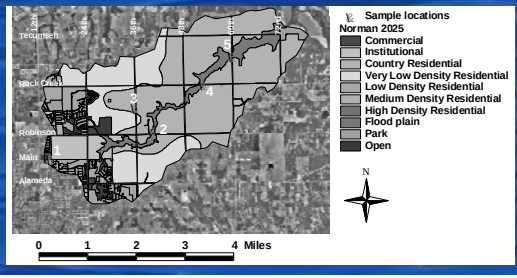












Storm Water Master Plan

QUESTIONS AND COMMENTS

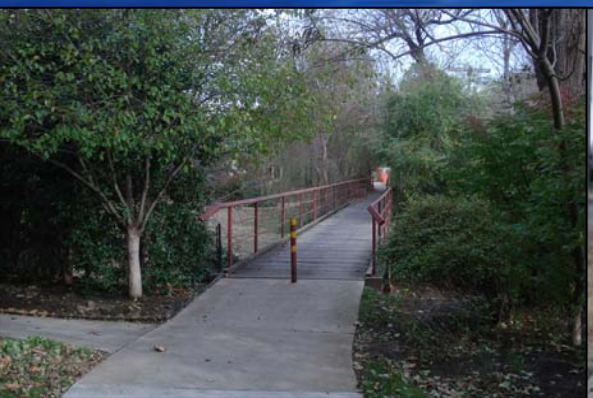
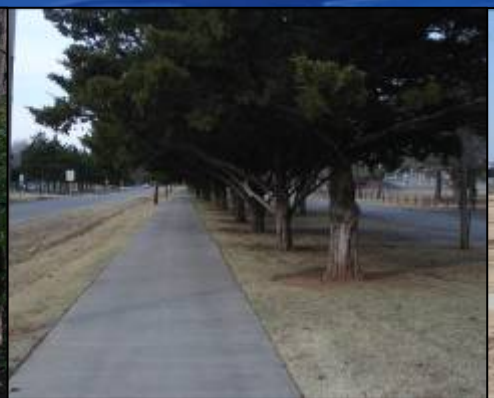
Lake Thunderbird Sunset

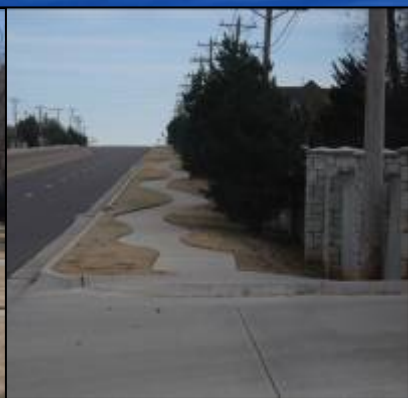
A Greenbelt Master Plan for Norman

Jim Carrillo, ASLA, AICP
Halff Inc.

What do Greenbelts offer residents of Norman?

- Offer something for all age users
- Provide alternative ways to get to key city destinations
- Support economic development by revitalizing areas and enhancing neighborhoods
- Provide capacity for storm water conveyance
- Promote a healthy lifestyle by providing opportunities to engage in exercise
- Help create a more attractive and unique city



Purpose of Norman's Greenbelt Master Plan

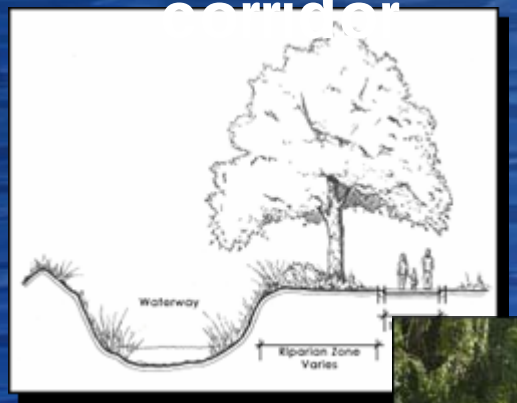
- Works in concert with storm water and floodplain management
- Provides guidance for the preferred locations of trail corridors, and which corridors to preserve
- Provides a framework for the City of Norman to assist private development in creating meaningful and connected trail corridors
- Helps the city make informed decisions as to how to fund trail development

Key Guiding Principles for the Greenways Master Plan

- Creates an **interconnected** system
- **Connects to multiple destinations** - schools, parks, employment, and other destinations
- Provides **easy access**
- Creates **identity** for Norman
- Enhances **learning**
- Promotes **safety**
- Adds to the **beauty of the City**
- **Fosters partnerships**

Creek/Drainage Corridor Trails

- Located along creek and drainage corridors
- Could be used for recreation or transportation uses
- Trail width can vary due to the conditions of the trail corridor

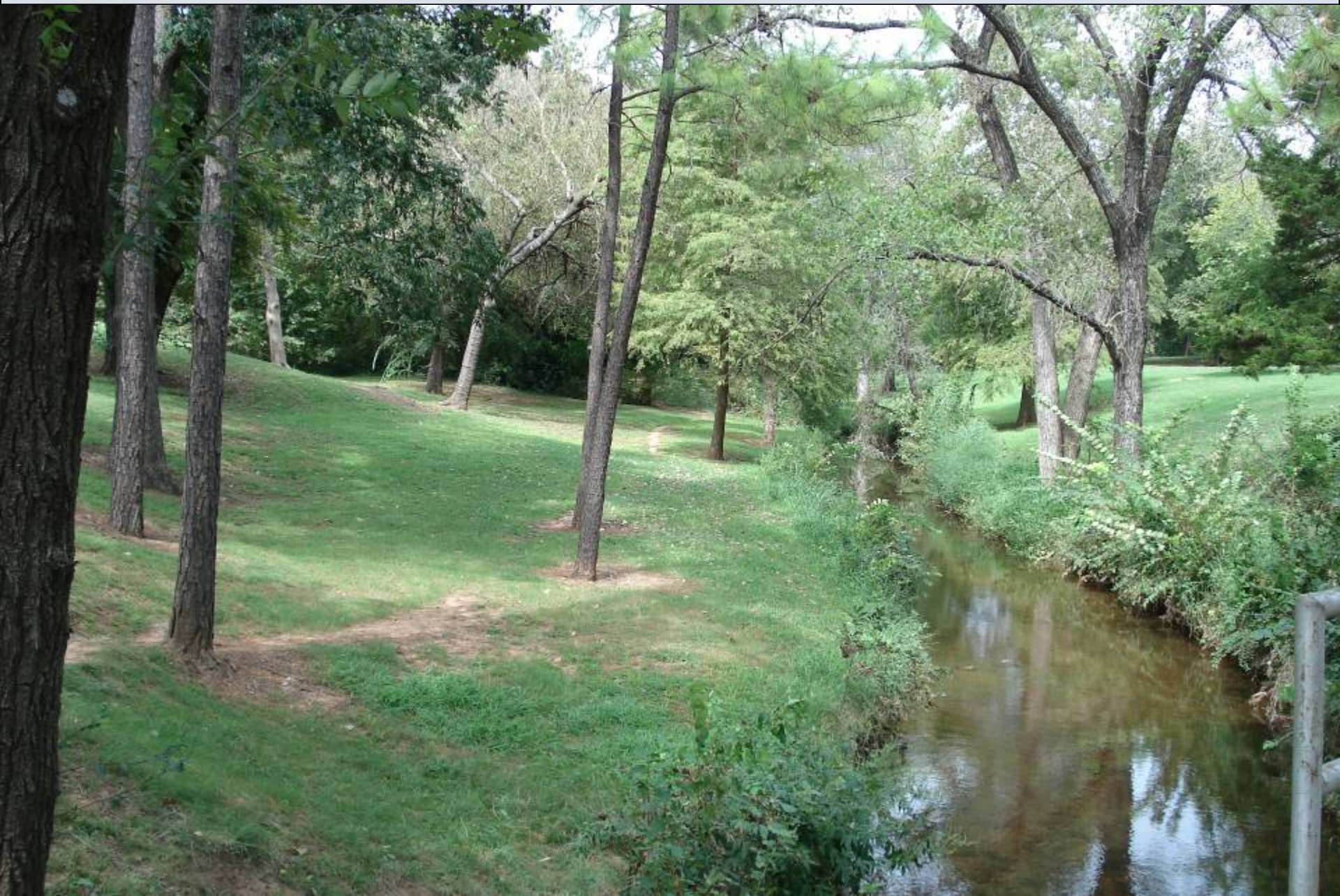


Bishop Creek – Existing Creek Trail

Imhoff Creek at Brooks Street

Merkle Creek

Bishop Creek



Parkway Trails

- Are usually adjacent to major arterial or collector roads
- Are typically wider than sidewalks, 8’ – 12’ path recommended
- Include amenities such as street trees, decorative lighting and crosswalk enhancements
- Help create attractive “boulevards” throughout Norman

OU Parkway Trail

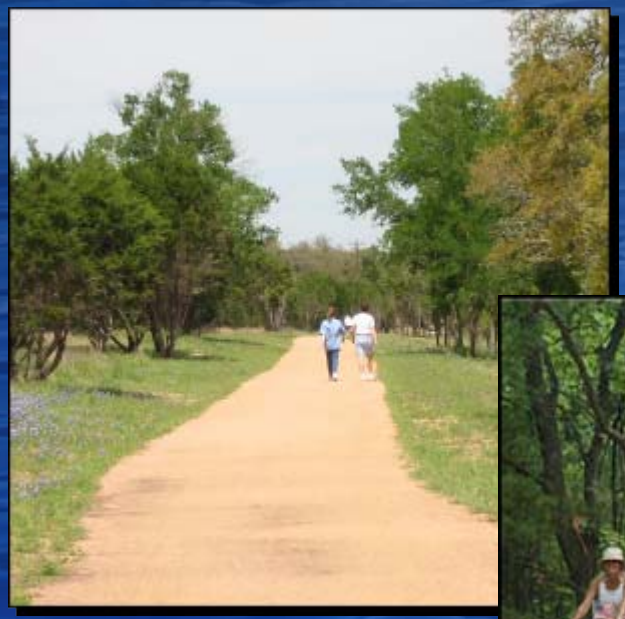
24th Street – Legacy Trail

Berry Street

36th Street (South of Main)

Scenic / Nature Trails

- Located in lower populated naturalized areas
- Mainly used for recreational purposes
- Rural trails are typically 8’-12’ in width



Utility Corridor Trails

- Follow power line and utility corridors.
- Roadway crossings create opportunities to highlight the corridor

Castle Rock Utility Trail

Potential Extension of Castle Rock Utility Trail

Bicycle Facilities

- Minimum 4 feet in width from the street edge of the gutter pan.
- A 5 foot wide on-street bike lane usually preferred for the more inexperienced rider.
- Off-street trails intended to accommodate bicycles are referred to as shared use paths.

Off-Street Facility

Legacy Trail

On-Street Facility

Shared Lane Marking

Rock Creek

Brooks Street

Trail Access Points and Trailheads

Typical Trailhead

Includes:

- Parking for 10+/- cars
- Small Shade Pavilion
- Drinking Fountains
- Optional Safety Call Box
- Kiosk with Trail Map and Information
- Bicycle Parking Area
- Optional Fitness Stations
- Landscaping and Amenities
- Trail Identification Signage
- Optional Restrooms

Trail Features

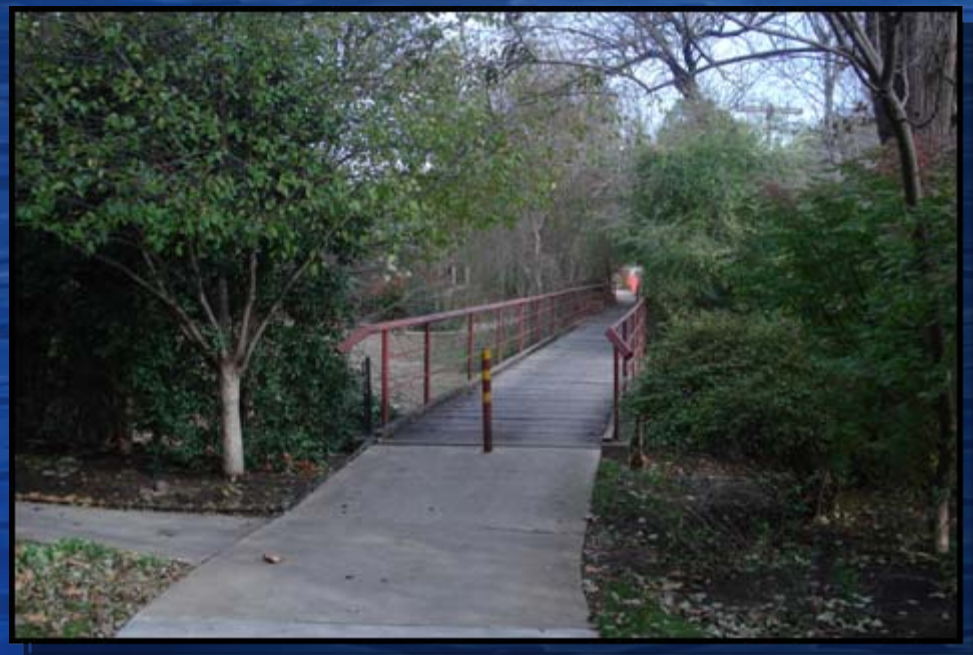
Typical Trail Features

Includes:

- Benches
- Bicycle Parking
- Drinking Fountains
- Maps and Signage
- Interpretive Installations
- Lighting
- Art Installations
- Milepost Markers
- Trash Receptacles

Bridges and Underpasses

Bridges – should be one of a kind and create a significant statement about Norman**.**



Underpasses – typically will go under an existing bridge to create a safe crossing. Connections to street level are required to allow access to and from the trail corridor.

Integration with the Storm Water Master Plan

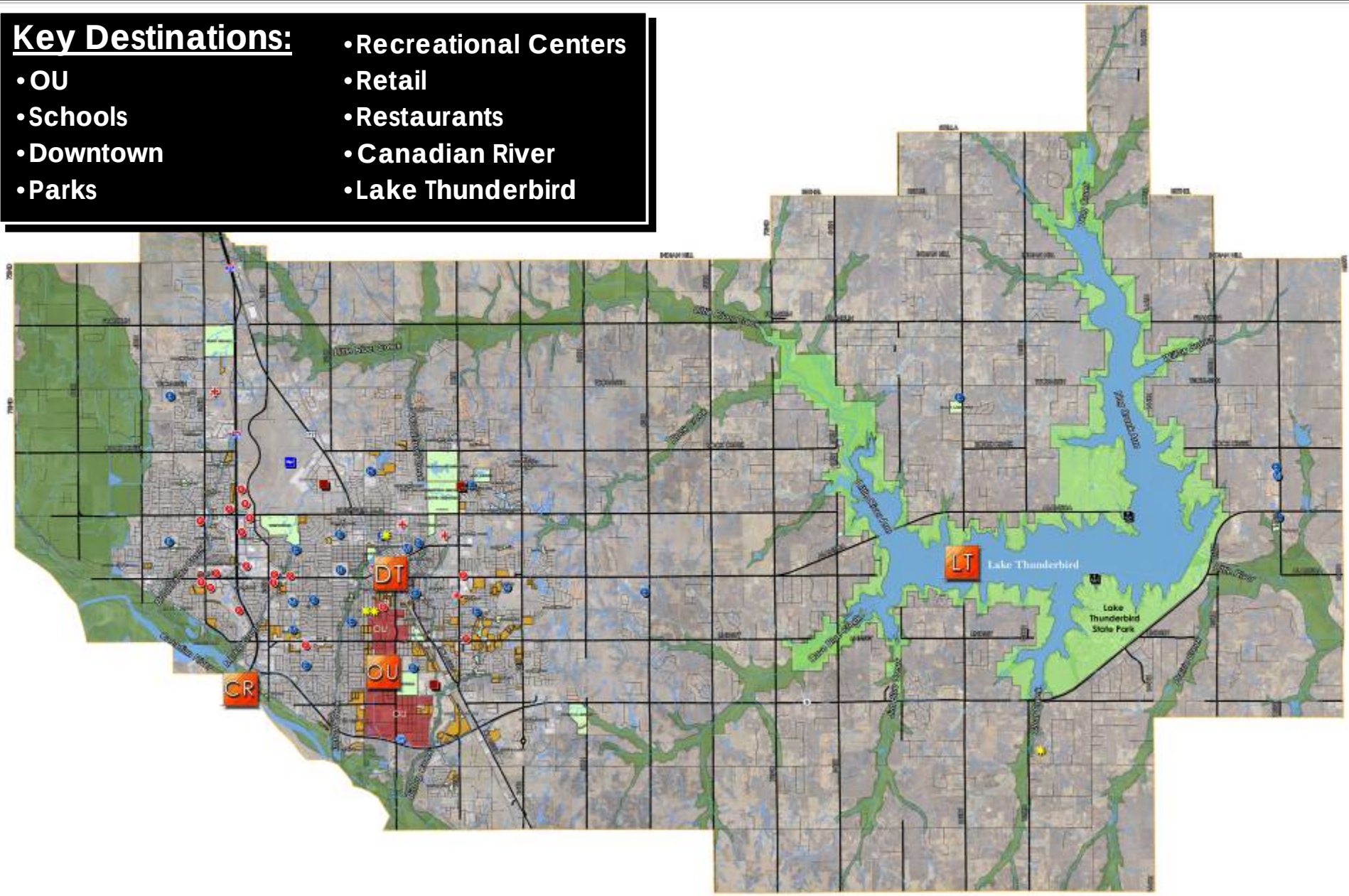
Missed Opportunities for Trails and Green Space Corridors

Integrate Trails and Green Space into Drainage Corridors

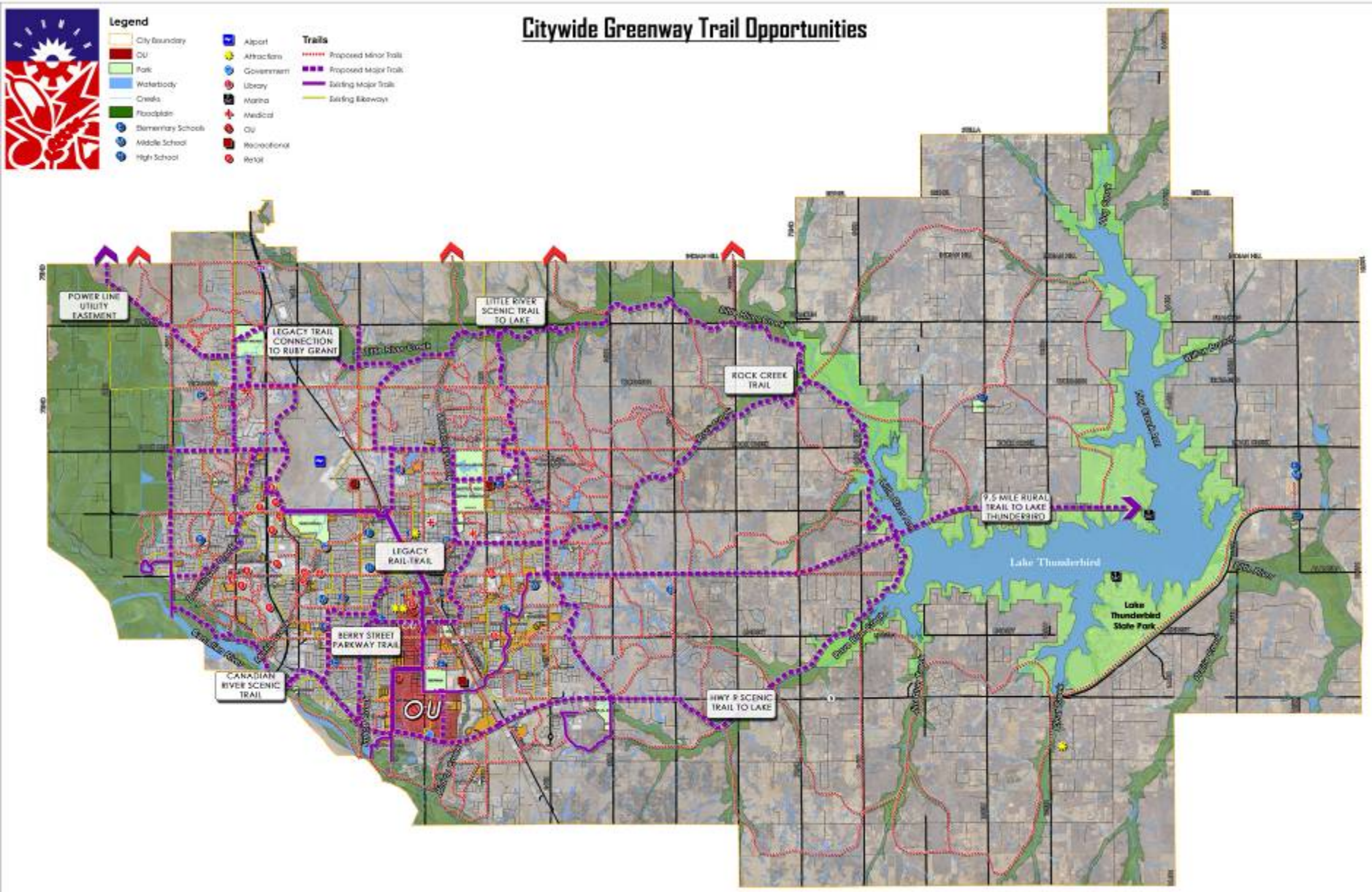
Greenbelt Destinations

Key Destinations:

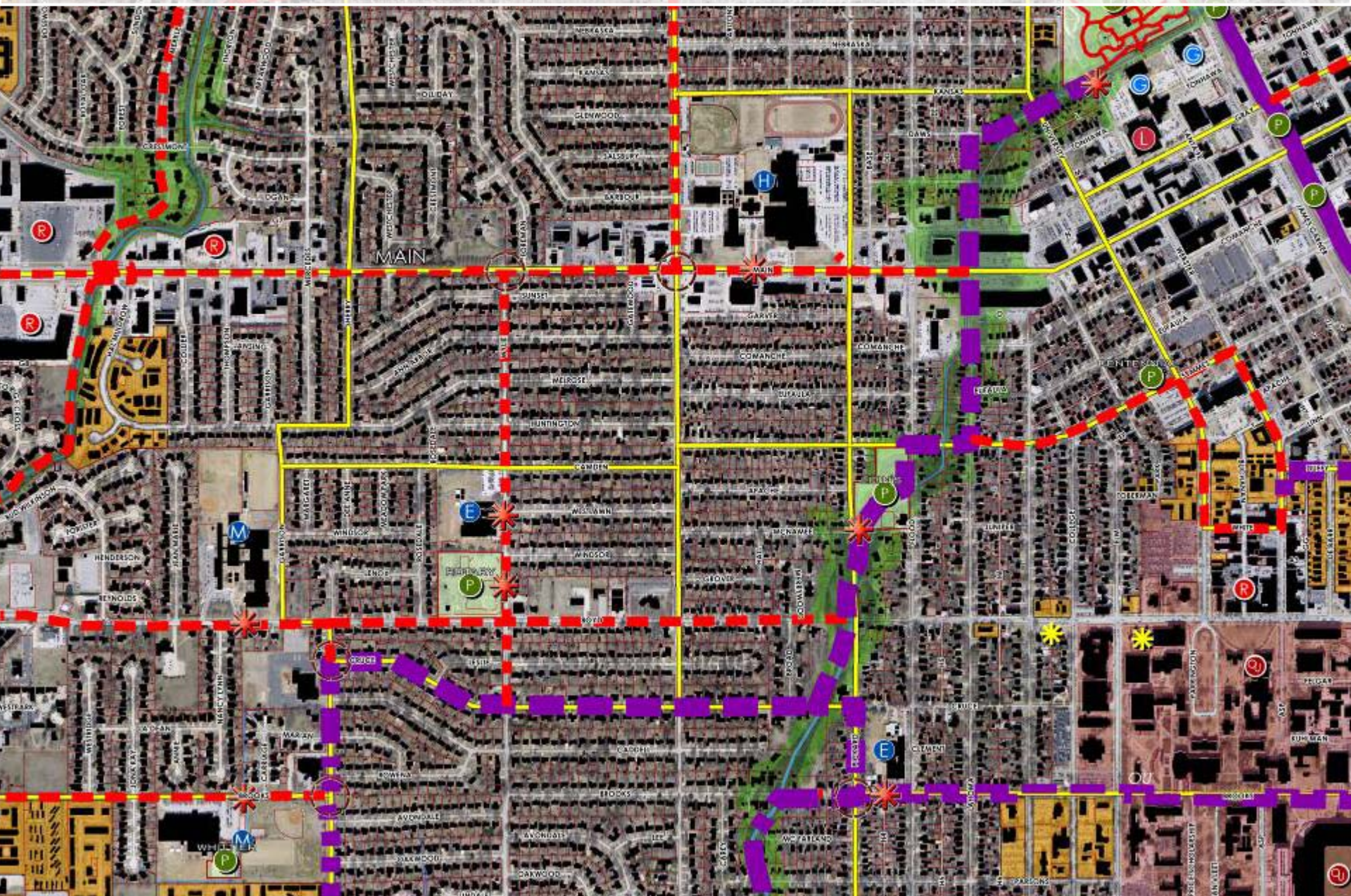
- OU
- Schools
- Downtown
- Parks
- Recreational Centers
- Retail
- Restaurants
- Canadian River
- Lake Thunderbird



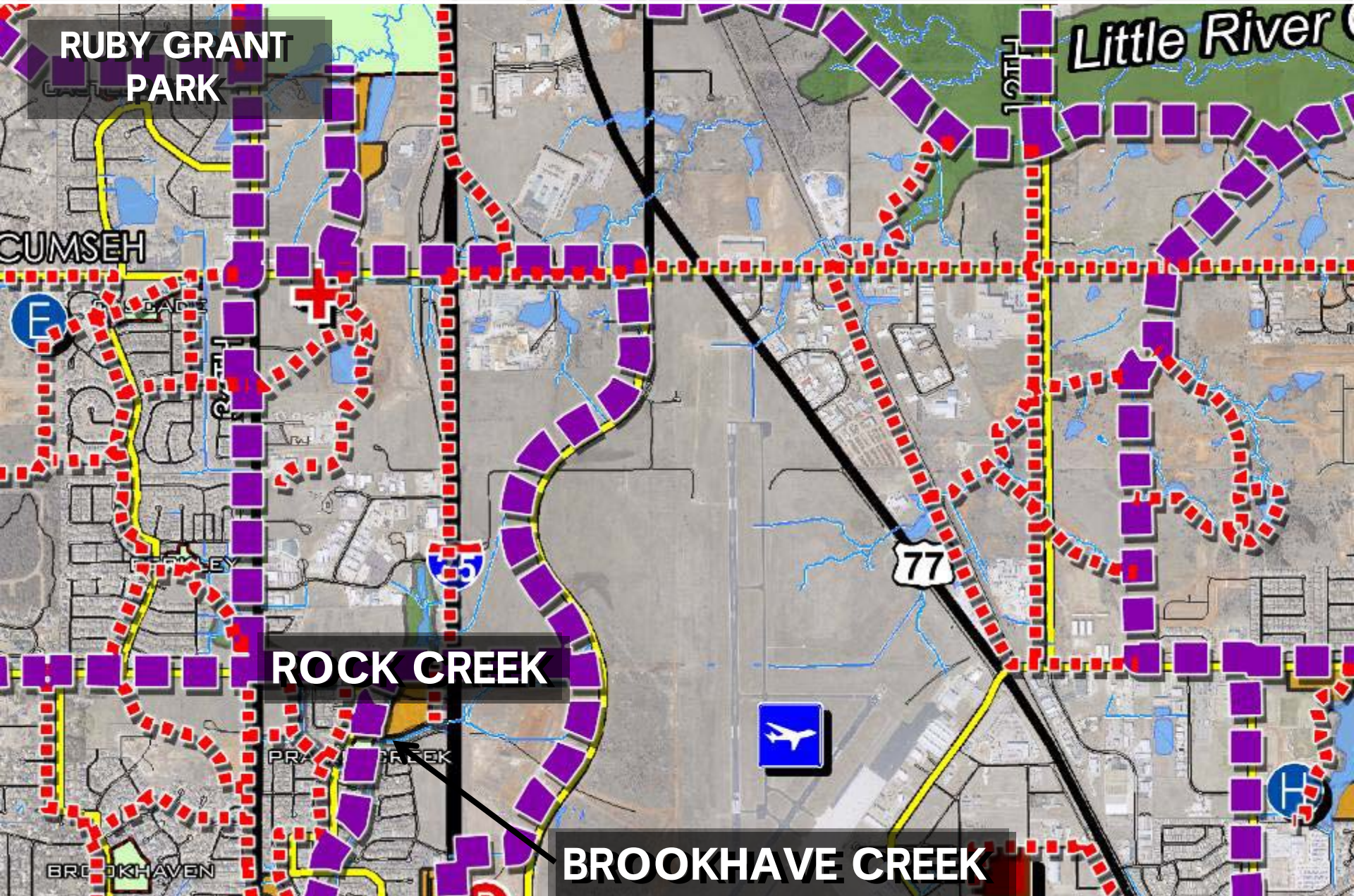
Preliminary Master Plan



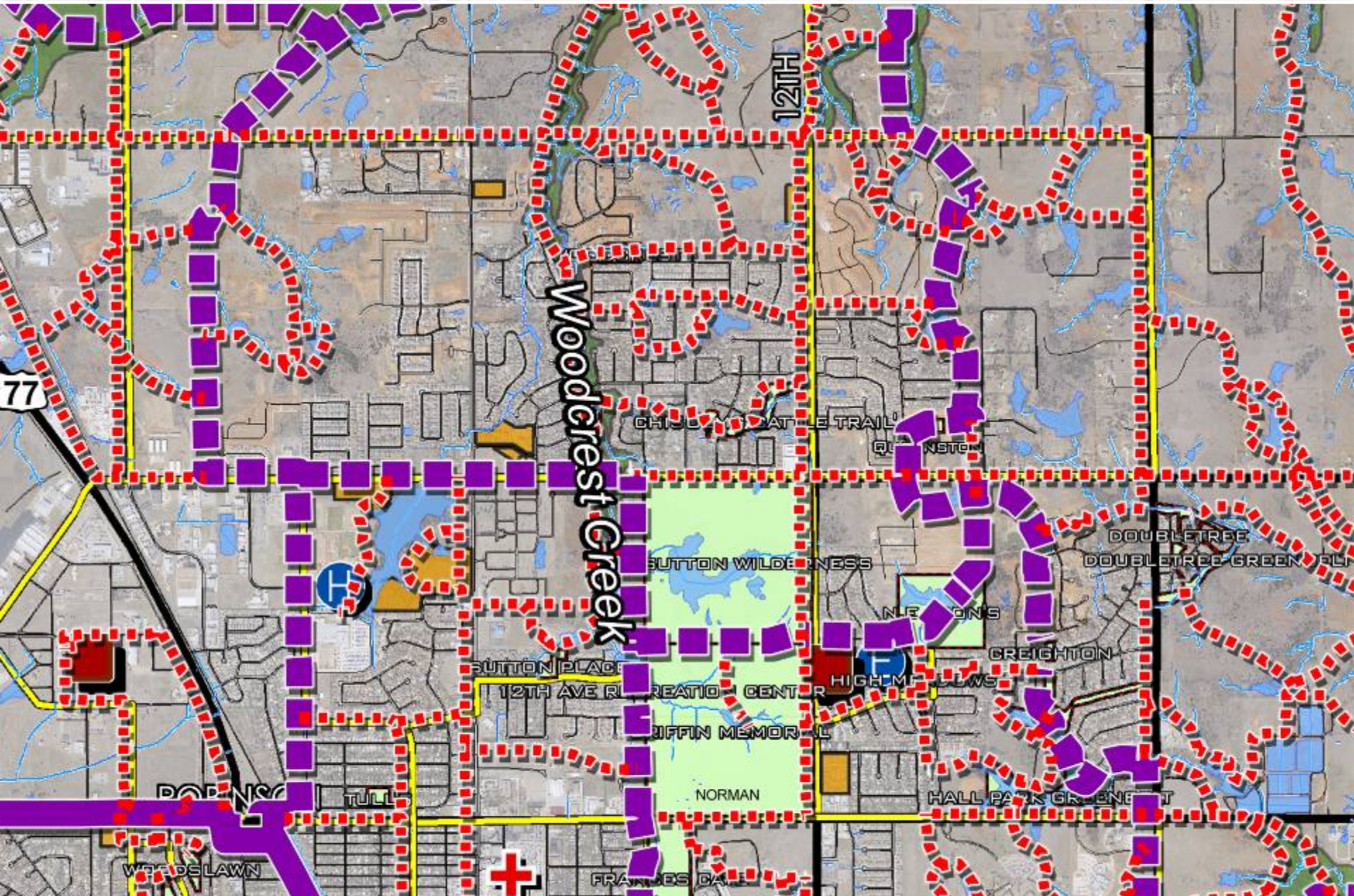
Imhoff Creek



Brookhaven Creek-Ruby Grant Park Connection



Woodcrest Creek



Greenbelt Master Plan

QUESTIONS AND COMMENTS

Master Plan Status

- Elements substantially completed
  - Data/Information Review
  - MS4 storm water permitting compliance update (“Phase II”)
  - Watershed/stream corridor assessments
  - Defining existing and future floodplain conditions
- Elements progressing
  - Meetings/Coordination
  - Defining problems
  - Greenbelt / Trails Master Plan
  - Regulatory update needs
  - Funding options
- Elements getting underway
  - Integrated solutions development
  - Increased Public Outreach/Education
  - Reporting

Storm Water Master Plan

QUESTIONS AND COMMENTS

Lake Thunderbird Sunset

Storm Water Master Plan

QUESTIONS AND COMMENTS

Lake Thunderbird Sunset

Number of Parcels by Drainage Area

Count of Parcel_ID	
DRAINAGE_AREA	Total
Bishop Creek	7,936
Brookhaven Creek	4,624
Clear Creek	376
Direct Lake Thunderbird Runoff	813
Elm Creek	4
Hog Creek	267
Hog Creek Arm	323
Hog Creek Tributary D	133
Imhoff Creek	5,543
Jim Blue Creek	301
Lower Dave Blue Creek	597
Lower Little River	425
Lower Mid Little River	199
Lower Rock Creek	273
Merkle Creek	3,244
Outside of Drainage Area	2,678
Ten Mile Flat Creek	1,903
Trib 1 to Lake Thunderbird	218
Trib 2 to Lake Thunderbird	205
Trib to Dave Blue Creek	496
Tributary G to Little River	1,062
Upper Dave Blue Creek	1,159
Upper Little River	938
Upper Mid Little River	519
Upper Rock Creek	2,637
Willow Branch	123
Woodcrest Creek	2,855
Grand Total	**39,851**

Impervious Cover by Drainage Area

Sum of IMPERVIOUS_AREA_FT2	
DRAINAGE_AREA	Total
Bishop Creek	64,657,416
Brookhaven Creek	26,629,604
Clear Creek	4,030,748
Direct Lake Thunderbird Runoff	12,205,044
Elm Creek	113,838
Hog Creek	2,323,487
Hog Creek Arm	2,506,863
Hog Creek Tributary D	1,266,211
Imhoff Creek	25,479,752
Jim Blue Creek	3,295,600
Lower Dave Blue Creek	6,509,665
Lower Little River	4,254,089
Lower Mid Little River	2,479,713
Lower Rock Creek	3,304,736
Merkle Creek	34,324,538
Outside of Drainage Area	19,894,102
Ten Mile Flat Creek	12,611,081
Trib 1 to Lake Thunderbird	2,385,787
Trib 2 to Lake Thunderbird	1,945,272
Trib to Dave Blue Creek	4,659,359
Tributary G to Little River	8,457,530
Upper Dave Blue Creek	6,852,051
Upper Little River	14,410,665
Upper Mid Little River	3,414,720
Upper Rock Creek	11,046,911
Willow Branch	1,233,259
Woodcrest Creek	11,523,780
Grand Total	**291,815,821**

Impervious Cover by Zoning Codes

Sum of IMPERVIOUS_AREA_FT2	
ZONING	Total
0	1,219,501
A-1: General Agricultural	390,560
A-2: Rural Agricultural	72,296,670
C-1: Local Commercial	4,683,269
C-2: General Commercial	26,956,589
C-3: Intensive Commercial	2,594,847
C-O: Suburban Office Commercial	19,243
CR: Rural Commerical	89,274
I-1: Light Industrial	13,617,821
I-2: Heavy Industrial	6,062,508
M-1: Restricted Industrial	209,365
No Data Available	1,275,550
O-1: Office-Institutional	348,318
PL: Park Land	459,538
PUD: Planned Unit Development	9,659,575
R-1: Single Family Dwelling	83,479,541
R-1A: Single Family Attached Dwelling	685,438
R-2: Two-Family Dwelling	3,365,722
R-3: Multi-Family Dwelling	7,913,790
RE: Residential Estates	18,095,191
RM-2: Low Density Apartment	4,348,293
RM-4: Mobile Home Park	1,661,478
RM-6: Medium Density Apartment	16,609,576
RO: Residence-Office	410,955
TC: Tourist Commercial	297,302
UNC: Unclassified	15,065,905
Grand Total	**291,815,821**