Overview of Land Construction Courses at Kansas State University

Developed by Professor Day in the mid 1960's at KSU, continuing to present time, is a vision of a Land Construction course series that examines the various subjects in a holistic manner, careful to resemble the actual experience of a professional practice setting. The Land Construction subject courses are closely coordinated one to the other, beginning with Materials & Methods, LAR 248; and followed by Land Construction I, LAR 438; Land Construction II, LAR 439; and Land Construction III, LAR 647. Following are descriptions of each of the courses developed and in place to date:

- **Materials & Methods, LAR 248** (Fall Semester, 2nd year) is an introduction to basic applications and materials common to the practice of landscape architecture including **basic surveying** information and methodology, basic **contour configuration and topography**, elementary **grading applications**, **concrete**, **masonry**, **wood** and **wood framing**, and the assembly of common **design details**. An introduction to Auto CAD as a drawing tool is used for the delineation of elementary topography, grading, and design details.

- **Land Construction I, LAR 438** (Fall Semester, 3rd year), as the first project oriented, real-world construction course in the curriculum, involves a site scale project of one to two acres including the siting of one or several buildings with associated parking, entry and/or egress drives, vehicular circulation, pedestrian circulation, planting and associated details. The project includes a real client, a real site and a real program of improvements with budget, all accessible to the students during the design phase of the project. Assigned projects over the semester include **1.)** a **letter proposal** for professional services, **2.)** a **site plat of existing conditions** including topography, roads, utilities, vegetation, surveyed parcel boundaries, the legal parcel description, etc., all to be developed by the student from a surveyors' log, **3.)** a **general site development plan**, **4.)** a **site grading plan**, and **5.)** site **earthwork quantity estimates** utilizing three different methods; — the average depth method, the contour area method and the end area method. Each student makes a formal presentation of their general development plan solution to the client at the completion of the design phase and prior to commencing the construction documentation beginning with the grading plan. Students can make revisions to their plan by writing a letter to the client explaining the revisions and why they are necessary. Auto CAD is emphasized as the graphic medium for design and construction documentation.

- **Land Construction II, LAR 439** (Spring Semester, 3rd Year) is a continuation of Construction I, continuing the construction documentation of the same project. Assigned projects over the semester include **1.)** a site **layout & dimension plan**, **2.)** a site **irrigation plan**, **3.)** a site **lighting & electrical plan**, **4.)** associated site **construction details**, **5.)** a site **construction specifications outline** with one selected construction specification to be written in detail and **6.)** preparation of **project bid documents** encompassing an advertisement for bids, instructions to bidders, a bid proposal form with bid schedule and a landscape architects' project cost estimate. Auto CAD is emphasized as the graphic medium for construction documentation.

- **Land Construction III, LAR 647** (Fall Semester, 4th year) involves a larger, community scale project of twenty to thirty acres with emphasis on the implementation of community systems including the siting of multiple buildings, open space and community amenities integrated with associated road systems, land form, drainage systems and utility systems. The project includes a real client, a real site and a real program of improvements with budget, all accessible to the students through the design phase. Assigned projects over the semester include **1.)** writing a formal **contract agreement** between owner and landscape architect for professional services, **2.)** a **master development plan**, **3.)** a **road alignment plan with profiles**, **4.)** a site **grading plan with earthwork quantity estimates**, **5.)** a **storm drainage plan and pipe profiles** including runoff estimates, detention / retention facilities, drainage facility details, erosion control and best management practices, and **6.)** a **sanitary sewer plan** including sewage quantity estimates, profiles and details. Each student makes a formal presentation of their master plan solution to the client at the completion of the design phase and prior to commencing the construction documentation beginning with the road alignment plan. Students can make revisions to their plan by writing a letter to the client explaining the revisions and why they are necessary. Auto CAD Land Development Desktop with the Civil Engineering package is emphasized as the graphic medium for design and construction documentation.

Student Work Examples

From the Land Construction III course Fall 2007

- The Following Student Work by Brett Tagtmeyer includes:
  - Master Plan for a 38.5 acre Mixed Use Development - *Design developed by student to serve as basis for construction documentation to follow*
    - Color Rendered Plan
    - Black & White Plan
  - Grading Plan for Entire Site
    - Enlargement of Northern Portion of Site
    - Earthwork Cut/Fill Diagram from Grading Plan
    - Enlargement of Earthwork Cut/Fill Diagram with Sections Indicated for Earthwork Estimation

Master Plan – Brett Tagtmeyer - Land Construction III Fall 2007

Concept Statement

The design for the Highway 24 Mixed Use PUD creates distinct neighborhoods surrounding open space. Stormwater management is a major force behind the use of open space in this way. The green corridors will provide a means to transport stormwater runoff through the site via vegetated swales, as well as space for stormwater infiltration via raingardens. Additionally, two parking structures located within the residential areas will house stormwater retention cells that will increase the time of concentration of the runoff.

The stormwater management system will act as an amentity for the residents in the PUD. The raingardens will include seating for passive recreation, and a walking trail leading through the site will be placed near the vegetated swales. The entry feature at the east entrance to the site includes two ponds that will detain water to be used in a fountain. Finally, shallow retention cell in the southeast corner of the site will provide emergency overflow storage for large storm events. This open space can be used for more active recreation such as pickup games of soccer.

The site design features a harmonious mix of single family residential, multi-family residential, and commercial uses. Each of these uses are within walking distance of one another and thus vehicle use is minimized.

Legend

Lines
- ROW
- Contour
- Plat
- Building Envelope
- Utilities: Water, Electric, Sewer, Cable TV, Telephone, Gas

Plant Material
- Existing Vegetation
- Street Tree
- "Other" Trees
- Landscape Planting
- Pond

Hardscape
- Street (BOC)
- Sidewalk Edge
- Parking

Structures
- Commercial/Apartments
- Townhouse
- Gazebo
- Condominium

General Information

Total Area
38.5 acres

Single Family Detached
- Quantity: 20 lots
- Land Area: 5.03 acres
- Average Lot: 0.25 acres
- Open Space: 1.17 acres
- Density: 3.23 units/acre

Duplex/Attached
- Quantity: 16 lots
- Land Area: 2.17 acres
- Open Space: 0.39 acres
- Density: 5.42 units/acre

Condominiums
- Quantity: 48 units
- Land Area: 4.13 acres
- Density: 11.62 units/acre

Townhouses
- Quantity: 24 units
- Land Area: 4.49 acres
- Density: 5.35 units/acre

Apartments
- Quantity: 20
- Parking: 20

Commercial
- Quantity: 45081 sq ft
- Parking (1/250): 180

Open Space (not included with residential)
- Quantity: 7.33 acres

Percent Land Use
- Commercial: 9%
- Single Family: 16%
- Multi-Family: 29%
- Open Space: 19%
- Infrastructure/ROWs: 27%

Street Information
- Street 1 Length: 1420.41'
- Street 2 Length: 562.40'
- Street 3 Length: 1337.62'
- Street 4 Length: 564.23'
- Street 5 Length: 414.95'
- Street Total L: 4299.61'
- Alley Total L: 2842.25'

Typical Street Width:	31' BOC to BOC
Big Bluestem Boulevard ROW:	60'
Tumblegrass Terrace ROW:	50'
Switchgrass Street ROW:	72'
Little Bluestem Lane ROW:	62'
Excel Lane ROW:	62'
Typical Alley Width:	16'
Pocket Mouse Place ROW:	30'
Porcupine Path ROW:	30'
Vole Vale ROW:	30'
Woodchuck Way:	30'

Lot Size Information

Lot	Area (acres)	Area (sq ft)	Lot	Area (acres)	Area (sq ft)
SF1	0.20 acres	8,516 sq.ft.	D1	0.11 acres	4,628 sq.ft.
SF2	0.17 acres	7,475 sq.ft.	D1	0.11 acres	4,628 sq.ft.
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SF15	0.27 acres	11,759 sq.ft.	D14	0.11 acres	4,846 sq.ft.
SF16	0.23 acres	9,829 sq.ft.	D15	0.13 acres	5,514 sq.ft.
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SF18	0.28 acres	12,288 sq.ft.			
SF19	0.25 acres	10,798 sq.ft.			
SF20	0.24 acres	10,382 sq.ft.			

Project Feasibility/Costs

	Improvement	Quantity	Cost	Unit	Total
Earthwork	Onsite mass earthwork cut to fill by 20 yd scraper including compaction and grading		$ 2.00	cu yd	$ -
	Barrow fill from off site by 12 yd dump truck (less than 5 mi haul)		$ 7.00	cu yd	$ -
Streets and Road Paving	31' paved streets (boc to boc), earthwork, 6" reinforced pavement depth, 12" rollback concrete curb and gutter with 5" curb height	4299.61	$ 140.00	lin ft	$ 601,945.40
	bituminous concrete BM1 (wear course) per 1" depth	5049.75	$ 3.00	sq yd	$ 15,149.25
	bituminous concrete BM2 (base course) per 3" depth	5049.75	$ 8.55	sq yd	$ 43,175.36
	parking lots - porous gravel to depth of 6'	1814.04	$ 20.00	cu yd	$ 36,280.80
	AB3 gravel sub base per 6" depth	5049.75	$ 7.50	sq yd	$ 37,873.13
Utilities	8" sanitary sewer (ABS truss pipe) 10' depth		$ 30.00	lin ft	$ -
	sewer manhole (precast conc) 10' depth		$ 3,500.00	ea	$ -
	6" water main (pvc) to 4' depth, incl. valves, services, fire hydrants complete		$ 30.00	lin ft	$ -
	underground electric complete	68	$ 1,100.00	per lot or building	$ 74,800.00
Survey	surveying/platting, complete	68	$ 1,000.00	per lot or building	$ 68,000.00
Storm Utilities	12" storm drain (concrete pipe) to 6' depth, complete	0	$ 25.00	lin ft	$ -
	24" storm drain (concrete pipe) to 6' depth, complete	0	$ 45.00	lin ft	$ -
	36" storm drain (concrete pipe) to 7' depth, complete	0	$ 75.00	lin ft	$ -
	drain inlet (precast conc) at curb, complete		$ 3,500.00	ea	$ -
	drain inlet (precast conc) as yard inlet, complete	0	$ 2,500.00	ea	$ -
Amenities	4" x 6'w asphalt walking/bike trail in place, including all grading, sub base and drainage, complete	4132.05	$ 25.00	lin ft	$ 103,301.25
	822 sq ft gazebo, wood frame, cedar shake shingle roof, with picnic tables and grill area	1	$30,000.00	ea	$ 30,000.00
	modular tot lot with treated timber members and sand surface, 20'x20' with 6" curbing	1	$15,000.00	ea	$ 15,000.00
	concrete walkway or slab, 4" thick	76737.18	$ 3.00	sq ft	$ 230,211.54
	grass seeding, open space and street ROW, K31 fescue	17.71	$ 1,000.00	acre	$ 17,710.00
	street trees (3" cal) in place	102	$ 500.00	ea	$ 51,000.00
	street lights, wiring, fixture, and steel pole standard, complete	40	$ 4,600.00	ea	$ 184,000.00

Total $ 1,508,446.73

Client
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Robert H. Eichman, President
701 South Fourth Street
Manhattan, KS 66502

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Engineers, Architects, and Surveyors
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Electric
Westar Energy
800.383.1183

Water
City of Manhattan
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Telephone
SBC Communications
800.499.7928

Prairie Place

A Mixed Use PUD

MARK	DATE	DESCRIPTION

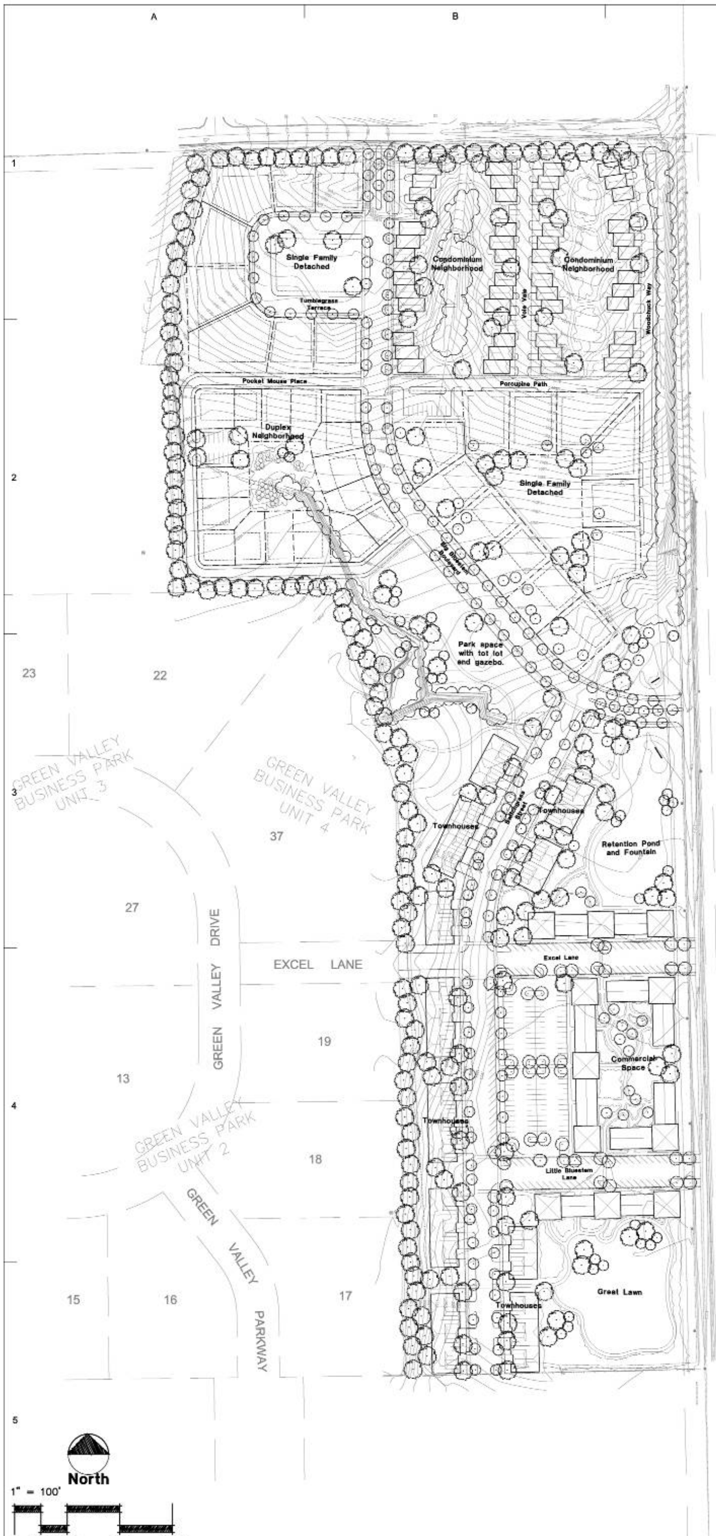
ISSUE:
PROJECT NO: C3-#2
CAD DWG FILE: HWY24_MixedUse_MasterPlan_092507
DRAWN BY: Brett Tagtmeyer
CHECKED BY:

SHEET TITLE

Master Plan

L-001

Master Plan – Brett Tagtmeyer - Land Construction III Fall 2007



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Townhouse
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Condominium

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	street lights, wiring, fixture, and steel pole standard, complete	40	$ 4,000.00	ea	$ 184,000.00
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Prairie Place
A Mixed Use PUD

MARK	DATE	DESCRIPTION

ISSUE:
PROJECT NO: C3-#2
CAD DWG FILE: HWY24_MixedUse_MasterPlan_092607
DRAWN BY: Brett Tagtmeyer
CHECKED BY:

SHEET TITLE
Master Plan

L-001

Grading Plan – Brett Tagtmeyer - Land Construction III Fall 2007

Legend

	Property Line
	Road Center Line
	Swale Flow Line
	Proposed Drain Pipe
1033.00	Existing Minor Contour
1030.00	Existing Major Contour
1029.00	Proposed Minor Contour
1030.00	Proposed Major Contour
⊠	Drain Inlet
TS	Top of Swale
BS	Bottom of Swale
FFE	First Floor Elevation
×1033.40	Proposed Spot Elevation
FFE 1030.00	Structure

Notes

Total Retention:
Area: 98,079 sq ft
2.25 ac
Volume: 335,295 cu ft
7.69 acre feet

Required Retention
Area: 65,340 sq ft
1.5 ac
Volume: 326,700 cu ft
7.50 acre feet

Note:
Porous parking lots are intended only to decrease TOC and are short-term detention devices. The potential storage volume is unknown. Porous parking 1 drains to level spreader.

Plan

Scale: 1" = 50'

0 25 50 100 150

North

Client

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Cable
Cox Communications
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Gas
Kansas Gas Service
800.794.4780

Water
Pottawatomie County
Rural Water District

Prairie Place

A Mixed Use PUD

MARK	DATE	DESCRIPTION

ISSUE:
PROJECT NO: C3-#4 Grading
CAD DWG FILE: HWY24_MixedUse_Grading_112807.dwg
DRAWN BY: Brett Tagtmeyer
CHECKED BY:

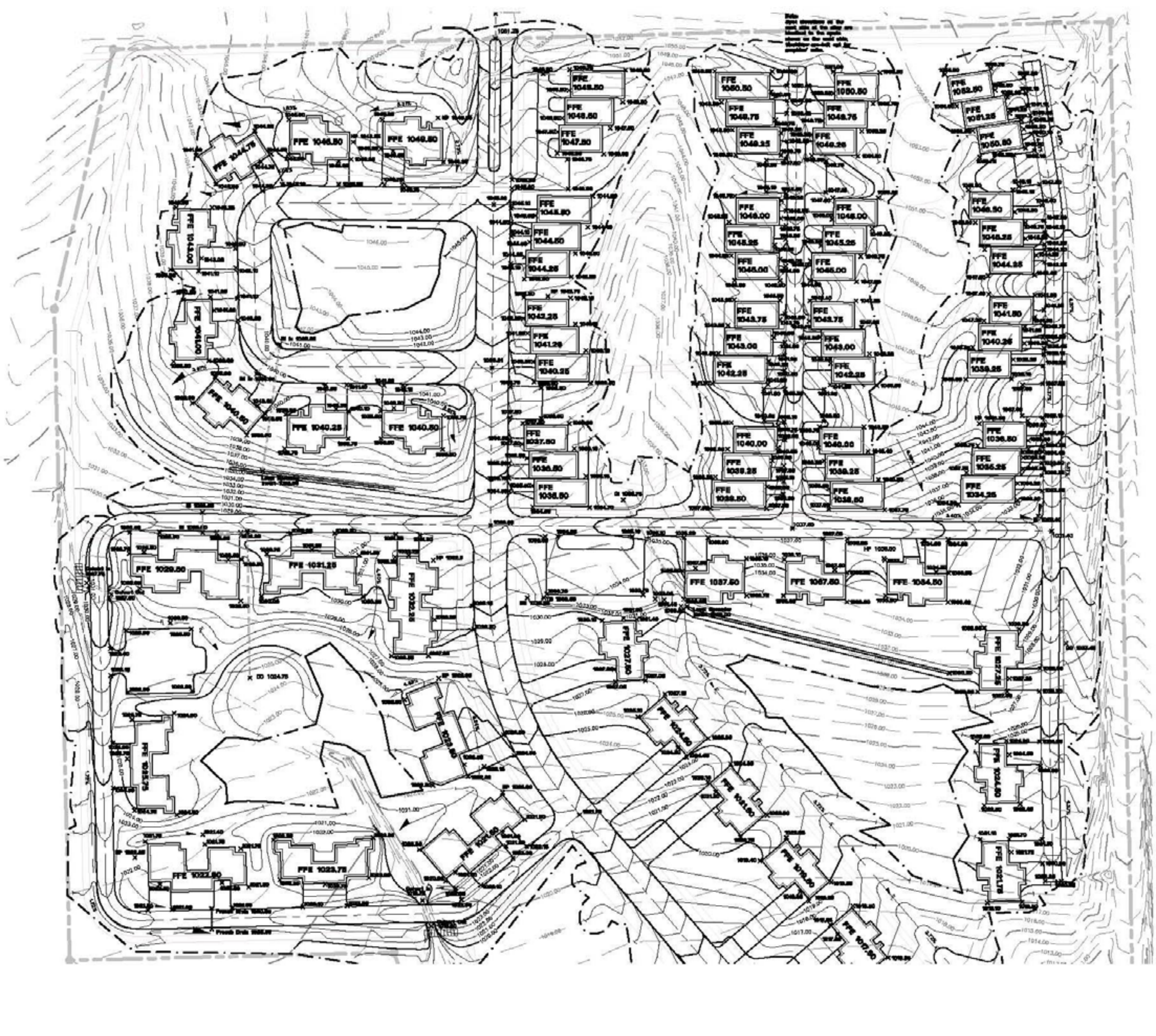
SHEET TITLE

Grading Plan -North-

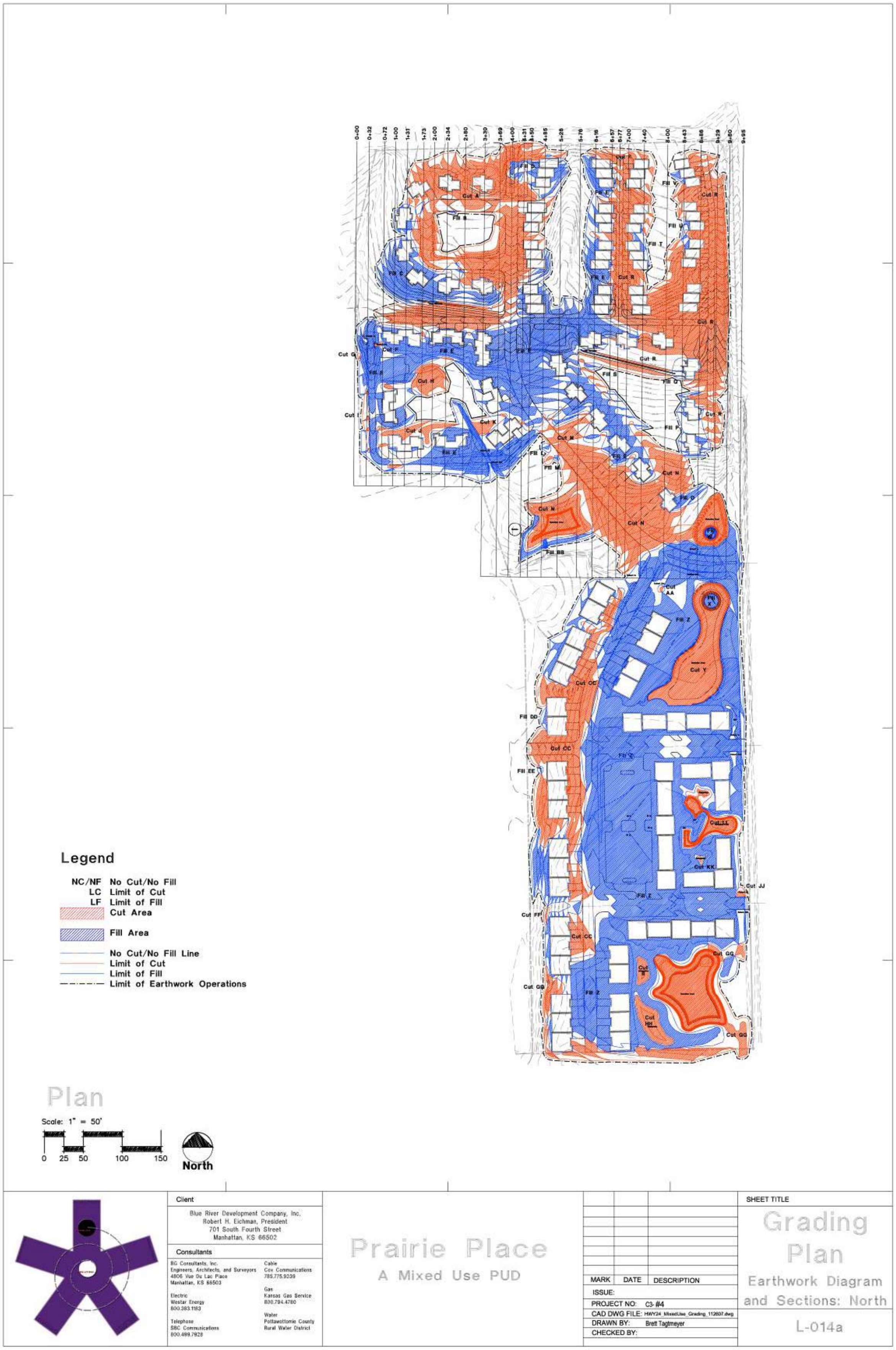
L-013a

Grading Plan Enlargement of Northern Area of Site Plan

Brett Tagtmeyer – Land Construction III – Fall 2007

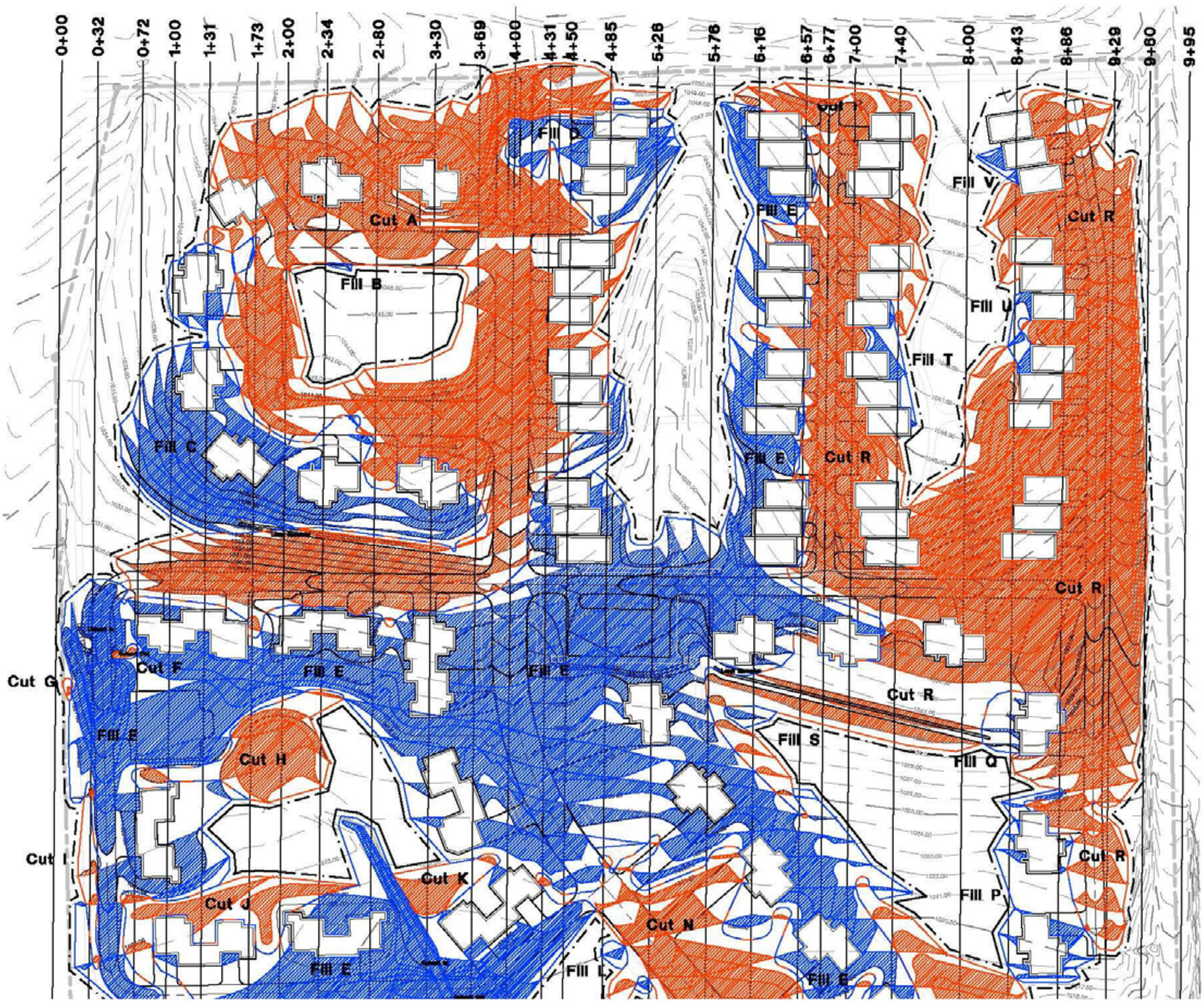


Earthwork Diagram from Grading Plan – Brett Tagtmeyer - Land Construction III Fall 2007



Earthwork Diagram Enlargement of Northern Area of Site Plan

Brett Tagtmeyer – Land Construction III – Fall 2007



Project Statement For LAR 647
Project #4 – Grading Plan and Earthwork Estimation

KANSAS STATE UNIVERSITY | **LAR 647**

Department of Landscape Architecture / Regional & Community Planning | Land Construction III

FALL 2007
INSTRUCTOR: Dennis J. Day

PROJECT #4

GRADING PLAN & EARTHWORK QUANTITY ESTIMATES FOR A MIXED RESIDENTIAL & COMMERCIAL PLANNED UNIT DEVELOPMENT

Reading Assignments:

Site Planning by Lynch; 3rd edition; pages 223-233; 448; 450; 451
Grade Easy by Untermann; pages 59-70; 87-115
Landscape Architecture Construction by Landphair & Klatt; 2nd edition; pages 24-25; 41-84
Site Engineering by Strom & Nathan, 3rd edition, pages 59-95; 113-129

An understanding and application of grading principles are essential for the Landscape Architect as nearly every project undertaken requires reshaping of existing ground surfaces in order to implement development plan proposals. Any comprehensive site design solution must recognize grading as a major consideration from the beginning of conceptual design studies through field construction. At the larger community scale, grading has marked impacts on any proposed development plan including road alignment systems, utility systems, drainage, existing vegetation, visual quality and continuing maintenance to mention a few. Incorporating structures, land use areas, circulation routes and utilities into the topography while balancing earthwork quantities, maintaining positive drainage and eliminating excessive grading where ever possible should be major functional objectives of any grading plan. Yet the Landscape Architect must also recognize that grading will be a necessary and positive element in the evolvement of any proposed plan. The grading plan should embrace and reinforce the major design concept or concepts; --- that is, focus visual attention, provide direction, define space, create vistas, provide desirable microclimates, provide visual screening where necessary, and insure a sense of continuity and tie in with the existing landscape; ---- as well as provide the more utilitarian aspects of positive drainage, positive flow of gravity utilities, balance of cut and fill, safe and reliable usability of facilities, ease of maintenance and so on.

This project is designed to acquaint the student with area grading at the larger community scale on a comprehensive project of his or her own design; to provide the student with a basic understanding of graphically representing his or her grading solution as a construction document, --- and to initiate an awareness of grading as it relates to implementation of the various systems required at the community scale level including the street system, the drainage system and the sewer collection system.

Project Statement For LAR 647
Project #4 – Grading Plan and Earthwork Estimation

The following letter has been received from Mr. Robert Eichman, a Partner and President of the Blue River Development Company, Inc., regarding the grading plan documents and earthwork estimates for the proposed mixed use residential and commercial development currently under consideration for a 38.5 acre tract of land located north of US 24 Highway East fronting on Excel Road, the proposed site lying south and west of the Excel Road - Elk Creek Road intersection as described heretofore in the project background statement, subsequent project statements and as delineated on the survey plat of existing conditions:

Ladies and Gentlemen:

The street alignment plan and profiles for the proposed general development plan encompassing the 38.5 acre mixed use residential and commercial planned unit development located north of US 24 Highway on Excel Road in Blue Township, Pottawatomie County, as prepared by your firm, have been received and are currently being reviewed by the Pottawatomie County Public Works Department and the Pottawatomie County Engineer for approval.

Our intentions are to proceed with the major site related construction for the proposed project this spring so that we might fully utilize the upcoming construction season. Our proposed construction schedule will require that all construction documents be completed by December 15, 2007, after which the bid package can be developed. The grading plan is of high priority, as earthwork and grading will be the first contract item to be put out for bid, probably in February 2008.

We shall look forward to meeting with you to review the grading plan and earthwork quantity estimates in the near future.

Sincerely,

Robert Eichman, President.
The Blue River Development Company, Inc

Required:

1) A grading plan at scale 1" = 50' (or as otherwise approved) including all necessary spot elevations, drainage pickup points with rim elevations, preliminary routing of storm drain lines, existing and proposed contours, necessary culvert alignment with invert elevations, drainage swales with flow line elevations, street intersection elevations, existing elevations to be maintained, and first floor elevations of each proposed building. Include the building placement with building wall outlines, driveways and/or parking areas as may be appropriate for all subdivided lots and land parcels, be they residential or commercial. Grade each developed lot or parcel in detail. Include a minimum storm water detention or retention area of 1½ acres at an average depth of 5 feet within the 38.5 acre project site "as a preliminary estimate" of stormwater

retention or detention capacity required by Pottawatomie County to maintain "zero runoff" from within the project site. The actual retention or detention capacity requirements will be determined and adjusted as necessary during the development of the storm water plan as a part of the next project. The 1½ acre detention or retention area can be subdivided into several smaller areas within the several watershed drainage areas occurring within the project site provided the required storage volume is maintained. Include the location, the specific type, the approximate area, estimated storage / absorption capacity and the controlling elevations for all planned storm water BMP's (Best Management Practices) encompassed within the grading plan. Storm water BMP's can reduce or replace required detention or retention capacities, provided BMP capacities and absorption rates can be established and verified..

Within the areas of proposed grading, the grading plan contour interval shall be one foot. Include notes and legend as necessary.

2) <u>Prepare an earthwork diagram plan on a copy of the grading plan document</u> delineating the areas of cut in red and areas of fill in blue, the limit of earthwork operations, the no cut-no fill lines and <u>the location of all earthwork sections</u>. Identify each area of cut and/or fill on the earthwork diagram plan as a separate area or entity.

3) Delineate earthwork sections @ scale 1" = 50' to be taken generally at 50 foot regular intervals, <u>and closer where necessary</u>, through all areas of proposed grading including, but not limited to, areas of design grading, streets, detention and/or retention ponds, building sites and drainage channels. The vertical scale of earthwork sections is typically represented at a 10:1 vertical exaggeration. Include notes and legend as necessary. <u>Reference the location of all sections on the earthwork diagram plan.</u> Reference and identify, <u>in each earthwork section</u>, major plan elements, such as property lines, streets or roads, street or road centerlines, building structures, first floor building elevations, drainage channel flow lines, utility piping, etc.

4) Determine earthwork quantities for all graded areas utilizing the end area method <u>directly on the earthwork section sheets</u>. Delineate all cut areas in red and all fill areas in blue directly on each section diagram. Also, indicate all earthwork cut and fill areas in square feet, either within or directly adjacent to, each earthwork section diagram to which they relate. Show all earthwork calculations in an accepted, organized format <u>between</u> the earthwork sections to which they apply. <u>Compute and record the volume of each cut area and each fill area identified on the earthwork diagram plan as a separate volume</u>.

Compute the volume of <u>subcut</u> and <u>subfill</u> for each area of cut and each area of fill identified on the earthwork diagram plan <u>separately</u>. Utilizing an 8½ x 11 page format, include the subfill and subcut volume calculations, along with an <u>earthwork mass diagram</u> in table format and a <u>summary of total earthwork quantities</u>, logically and sequentially organized with tabbed sub sections and all bound in a note book binder.

Solutions shall be submitted on 24" x 36" sheets of translucent bond, opaque bond or vellum, either manually drawn or plotter generated. In either case, plotted or hand drawn, as a construction document, all drawings will be black line on a white or transparent sheet, adequate for reproduction copy purposes.

Project Statement For LAR 647
Project #4 – Grading Plan and Earthwork Estimation

Each student should retain a hard copy and an electronic copy of all grading plan documents, all earthwork sections and earthwork calculations as submitted for future reference and review.

Again, the earthwork diagram plan shall be submitted on a copy of the grading plan document.

Submittals shall be evaluated on grading concept, recognition of existing features and drainage patterns, application of basic grading principles, visual continuity of grading, accommodation of drainage, accuracy and completeness of earthwork quantity estimates, balance of earthwork quantities, construction feasibility, inclusion of necessary information and detail, and graphic presentation.

Due: ______________________________

NOTE: The grading plan will be the fifth (and/or sixth, seventh, etc.) sheet respectively, depending on the number of preceding sheets submitted to date, — all to be assembled in a matched set of construction drawings to be submitted during the course of the semester.

The copy of the grading plan, used as the earthwork diagram plan, the earthwork sections used for earthwork computations and the earthwork calculations themselves are not construction documents that the contractor utilizes to construct the project at hand. In fact, the contractor never sees the earthwork diagram, the earthwork sections or the calculations utilized in estimating earthwork quantities. The earthwork plan diagram, the earthwork sections and earthwork calculations are "in house" work sheets developed and utilized solely by the landscape architect to estimate earthwork quantities, balance earthwork quantities, estimate earthwork costs, and so on. As "in house" work sheets, the earthwork diagram, the earthwork sections and earthwork calculations must be presented in an organized, neat and legible manner for use as inner office project documents to be referenced by any number of in-office personnel during the design and construction of the project. All earthwork estimate documentation (each sheet) must include the project name, date, professional firm, responsible party (you), be numbered in sequence and labeled "in house documents".

Evaluation Criteria for Student Work –
Provided to Students at Project Assignment

KANSAS STATE UNIVERSITY LAR 647 & LAR 765
Department of Landscape Architecture Land Construction III
Composite Land Construction III

INSTRUCTOR: Dennis J. Day
FALL 2007

EVALUATION CRITERIA
Project 4 / **GRADING PLAN & EARTHWORK ESTIMATE**..**(400 points)**

Recognition of Existing Conditions (in relation to proposed grading).........................(45 points)

- recognition of existing drainage patterns & swale flow lines
- conformance to existing topography, slopes, & land forms
- minimal grading of adequately drained natural surfaces
- preservation of existing vegetation
- recognition of existing control elevations & considerations
  - property boundaries
  - existing or adjacent streets or roads
  - existing buildings or structures to be retained
  - existing drainage break points / high & low points / swales
  - existing culverts & drainage inlet structures
  - existing sanitary sewer depth & gradient (if applicable)
  - existing storm drain depth & gradient (if applicable)
  - existing utility easements (if applicable)

Grading Feasibility..(65 points)

- positive drainage of graded surfaces
- positive drainage away from building envelope / major activity areas (as applicable)
- access per drive slope @ each lot (if applicable)
- indication of building foundation type matched to each lot slope (as applicable)
- drainage to and placement of drain inlets
- use & placement of surface drainage elements - swales, road ditches, curbs, bmp's
- use & placement of culvert piping
- preliminary location of storm drain piping
- use of sections in development of grading concepts
- visual balance of cut and fill
- grading at street intersections
- the interface of proposed grading & drainage with existing topography & drainage patterns
- recognition of minimum, maximum, & desirable slope rates
  - streets (1% - 12%)
  - parking areas (1% - 5%)
  - service areas (1% - 4%)
  - pedestrian walks (1% - 8%)
  - recreation areas (2% - 4%)
  - swales (0.5% - 5%)
- recognition and use of grade separation elements / erosion control / slope treatment where applicable
- use of grading & directed drainage to accommodate storm water "best management practices"
- avoidance of unnecessary grading
- basic understanding of grading principles

Design Grading..(40 points)

- use of grading to reinforce design concepts
- use of grading to provide direction / emphasis
- use of grading to screen undesirable elements
- visual continuity of graded land form

Evaluation Criteria for Student Work –
Provided to Students at Project Assignment

Included Information / Technical Detail...(55 points)

- use & inclusion of spot elevations where necessary
  - first floor building elevations
  - high & low points / drainage break points
  - corners of all paved areas
  - @ the curb radii
  - swale centerline at +/- 100 ft. intervals
  - rim elevations of drain inlets
  - invert elevations of culverts
  - street / road centerline intersections
  - street / road high & low points
  - street / road beginning & ending points
  - edge of street or road paving @ intersecting street or road centerline
  - grade separation elements (walls, steps, ramps, curbs, 6:1plus slopes)
- existing elevations to be maintained
  - existing drain inlets (if applicable)
  - existing inverts (culverts, storm drains, sanitary sewers)
  - existing plant materials (surface elevation maintained to drip line x 2 if possible)
  - existing streets / roads
  - existing drainage swales
  - existing property lines
- contour configuration and representation
- contour labeling (every contour labeled @ regular intervals / both existing & proposed)
- use of slope & swale indicators with % of slope given
- indication of drainage easements where necessary
- inclusion / completeness of notes & legend
- overall detail of grading plan & sections
- transfer of technical detail to the contractor

Earthwork Diagram & Sections...(50 points)

- delineation of earthwork on grading plan print
  - areas of cut & fill designated & identified
  - no cut-no fill line designated
  - limits of cut or fill designated
  - limits of earthwork operations designated
  - areas of pavement metal designated
- delineation of earthwork on sections
  - areas of cut & fill designated & identified
  - no cut-no fill line designated
  - limits of cut or fill designated
  - areas of pavement metal designated
  - inclusion of all proposed improvements & references @ section line (streets, roads, buildings, swales, road center lines, property lines, etc.)
  - indication of existing & proposed ground surfaces @ section line
- referencing sections to plan & plan to sections by stations or other reference system
- location of each section indicated on the earthwork diagram plan by section line w/ reference designation to each individual earthwork section
- location of sections for optimum accuracy of earthwork quantities
- accuracy of the earthwork diagram to sections
- accuracy & exaggeration of <u>drawn</u> sections
- completeness of notes & legend applied to earthwork diagram & sections

Evaluation Criteria for Student Work –
Provided to Students at Project Assignment

Earthwork Computations..........(50 points)

- measured accuracy / section areas of cut & fill
- recognition of vertical scale exaggeration in section area measurements
- organization & clarity of earthwork computations
  - indication & application of end area formula:

$$V = \frac{A_1 + A_2}{2} \times L \ / \ 27$$

  - area values of cut & fill indicated adjacent to the corresponding sections
  - volume computations indicated between corresponding sections
  - cut & fill volume computations maintained as separate entities for each area of cut and each area of fill throughout the computation process
  - determination of subfill & subcut volumes for each cut or fill area
  - transfer of volumes to the mass diagram
  - transfer of volumes to the earthwork summary
- accuracy of end area earthwork computations
- inclusion & understanding of the mass diagram
- increase of fill quantities for loss & compaction (typically 10%)
- inclusion & understanding of the earthwork summary
- summation of quantities
  - topsoil stripped
  - subcut placed in subfill
  - excess subcut (removed from site, stockpiled for future use or wasted)
    or
  - subcut shortage borrowed & placed in fill
  - topsoil replaced
  - volume(s) of subbase(s) if applicable (each <u>type</u> of subbase volume should be indicated as a separate quantity)
  - volume(s) of pavement(s) if applicable (each <u>type</u> of pavement volume should be indicated as a separate quantity)
  - area(s) of pavement type(s) if applicable (each <u>type</u> of pavement area should be indicated as a separate quantity)
  - area of seeding
- balance of cut & fill
- basic understanding & application of end area earthwork estimating method

Graphics (grading plan & sections)..........(55 points)

- readability of grading plan & sections
- line weight / lettering quality
- graphic detail
- sheet arrangement / composition

Project Progress..........(40 points)

Progress Evaluation Criteria for Student Work –

Evaluation of student work at approximately mid term of project duration

PROGRESS EVALUATION FORM

Land Construction III LAR 647
Composite Land Construction III LAR 765
Fall 2007 Instructor: D J Day

DATE: November 6, 2007

PROJECT: (#4) **Grading Plan & Earthwork Sections**

NAME ______________________________________ TIME: _____ COURSE: _________

Grading Plan

[ ] notation of all critical existing elevations to be met

[ ] diagrammatic indication of major existing drainage flows & channels across the site (hand drawn or cad overlay)

[ ] diagrammatic indication of major proposed drainage flows & channels located w/ critical flow lines & critical elevations indicated across the site delineating the relationship to existing drainage patterns required above (hand drawn or cad overlay)

[ ] set first floor elevations for all buildings (or building envelopes as appropriate)

[ ] evidence of work sections used to set 1st floor elevations in relation to existing topography, street & property line considerations (one section per lot minimum)

[ ] elevations noted at start of streets, end of streets, at all intersections & edge of street pavement-centerline intersections on minor streets where appropriate

[ ] proposed preliminary contour configuration in place across +/- 50% of the site grading plan (hand drawn or cad overlay of grading plan in progress)

[ ] an indication of proposed detailed grading around a minimum of ten (10) residential building sites and one (1) commercial building site w/ parking (as part of a hand drawn or cad overlay of grading plan in progress)

[ ] necessary drainage pickups (inlets) located w/ elevations noted within areas of the grading plan completed to date (+/- 50% of site minimum)

Progress Evaluation Criteria for Student Work –

Evaluation of student work at approximately mid term of project duration

[ ] street high points & low points located w/ elevations noted

[ ] preliminary routing alignment of culvert pipes & storm drain pipes (plan only)

[ ] preliminary location & approximate area (per project statement) of detention / retention pond areas

[ ] preliminary location & approximate area (per project statement) of storm water best management practices (rain gardens, sediment basins, bioswales, buffer strips, level spreaders, bio detention cells, porous paving, constructed wetlands)

Earthwork Diagram / Earthwork Sections

[ ] preliminary location of all earthwork sections for accurate earthwork quantity computations on copy of grading plan (11"x17" or 24"x36" sheet size & scale 1" = 100 ft acceptable for progress)

[ ] a minimum of four earthwork sections, in sequence, w/ existing & proposed surfaces in place cut at critical locations of maximum site earthwork, hand drawn or cad generated, at the scale of the grading plan (1" = 50 ft or other scale as approved by instructor)

[ ] computation of end area earthwork quantities between the four sections noted above (subcut or subfill calculations are not required for progress)

[ ] progress to date vs expected progress
[ ] quality of effort

progress evaluation $\boxed{}$

Please Note: If you submit progress drawings in a roll, roll the drawings facing out with your name in open view and secured with a rubber band. If you submit a notebook, fold the drawings to an 8 ½ "x 11" size and insert in the notebook pocket or secure in place against the back notebook cover with a rubber band. Include your name and the date on the front of the notebook and on all pages or sheets of all submittals. Thank you.

Project Requirements Criteria for Student Work –
Evaluation of student work at final submittal to indicate fulfillment of requirements

PROJECT REQUIREMENTS FORM

Land Construction III LAR 647 DATE: November 29, 2007
Composite Land Construction III LAR 765
Fall 2007 Instructor: Dennis J. Day

PROJECT: **(#4) Grading Plan & Earthwork Estimate**

NAME ________________________________ COURSE: ____________

Date Due: Thursday, November 29, 2007
Submitted: [ ] on time [ ] late days late _____ penalty [ ]

Requirements (✓)

[ ] grading plan
- O legend of grading plan symbols
- O grading plan notes
- O title block / construction document
- O scale & north arrow
- O proposed contours @ 1 ft interval; solid line; contours numbered (graphic priority)
- O existing contours @ 1 ft interval; dashed line (subdued graphic priority)
- O critical spot elevations (centerline intersections; edge of minor street @ centerline, drainage pickup points, high points; low points; first floor elevations)
- O swale/ditch/channel flow line indicators w/ percentage
- O slope indicators (pointing down slope)
- O positive drainage away from structures

[ ] earthwork plan diagram (on copy of grading plan)
- O legend of earthwork diagram symbols
- O earthwork diagram notes
- O delineation of cut areas in red, fill areas in blue, the no cut - no fill line, limits of cut & limits of fill
- O each separate cut & fill area identified on earthwork diagram plan
- O location of earthwork sections on the earthwork diagram plan or on a transparency overlaying the earthwork diagram plan w/ each earthwork section referenced

[ ] earthwork sections
- O sections referenced (to earthwork plan locations)
- O delineation of cut areas in red, fill areas in blue, the no cut - no fill line, limits of cut & limits of fill
- O sections include major identifying features or references (streets or roads w/ centerline, property lines, structures, walls, etc)
- O horizontal & vertical scale noted

Project Requirements Criteria for Student Work –
Evaluation of student work at final submittal to indicate fulfillment of requirements

[ ] earthwork computations (phase one of the project / north half of site)
- O procedure of earthwork calculations noted
- O <u>section cut & fill areas</u> identified, calculated & recorded <u>individually @ each section</u>
- O end area formula applied <u>between</u> each set of sections with individual cut & fill volumes calculated & noted for <u>each</u> identified cut or fill area <u>separately</u>)
- O earthwork mass diagram (using gross cut & gross fill volumes)
- O determination of topsoil, subbase & pavement volumes as separate volumes within each separate area of cut and/or fill identified on the earthwork diagram
- O determination of subcut & subfill volumes calculated & recorded as separate volumes on a matrix table summary sheet of earthwork & material quantities (spread sheet) for each separate area of cut and/or fill as identified on the earthwork diagram
- O summary of earthwork* & material volumes for phase one of the project (north half)
  * (using subcut & subfill volumes)

AN INVESTIGATION
OF ALTERNATIVE STORM WATER MANAGEMENT
OPTIONS & TECHNIQUES IN THE URBAN WATERSHED

By Dennis J. Day, Professor of Landscape Architecture - Kansas State University - Manhattan Kansas

D R A F T - 03/10/08

INTRODUCTION
Water is the basis of all life. How we manage and conserve water now and in the immediate future will have major impact on the quality of life for all populations across the globe. If we continue our current trends of disrupting the hydrologic cycle, as well as continue our depletion and degradation of available water sources, the outcome will most certainly be negative, and more probably, catastrophic with regard to our quality of life. If significant adjustments are not put in place in the near future to mitigate available water supply and the quality of that water supply, life as we have come to know it, will be at risk. Storm water is a major contributing component of overall water resources in general, representing an area of study and an area of practice where the profession of landscape architecture should play a significant role in offering alternative resolutions aimed at reversing the depletion of water availability and water quality in our urban centers. It is for that reason, and several others to be stated hereafter, that storm water will be the focus of my research efforts.

THE PROJECT
This research project, entitled An Investigation of Alternative Storm Water Management Options & Techniques in the Urban Watershed, will encompass three major components. The first component of the study will be two fold; — first, an in depth review of current literature, references and articles, as well as attendance of workshops and conferences, on the subject of storm water management; — and second, an in depth review of the changing storm water flow patterns and resulting impacts due to urbanization across the Midwest region. The second component of the study will be an investigation, an analysis and a documentation of current, innovative methods, techniques and applications being employed in the Midwest region to mitigate the negative aspects of urban storm water flows and restore some semblance of the natural water flow cycle within the urban watershed. The third component of the study will involve a real world case study as a means of applying the above noted findings and observations within an urbanized watershed by projecting and modeling storm water peak flow rates and volumes over time; — by identifying current and anticipated negative storm water issues and impacts within the watershed resulting from those peak flows, peak volumes and water degradation where ever they might occur; — and finally, by offering alternative solutions to mitigate those negative storm water impacts at appropriate locations in the urbanized watershed, restoring the natural hydrologic cycle of water flow through the landscape as is possible.

PROJECT PURPOSE

The purpose of this applied storm water research study is to provide documented, meaningful findings that can be utilized in a number of venues. In the classroom, as a means of acquainting students with urban storm water issues and impacts, teaching watershed runoff quantity determination procedures, the process of urban watershed analysis and the in-depth, detail design of applied, best management practice solutions. In professional practice, as a means of introducing practitioners to innovative urban storm water management methods, techniques and best management applications that can be incorporated into every site plan and every master plan undertaken. In the public arena, as a means of educating the public and elected officials to urban storm water issues and the costly, negative impacts that will result in not dealing with those issues in a planned and coordinated manner at both the individual and community levels.

PROJECT LOCATION AND SIGNIFICANCE

After careful consideration of several case study possibilities, Blue Township, in southwest Pottawatomie County, has been selected as the case study focus for this research effort for several reasons. **First**, Blue Township is projected as one of the fastest growing townships in the State of Kansas with the projected construction of 1200 homes over the next two years, thus meeting, and actually exceeding by most measurements, the criteria of a high growth urban - suburban area watershed. **Second**, all necessary base data, including current air photography maps, topography maps and projected land development patterns over the next several years are readily available from the County Planning Department, along with the cooperation and assistance of the County Planner, John Keller, in support of this case study undertaking. **Third**, there has been little, if any, overall storm water management planning for the Blue Township watershed, and in lieu of the significant growth currently under way, this case study will provide valuable projections and information regarding storm water impacts specific to Blue Township, none of which is currently available to the County Staff or Commissioners to my knowledge. All findings of the Blue Township Storm Water Case Study will be made available as a public service on behalf of myself, my students, the Department of Landscape Architecture & Regional / Community Planning, — and Kansas State University. And finally, **fourth**, the Blue Township case study process and findings will provide an excellent, nearby example of an urban water shed with current data available for use in the classroom involving the study of storm water management issues and applications.

The Pottawatomie County Commissioners endorsed the Blue Township Storm Water Case Study as proposed in June 2006, recognizing the study officially as providing a real and significant public benefit to the County, to the residents of Blue Township in particular, and to the residents of Pottawatomie County at large, given that the findings of this study will most probably have application county wide over time. A major purpose of this endorsement is to establish official recognition of the study as a public benefit in seeking grant funds to finance the overall research project.

A REVIEW OF SELECTED STORM WATER REFERENCES & ARTICLES
Information to be added at later date.

BACKGROUND RESEARCH FOR AN INVESTIGATION & DOCUMENTATION OF INNOVATIVE STORM WATER BEST MANAGEMENT PRACTICES APPLICATIONS

A major aspect of this research effort involves a review and documentation of current innovative storm water management applications in place on the ground in the Midwest region as implemented by practitioners recognized for their storm water expertise. During 2006 and the first half of 2007, the following professional firms and their principals, recognized for practicing cutting edge storm water management applications, were identified and interviewed to ascertain their conceptual and technical approaches to resolving and mitigating storm water issues in the urban and suburban landscape. In addition, the following urban and suburban storm water projects encompassing innovative, cutting edge "best management practice" applications designed by the identified firms noted here after, were visited on the ground to observe first hand the effectiveness and mitigation impacts of those best management practice applications as they were employed.

Insite Design Studio
Ann Arbor, Michigan

Andrea Kevrick, RLA; Principal

Projects Visited:

Malletts Creek Branch Library
Ann Arbor, Michigan

Dexter Medical Center
Dexter, Michigan

Horiba Instruments, Inc
Pittsfield Township, Michigan

Pittsfield Branch Library
Ann Arbor, Michigan

Conservation Design Forum
Elmhurst, Illinois

James Patchett, RLA; Principal
David Yocca, RLA; Principal
Thomas Price, PE; Principal

Projects Visited:

Rush Residence
Elmhurst, Illinois

Villa Park Police Station
Villa Park, Illinois

Tellabs Headquarters Office Park
Naperville, Illinois

Kresge Foundation Headquarters
Troy, Michigan

Coffee Creek Mixed Use Community Restoration
Chesterton, Indiana

Blackberry Creek Watershed
Kane County, Illinois

Applied Ecological Services Steven Apfelbaum, Ecologist; Principal
Brodhead, Wisconsin

Projects Visited:

Heritage Park Mixed Residential Community
Minneapolis, Minnesota

Prairie Crossing Mixed Residential Community
Prairie Crossing, Illinois

Other Projects Visited:

Jackson Street Mall
Department of Public Works / Storm Water Division; City of Topeka, Kansas
Mark Green, Director & Project Implementer (left City of Topeka fall 2005)

The process of reviewing, studying and analyzing selected design and construction documents, including construction plans and specifications when available, of selected BMP's encompassed within several of the above noted projects is ongoing. The major purpose of the document review is to determine materials and techniques utilized in constructing the BMP's and their appropriate application and effectiveness in mitigating the various urban and suburban storm water issues at hand.

A CASE STUDY DEFINED
BLUE TOWNSHIP / POTTAWATOMIE COUNTY, KANSAS

The third major component of this research effort is to conduct a real world case study application involving a major watershed within a high growth urban-suburban area. After due consideration and deliberation, Blue Township in Pottawatomie County, immediately east and bordering the city limits of Manhattan, Kansas was selected for two compelling reasons. First, the base data and the projected land use plan is readily available from Pottawatomie County and second, Blue Township is projected as the fastest growing township in the State of Kansas with the construction of 1200 homes forecast over the next two years, thus meeting the criteria of a high growth urban-suburban watershed.

The selected Blue Township Storm Water Management Case study will serve several purposes integral to this research endeavor:

1) — first as a means to employ and compare the two methods commonly utilized for urban watershed runoff determination, namely the Rational method and the NRCS TR55 method;

2) — second, as a means to identify, investigate, and assess the impacts of urbanization over time within a rapidly changing, high growth watershed typically encompassing increased peak flows, increased downstream flooding, stream channel degradation, erosion, decreased water quality, decreased stream base flows and ground water depletion;

3) — third, as a means to identify and propose appropriate, innovative storm water BMP solutions at optimum locations within the high growth Blue Township urban-suburban watershed as a means of reducing and/or mitigating negative storm water generated impacts brought on in large part by unchecked urban growth. Recommended BMP solutions will be based on the calculated peak flow and volume runoff determinations heretofore noted and utilized in conjunction with the observed BMP field study findings undertaken in part one of this research effort; --- and finally;

4) — forth, as an opportunity to present the Blue Township storm water management case study findings and the proposed storm water BMP solutions to the Pottawatomie County Commission and the public at large as an educational and public service endeavor directed toward improving the environmental quality and natural function of the watershed while also improving the quality of life for current and future residents living within the impacted watershed.

Professor Tim Keane has agreed to participate in the fluvial flow (stream channel) aspects of this Blue Township Case Study in terms identifying, analyzing and projecting stream flows and channel conditions within the study area; --- and based on the findings of that analysis, offer appropriate recommendations to mitigate negative flow and channel impacts anticipated in the presence of rapid urbanization. Professor Keane's knowledge and expertise in the area of fluvial systems will add significant breath and credibility to the outcome of this study in terms of a comprehensive solution.

During 2007 the major focus has been on gathering, mapping and quantifying watershed data in the Blue Township watershed study area preliminary to determining runoff quantities utilizing both the TR-55 and Rational Methods. More specifically, hydrologic soil types, vegetation types and land uses were determined and mapped for the entire 12,900 acre watershed as well as mapping, quantifying and recording the pervious and impervious surfaces across the case study watershed.

SCHEDULE OF PROJECT TASKS & ACTIVITIES

Following is a summary of tasks completed [√], tasks ongoing [og], and tasks to be completed [ ] for the Blue Township Storm Water Management Case Study through year 2007:

[√] establish a methodology, a defined process and a plan of implementation as necessary to undertake and complete the Blue Township Storm Water Management Case Study

[√] presentation of objectives and intent of the Blue Township Storm Water Management Case Study to the Pottawatomie County Commissioners

[√] prepare and enter into an agreement of understanding with Pottawatomie County to undertake the Blue Township Storm Water Management Study (signed copy available on request)

[√] gather base information necessary to conduct the case study including existing and projected land uses, topography, soil types and classifications, vegetative cover, stream channel conditions, drainage patterns, census population data, building permits issued, air photo images of study area in year +/-1965 and year 2004, and other items to be added as the necessary

[og] conduct interviews with key Pottawatomie County professional staff, namely the County Engineer and the County Planner to 1) ascertain current view points and attitudes regarding storm water issues within the case study area; 2) determine the identity and status of storm water studies, if any, either past or currently ongoing, within or impacting <u>this</u> case study area; 3) determine any projected drainage infrastructure improvements planned for construction within the study area over the next ten years; and 4) determine projected development patterns and land use within the case study area anticipated over the next ten years

[og] observe and document by photo image existing conditions on the ground and along the major tributary channels, including possible flow obstructions and possible flow stress points within the defined case study area

[√] prepare a digital base map of the case study area layering existing and projected conditions for years 1965, 2004 and projected 2015 as a CAD document

[√] determine the watershed & sub watershed boundaries within the defined case study area

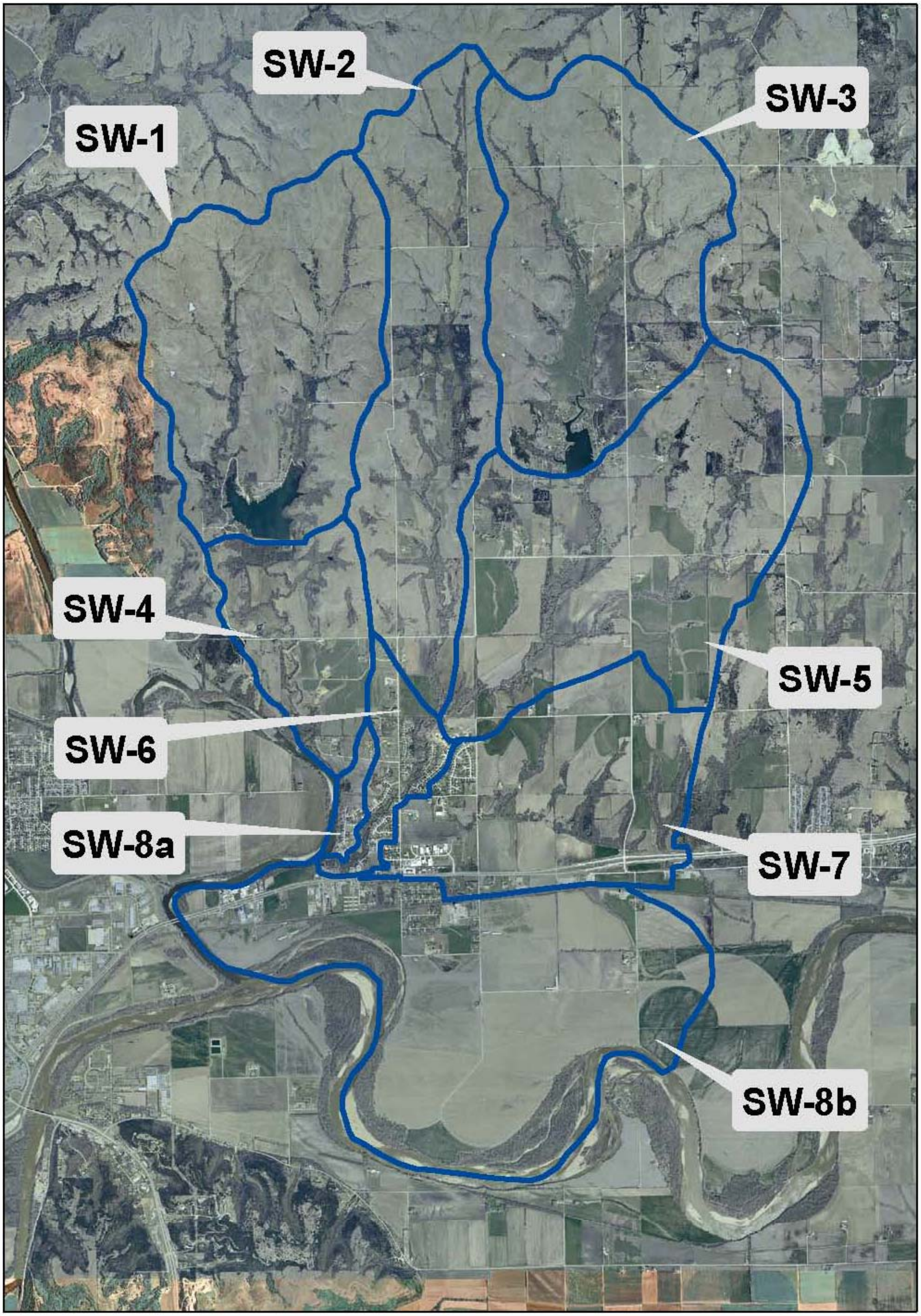
[og] undertake calculations to determine peak flows and volume of runoff: 1) for each of the eight sub watersheds; 2) for the three major tributary channel flows encompassed within the study area; and 3) for the total watershed study area; ---with separate sets of calculations for the <u>two year storm frequency</u>, for the <u>ten year storm frequency</u>, for the <u>twenty five year storm frequency</u> and for the <u>one hundred year storm frequency **at year 1969**, **at year 2004** and at **projected year 2015**</u>; --- and finally, develop two totally separate sets of runoff computations utilizing different methods for comparative purposes, one set of runoff computations utilizing the <u>Rational Method</u> and the other set of runoff computations utilizing <u>the TR55 Method</u>

[og] analyze runoff peak flows and volumes to determine and identify major points of flow stress, soil erosion, flooding and stream channel degradation within the defined case study area

[ ] identify the optimum location and type of storm water BMP's (best management practices) and stream channel restoration techniques that might be employed to mitigate, counter and otherwise lessen the negative impacts of increased storm water runoff and volumes due to urbanization within the case study area including 1) the retrofitting of in place storm drainage systems with appropriate best management practices within existing development where possible; --- and 2) propose the requirement that appropriate storm water best management practices be incorporated into any proposed future development as a condition of County approval

[ ] prepare and document the findings of the Blue Township Storm Water Management Case Study in the form of 1) an illustrated power point presentation and 2) a bound summary report for the Pottawatomie County Record

[ ] present the findings and recommendations of the Blue Township Storm Water Management Case Study to the Pottawatomie County Commissioners and the public at large at an open public forum presentation

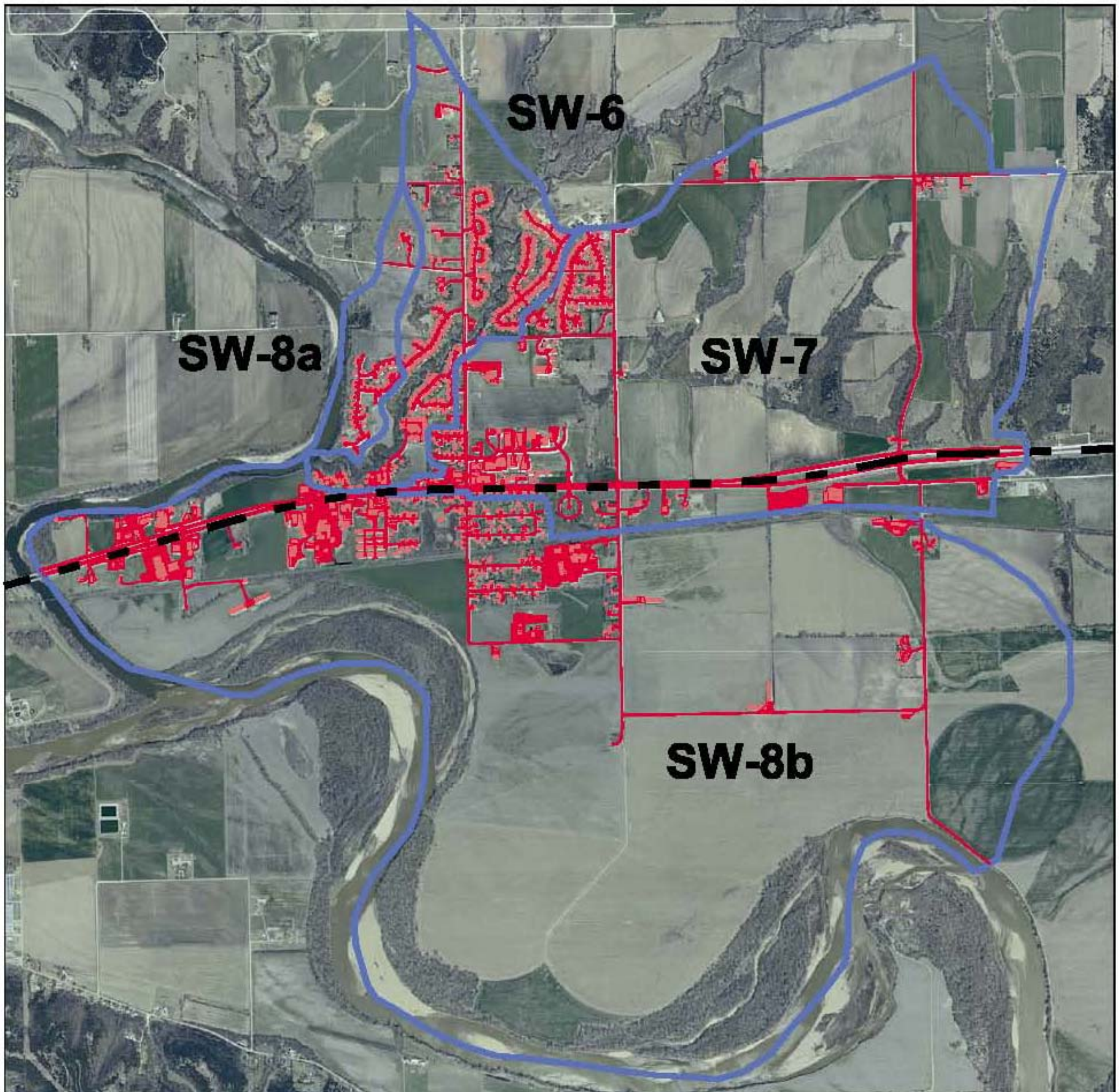


Blue Township Watershed Study

Kansas State University

Prof. Dennis J. Day

Department of Landscape Architecture



Impervious Cover (IC) along Highway 24

SW I.D. #	Area	Total IC	% IC
SW-6	308 Acres	49.5 Acres	16.1%
SW-7	1,367 Acres	102.9 Acres	7.5%
SW-8a	90 Acres	8.6 Acres	10.5%
SW-8b	2,587 Acres	118.8 Acres	4.5%

Prof. Dennis J. Day

Kansas State University
Department of Landscape Architecture

Design Intelligence®
Rankings for Landscape Architecture Programs Skills Assessment in "Construction Methods and Materials"

2005

CONSTRUCTION METHODS AND MATERIALS

1. Kansas State University
2. University of Georgia
3. Pennsylvania State University
4. California Polytechnic State University, San Luis Obispo
5. Ohio State University
6. Purdue University
7. Mississippi State University
8. Cornell University
   Iowa State University
   Louisiana State University

2007*

Construction methods and materials:

1. Kansas State University
2. University of Georgia
3. Louisiana State University
   Pennsylvania State University
   Purdue University

2008

Construction methods and materials

1. Kansas State University
2. University of Georgia
3. Cornell University
   Purdue University
5. Mississippi State University
   Texas A & M University

2009

Construction Methods and Materials

1. Kansas State University
2. Mississippi State University
   University of Georgia
4. Louisiana State University
   Purdue University

*** -** *no skills assessment rankings were given for 2006*

Material taken from Design Intelligence Reports – 2005, 2007, 2008, 2009