

Evaluation of Two Existing Midwest Subdivisions for Green Infrastructure Costs

Applied Ecological Services, Inc.
Gary Paradoski, P.E.

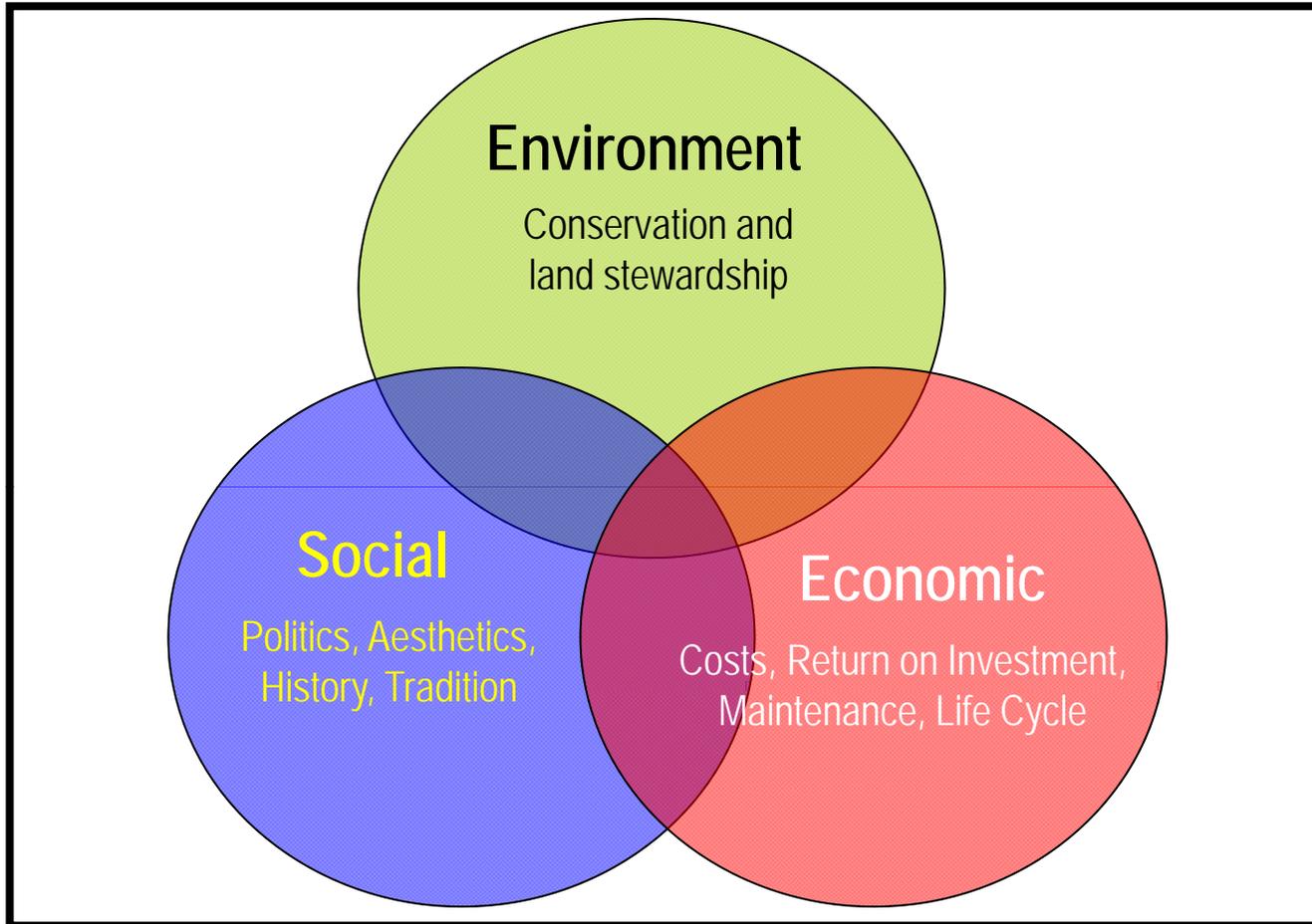
Applied Ecological Services, Inc.
West Dundee, Illinois

“Bringing the science of ecology to all land use decisions”

- Practice sound ecosystem science
- Work at all spatial scales
- Strive for ecosystem health



Triple Bottom Line



Sustainable Planning Objective:

High quality of life in the context of responsible land stewardship, economic viability, and long-term sustainability.



A set of environmental, economic and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality or availability of natural, economic, and social resources (ASCE, 2011).

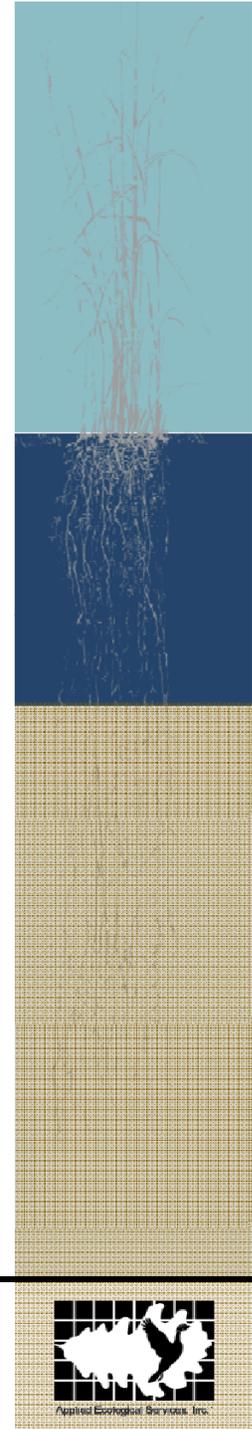


www.sustainableinfrastructure.org

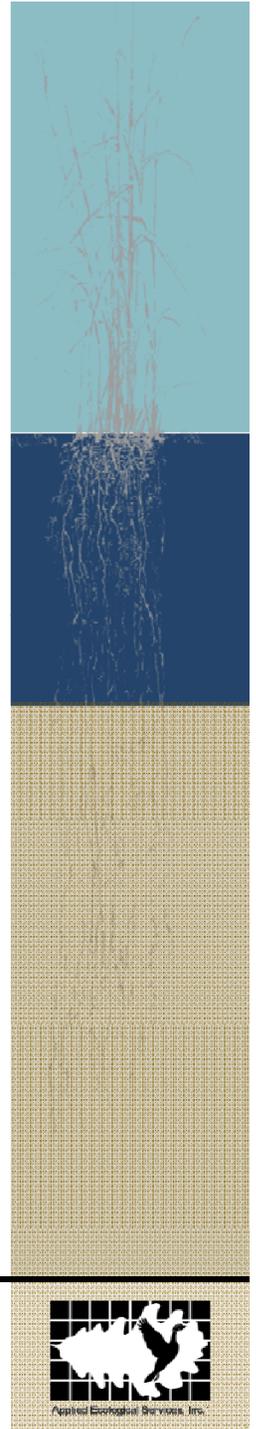


The Multiple, Valuable Functions of Open Space

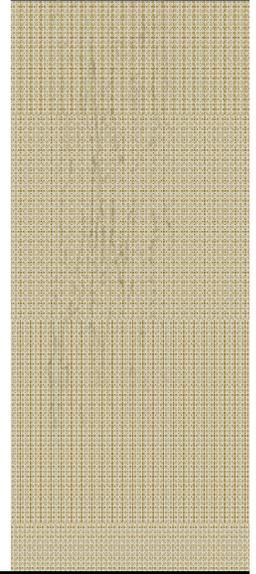
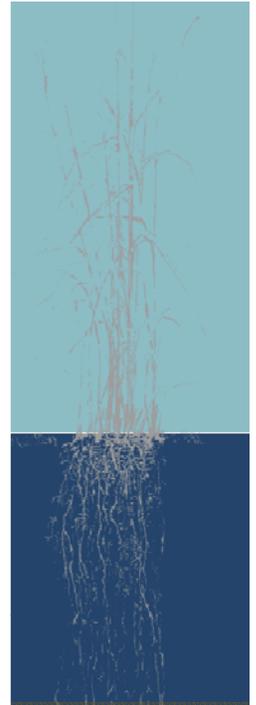
	<p>Visual/Aesthetic Value People see nature, not the neighbor's lot line; Makes the lot feel much bigger; Also can provide distance from & visual screening of adjacent unsightly areas.</p>
	<p>Sustainable Storm Water Management Open Space is the place where the Storm Water Treatment Train happens</p>
	<p>Pedestrian Circulation Open Space is the place where Paths and Trails are located, by which people have access to meet neighbors & access other open space areas; People more likely to walk and jog due to safety & comfort of surface</p>
	<p>Floral & Faunal Diversity Open Space can provide critical area for an increased variety of plant species to flourish, which in turn supports a greater diversity of fauna. Bird and Butterfly watchers will find increased satisfaction.</p>
	<p>Creating and Buffering Wildlife Corridors Open Space zones often transition to "critter highways" or provide essential buffering to adjacent environmentally sensitive areas.</p> <p>Farmland Preservation Farmland is Actively (through set-aside or integration) or Passively (Prairie=soil enrichment for potential future agricultural production) accommodated.</p>



Trail Networks: Connecting People



Prairie Restoration, Parks and Open Space



Experiencing the Open Spaces...



Looking out the window...

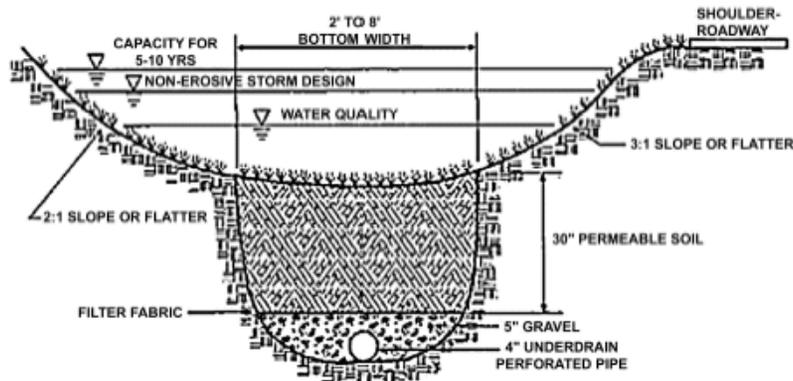


Stepping out the door...



Strolling along the path

Bioswales



Bioswales are used primarily for conveyance, but also promote infiltration and pollutant removal as denser, deeper root plants slow water and loosen soil better than short grasses.

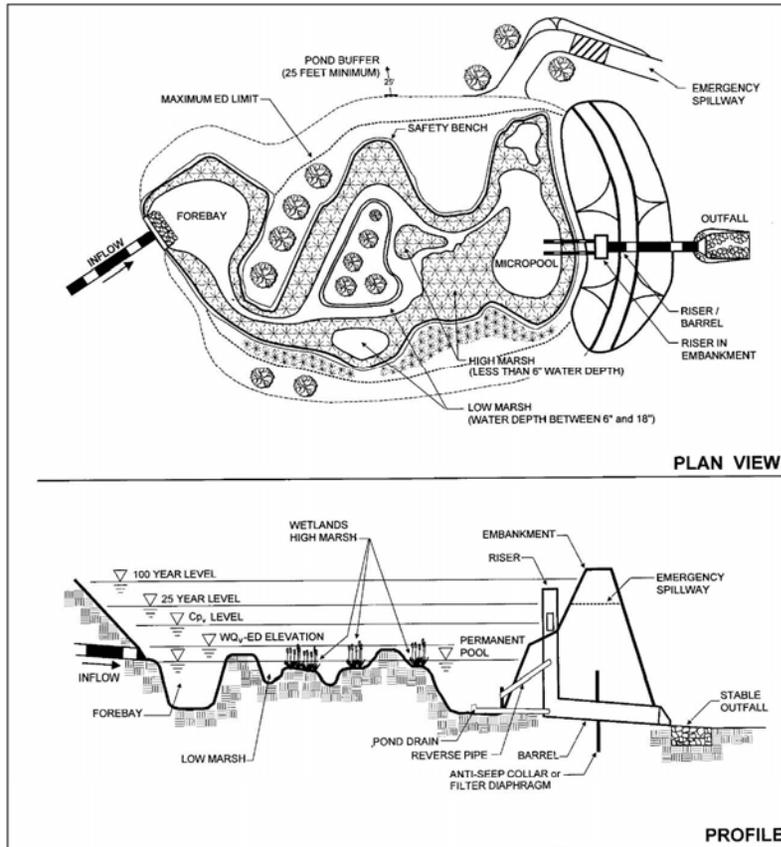
Design Considerations

- Drainage area <10 acres to maximize water quality benefits
- Design to convey larger storm events with non-erosive velocities

Maintenance

- Relatively low maintenance
- Remove trash and debris
- Repair any erosion problems
- Replace damaged vegetation

Extended Wetland Detention

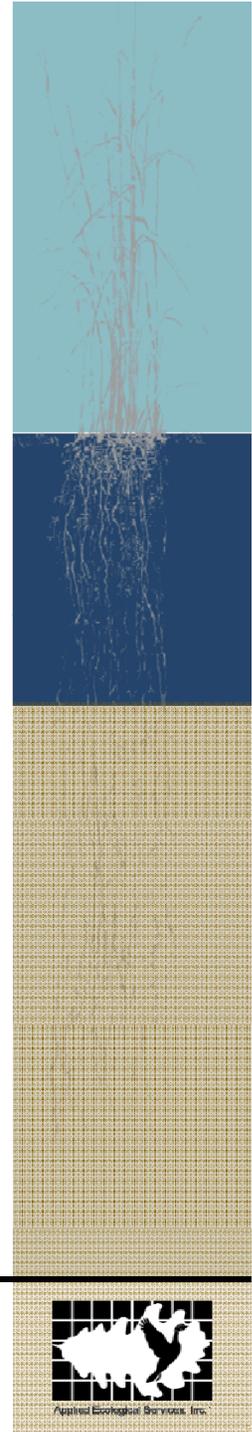
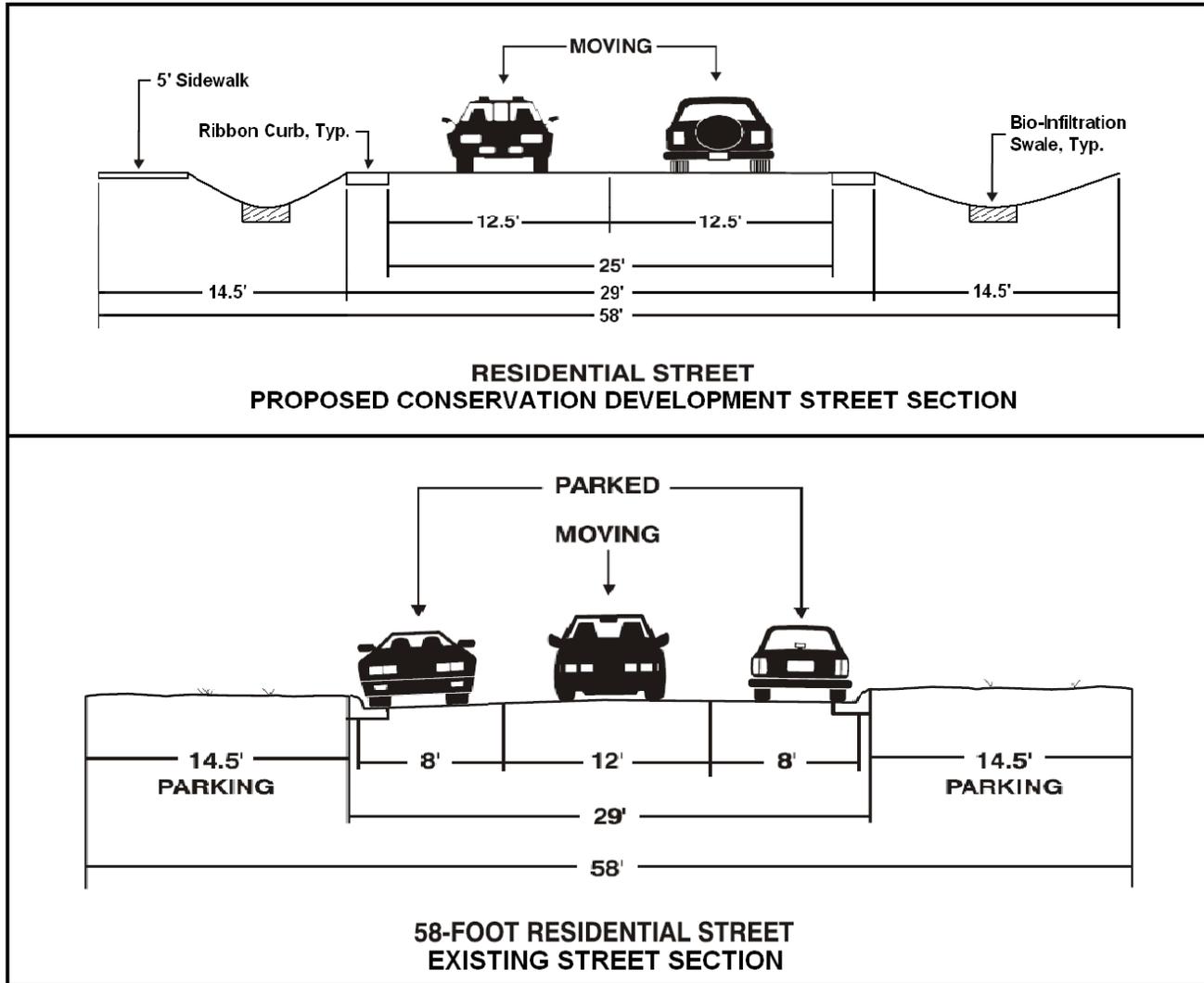


Treatment wetlands can remove nitrogen, organics, and suspended solids, while also providing storm water detention.

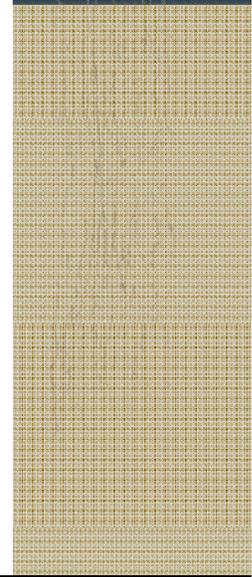
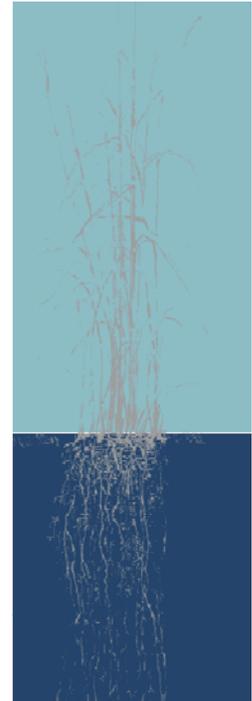
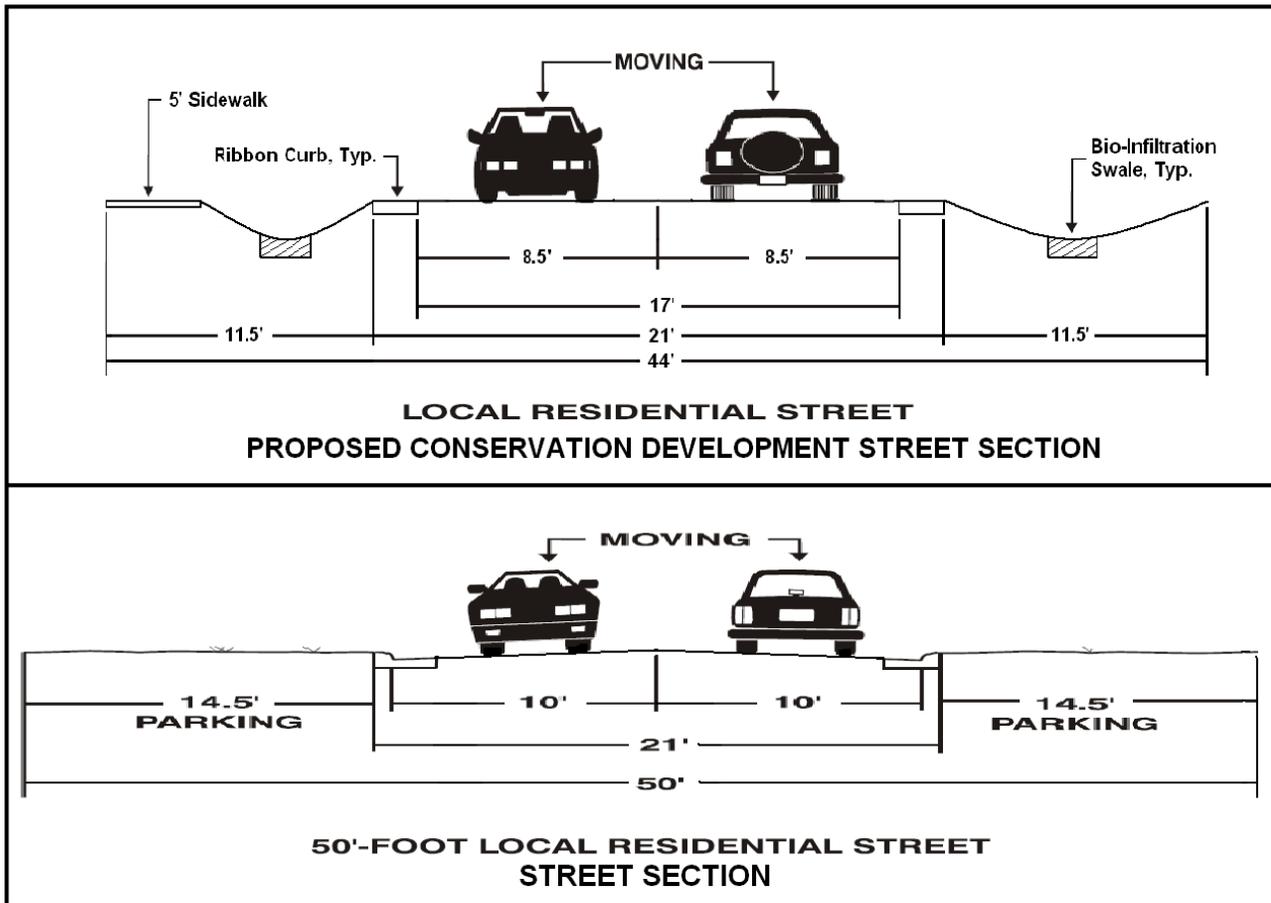
Design considerations

- Best in lowland areas with low infiltration rates
- Design to minimize water fluctuations that would compromise vegetation
- Maximize L:W ratio to increase flow path

58' Residential Streets



50' Local Residential Streets





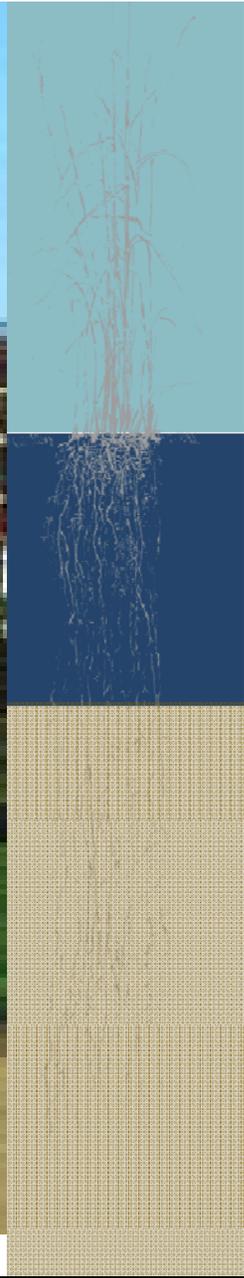
Prairie Crossing, Grayslake, Illinois

<http://www.epa.gov/owow/NPS/lid/costs07/documents/reducingstormwatercosts.pdf>

<http://www.prairiecrossing.com/>

Conservation Development





Prairie Crossing, Grayslake, Illinois

Conservation Development



Applied Ecological Services, Inc.



Prairie Crossing, Grayslake, Illinois

Conservation Development



Planning for the Conservation Development

<u>Component</u>	<u>Effect</u>
Rural or Hybrid Roads	Increased STT flexibility, reduced infrastructure cost (pipe, CB's, curbs)
Narrower Streets	Reduced impervious surface, slows traffic
Narrower ROW's	More appropriate Enclosure Scale; Reduced overall development footprint
Smaller Lots	Enables O/S creation while maintaining feasible densities
Reduced Setbacks	Front: More appropriate Enclosure Scale; Reduced Driveway length Side: More efficient clustering; makes room for periodic cut-throughs Rear: Flexibility in dealing with Common Open Space locations
Lots to O/S Placement	Facing O/S: Provides Porch orientation & Picture Window views; Backing O/S: Provides separation from rear neighbor; access to trails Creates good solution when front façades face ex. collectors/arterials
Recessed garage	Downplay the garage door; emphasize the front door; create parking nook
Trail Access Points	Access to O/S made convenient at Max. 900' front door to trail point

Example: Sun Prairie, Wisconsin

Conventional Development



Development Summary

Single Family Units: 340
(12,000 sq. ft.)

Multi-Family: 0 units

Total Site Acreage: 203 AC

Open Space: 16.81 AC (8%)
(community sewer)

Conservation Development



Development Summary

Single Family Units: 310
(8,000 sq. ft.)

Multi-Family: 30 units

Total Site Acreage: 203 AC

Open Space: 104.5 AC (51%)
(community sewer)

SITE INFORMATION

Site Acreage: 441 Acres
Location: This site is located in the NE quarter of the NW quarter and in the SE quarter of the NW quarter of Section 14, Township 3 North, Range 1 West, City of Plainville, Grant County, Wisconsin.
Existing Easements: "Rountree Recreational Trail Easement" @ 66' each side of the centerline of Rountree Branch (132' total width) extending from Mitchell Hollow Road to the Pecatonica Trail.
Existing Utilities: Waterline at NW corner of site (see plan) and sanitary sewer line extending from Grant St. south through site to Jackson St.



VICINITY MAP

LEGEND

Agricultural Lands	
	1a - Old Fields (Open) ±14.2 Acres
	1b - Old Fields (Woody Invasion) ±2.0 Acres
Forested Communities	
	2 - Historic Oak Savanna with Recently Developed Closed Canopy ±14.9 Acres
Wetland Communities	
	3a - Degraded Lowland Forest (Silver Maple, Eastern Cottonwood) ±2.7 Acres
	3b - Degraded Stream Corridor with Variable Shrub and Young Woody Canopy ±5.3 Acres
Other Map Features	
	Mowed Lawn ±0.8 Acres
	Severe Erosion
	Surface Drainage



TREES
 Native tree species are to be found throughout the site, some of which are well over a century old. These trees are important habitat for native fauna such as squirrel, owl, hawk, woodpecker, etc.

EROSION
 Evidence of recent erosion suggests "flashy" stormwater movement in this area which threatens to destabilize forested slopes.



EROSION: Existing eroded drainage way along Mitchell Hollow Road, which enters at the northwest corner of the property.



STORMWATER OUTLET
 This culvert originates at the curb inlets along Lincoln Street. Significant erosion at base of pipe and downspout is evident.

Existing Meadow

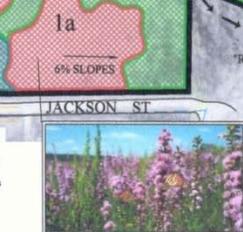
This north-facing panoramic view (West to East) shows the open meadow area at the northwest corner of the site and faces a possible roadway ingress/egress point for the site along Grant Street.



Swamp Milkweed
Asclepias incarnata
 Clusters of bright pink, delicately fragrant flowers are extremely attractive to Monarch Butterflies.



CARDINAL FLOWER
Loebelia cardinalis
 This beautiful wildflower can be found in wet prairie, wet woods, and wetland habitats and is especially loved by hummingbirds.



PRAIRIE
 A favorite prairie flower of many people, Blazing Star will create a dramatic midsummer display in restored areas.



Blue Joint Grass
Calamagrostis canadensis
 A gracefully arching wet prairie grass with a leathery seedhead over blue-green foliage.



Rountree Recreational Trail
 An inviting pathway through wooded areas at Southeast corner of property. Consideration should be given to preserving & enhancing this trail as a natural link into the WAGR Pecatonica Trail located along the abandoned Chicago-Milwaukee-St. Paul & Pacific Railroad.



PRAIRIE
 Yellow Coneflower, Bee Balm, and Pale Purple Coneflower are just a few prairie plants that can provide color to a restored meadow.



GROUNDWATER RECHARGE
 The accelerated flow of stormwater due to channelization and piping hinders the ability of water to infiltrate back into the ground to provide proper base flow into the Rountree Branch. Under natural circumstances, rainwater is soaked as it infiltrates and is a critical factor in maintaining cold water stream habitat for species such as Brown Trout and other fishes, mentioned below.



BROWN TROUT
Salmo trutta
 The upper reach of the Rountree Branch represents a major rearing/feeding area for the Brown Trout and some other fish species, such as Creek Chubs, Common Shiners, Fantail and Johnny Darters, Blacknose and Longnose Dace, and White Suckers.
 -Kris Wright, U. of Wisconsin-Platteville



WOOD DUCK
Aix sponsa
 The surface-feeding woodland duck is equipped with sharp claws for perching in trees. It nests in tree cavities and nest boxes.



BELTED KINGFISHER
Ceryle alcyon
 This year-round resident is a solitary bird of wooded streams and ponds. They dig nest burrows in stream banks. They fish while hovering or from low perches, plunging headfirst to catch their prey.



GREAT BLUE HERON
Ardea herodias
 An elegant bird of this freshwater river habitat. It nests in colonies and forages in shallow water and wetland areas for the fish, small mammals, and aquatic macroinvertebrates which are found in the Rountree Branch ecosystem.

SCALE: 1" = 100'

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Clare Properties: Rountree Branch Conservation Development - Natural Resource Inventory





SITE INFORMATION

Site Acreage: ±41 Acres
Location: This site is located in the NE quarter of the NW quarter and in the SE quarter of the NW quarter of Section 14, Township 3 North, Range 1 West, City of Platteville, Grant County, Wisconsin.
Existing Easements: "Rountree Recreational Trail Easement" @ 66' each side of the centerline of Rountree Branch (132' total width) extending from Mitchell Hollow Road to the Pecatonica Trail.
Existing Utilities: Waterline at NW corner of site (see plan) & sanitary sewer line extending from Grant St. south through site to Jackson St.

DEVELOPMENT DATA

Site Acreage: ±41 Acres
Total SF Units: ±38 Units
Total MF Units: ±32 Units
Total Combined Units: ±70 Units
Gross Density: ±1.7 DU/Acre
Open Space: ±22.9 Ac (56%)



VICINITY MAP



SCALE: 1" = 100'



PREPARED NOVEMBER, 2002
 FOR: E. R. CLARE
 BY: CT (JOB # 02-158)

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- ~ TOWNHOUSE CONCEPT ~
- ★ ELEGANT ARCHITECTURE
 - ★ INDIVIDUAL GARAGES
 - ★ NATURE TRAILS



- ~ SINGLE FAMILY HOME CONCEPT ~
- ★ "FOUR-SIDED" ARCHITECTURE
 - ★ ±2600 SF HOME FACING/BACKING ONTO NATURAL AREAS & OPEN SPACE
 - ★ IN PROXIMITY TO INTERCONNECTED TRAIL SYSTEM



Clare Properties: Rountree Branch Conservation Development - Concept



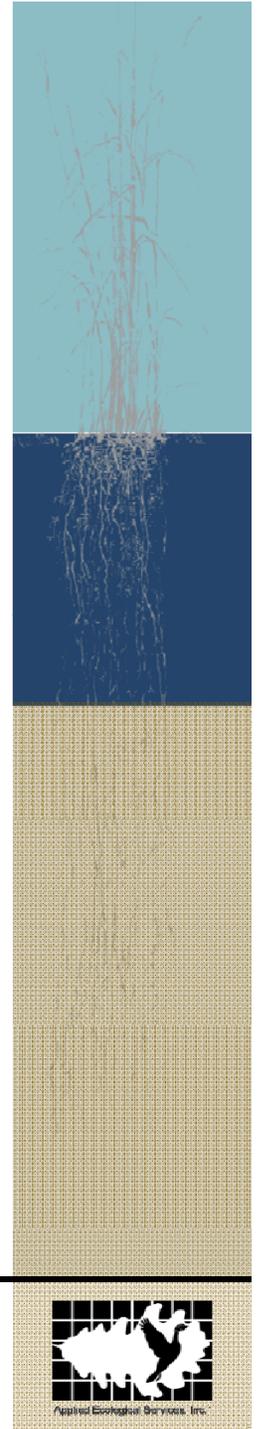
Comparison Challenges

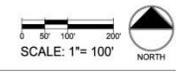
- Residential development freeze
- Conservation bids for comparison
- Long-term construction efficiencies/innovation
- Long-term maintenance savings
- Quantifying intangibles/quality of life

Assumptions

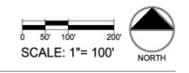
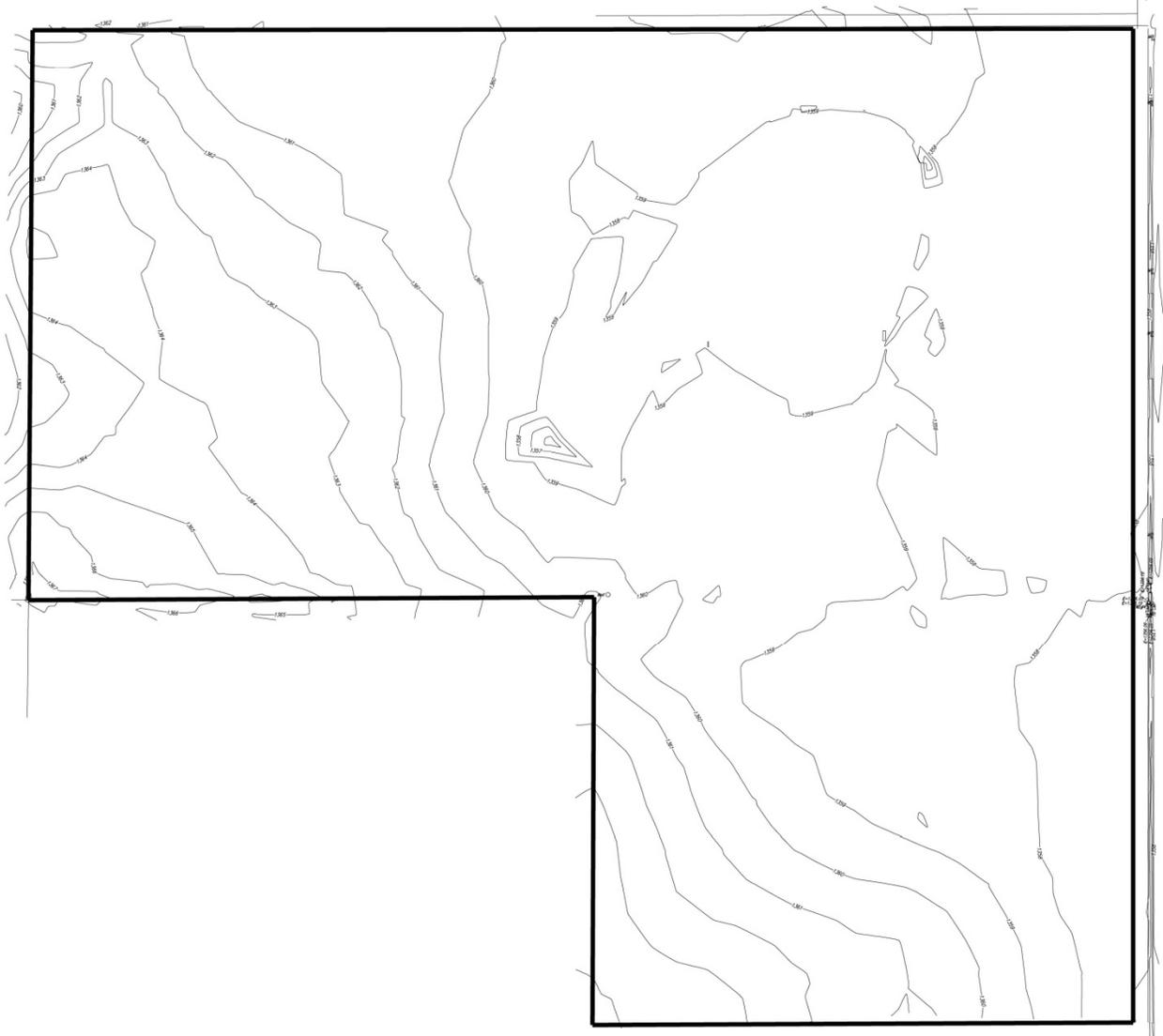
- RS Means Cost Data 2011, AES Contracting, 2006 unit costs, not DOT bids
- City Cost Index (94%)
- Historical Cost Index 2007 (91.6%)
- Ave. O & P, not flat rate
- Equipment & Crews
- Compare to 2007 Construction Costs

Conservation Design Overlay Process "Goldstone"

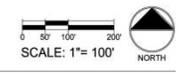
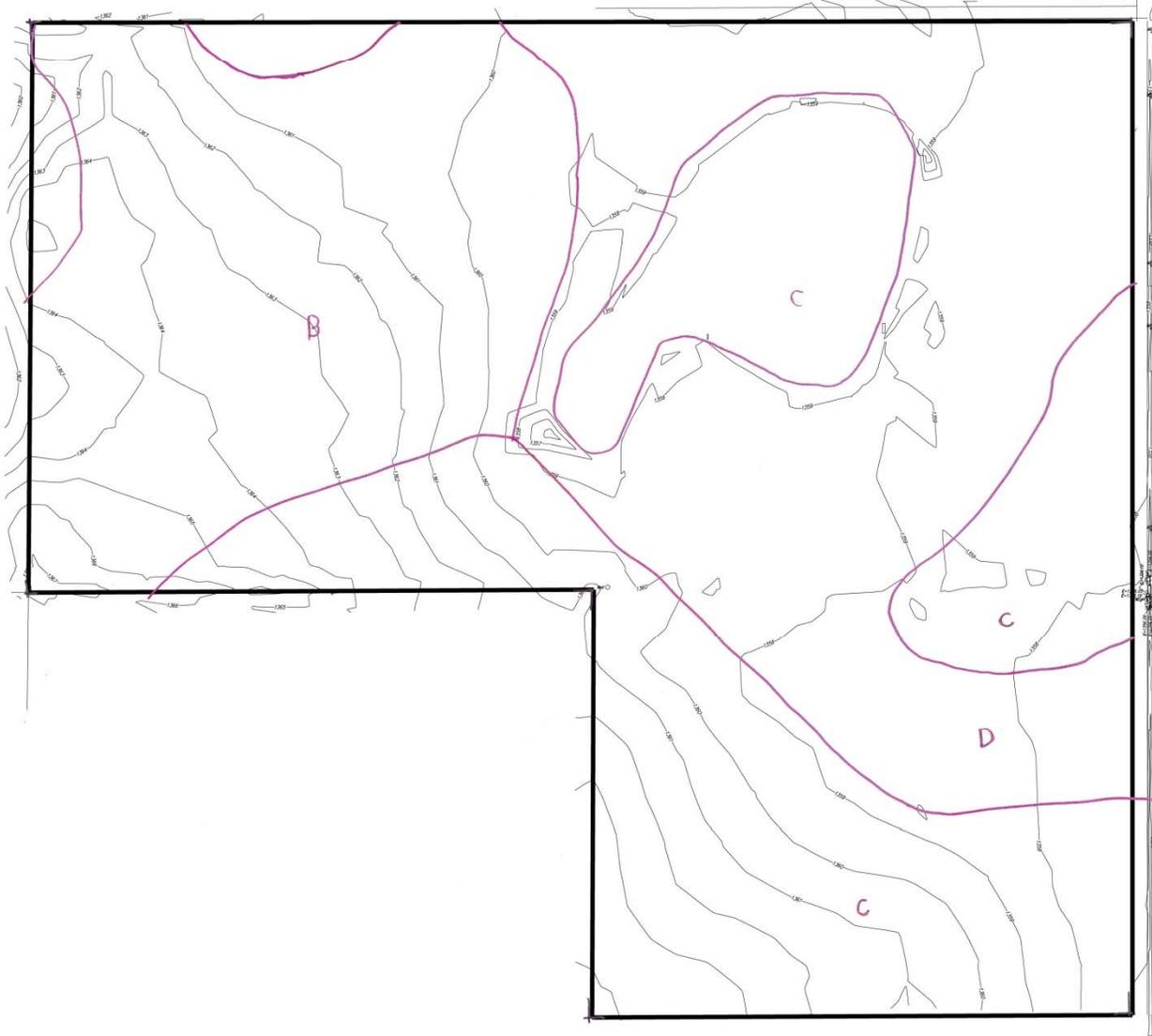




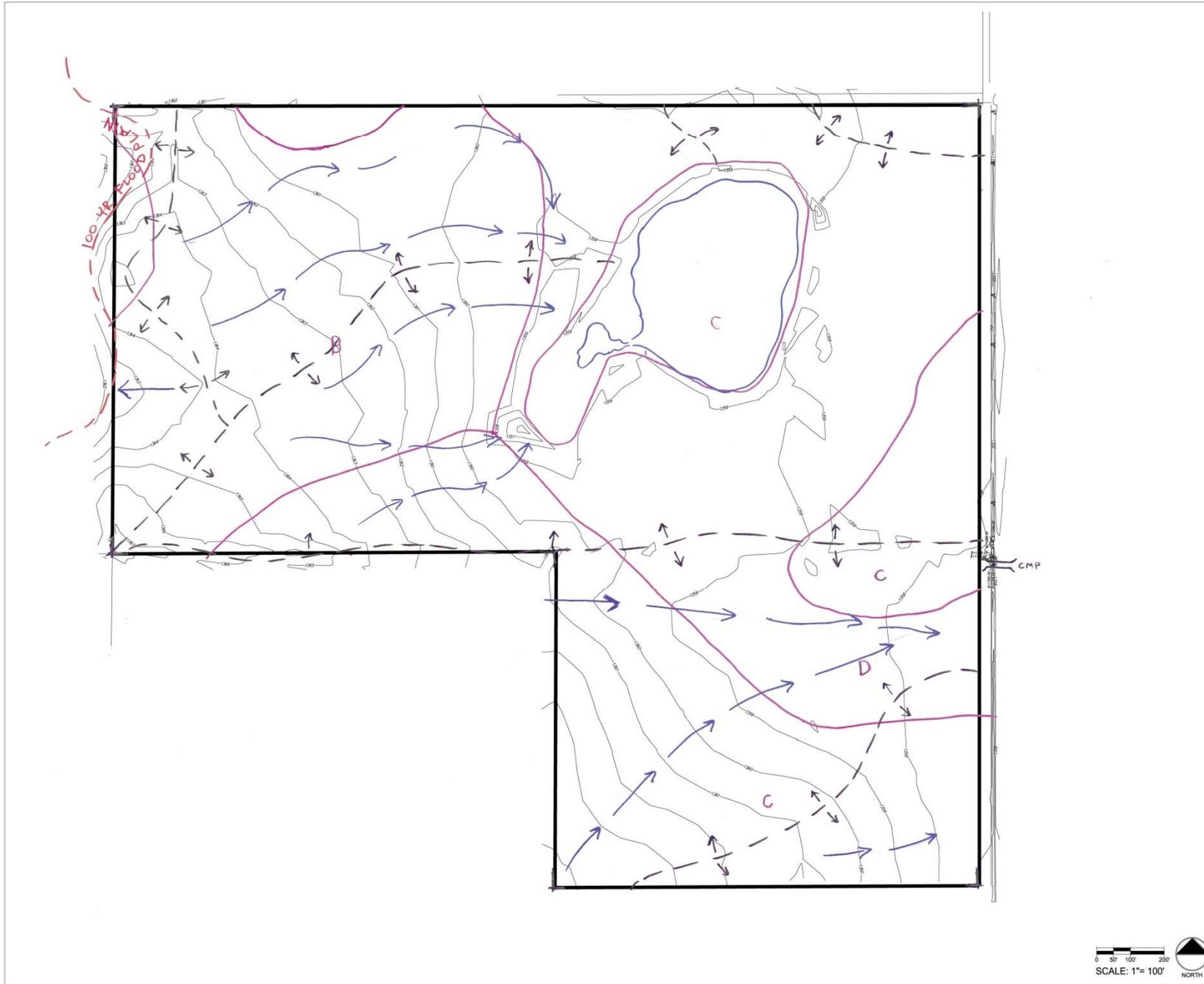
Aerial Photo + Boundary



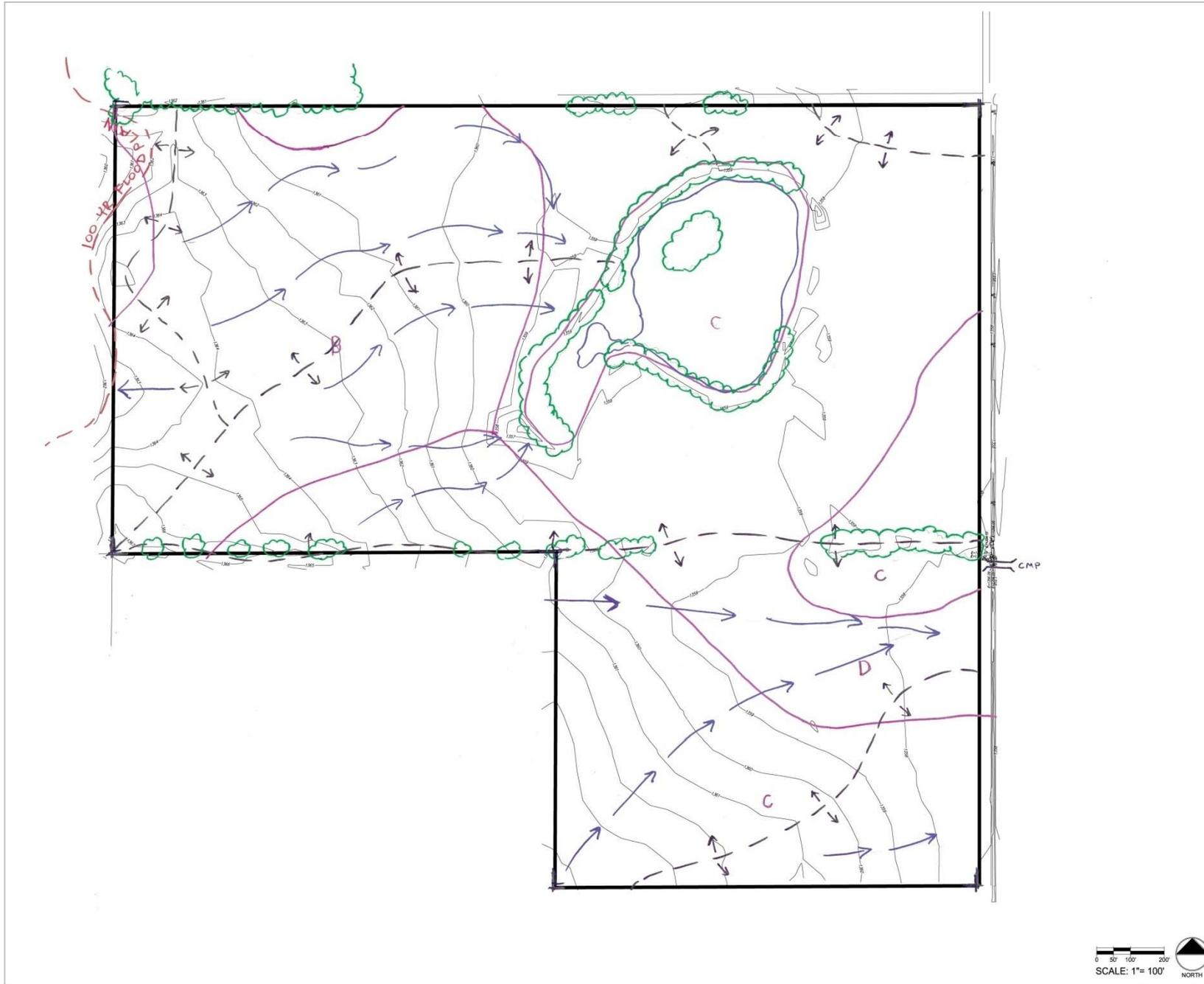
Base Topo



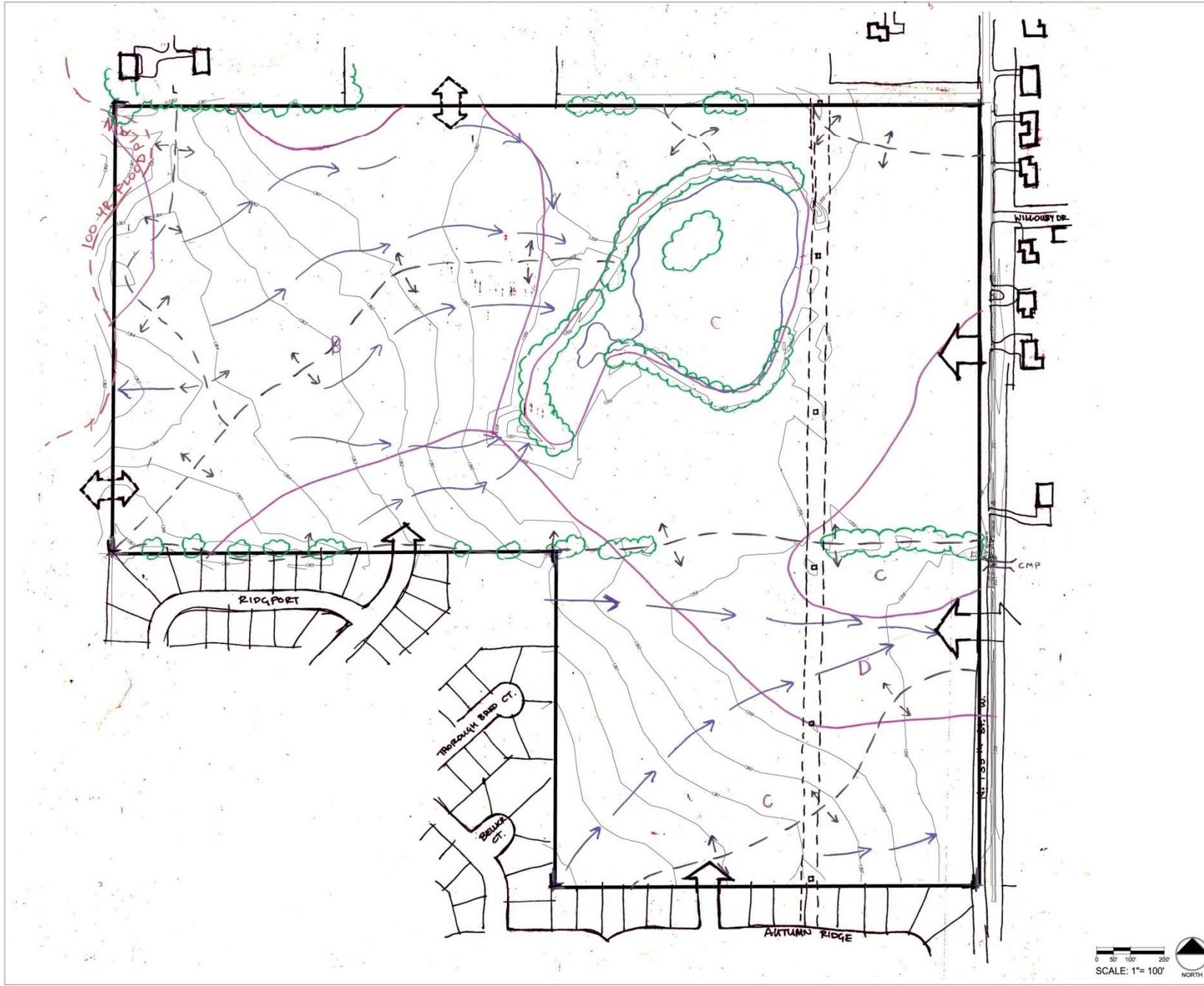
Base Topo + Soils



Base Topo + Soils + Ex. Drainage



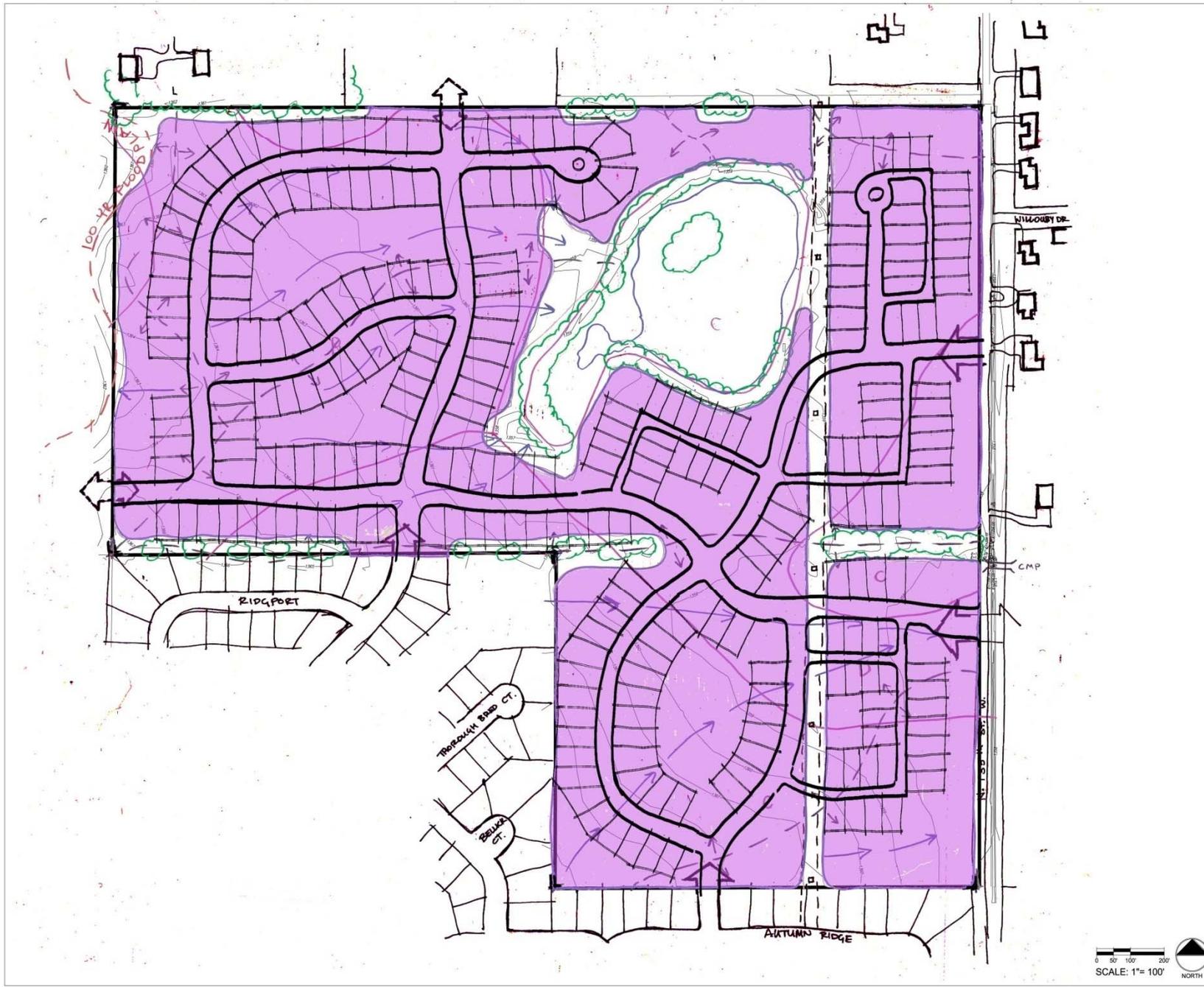
Base Topo + Soils + Ex. Drainage + Woods



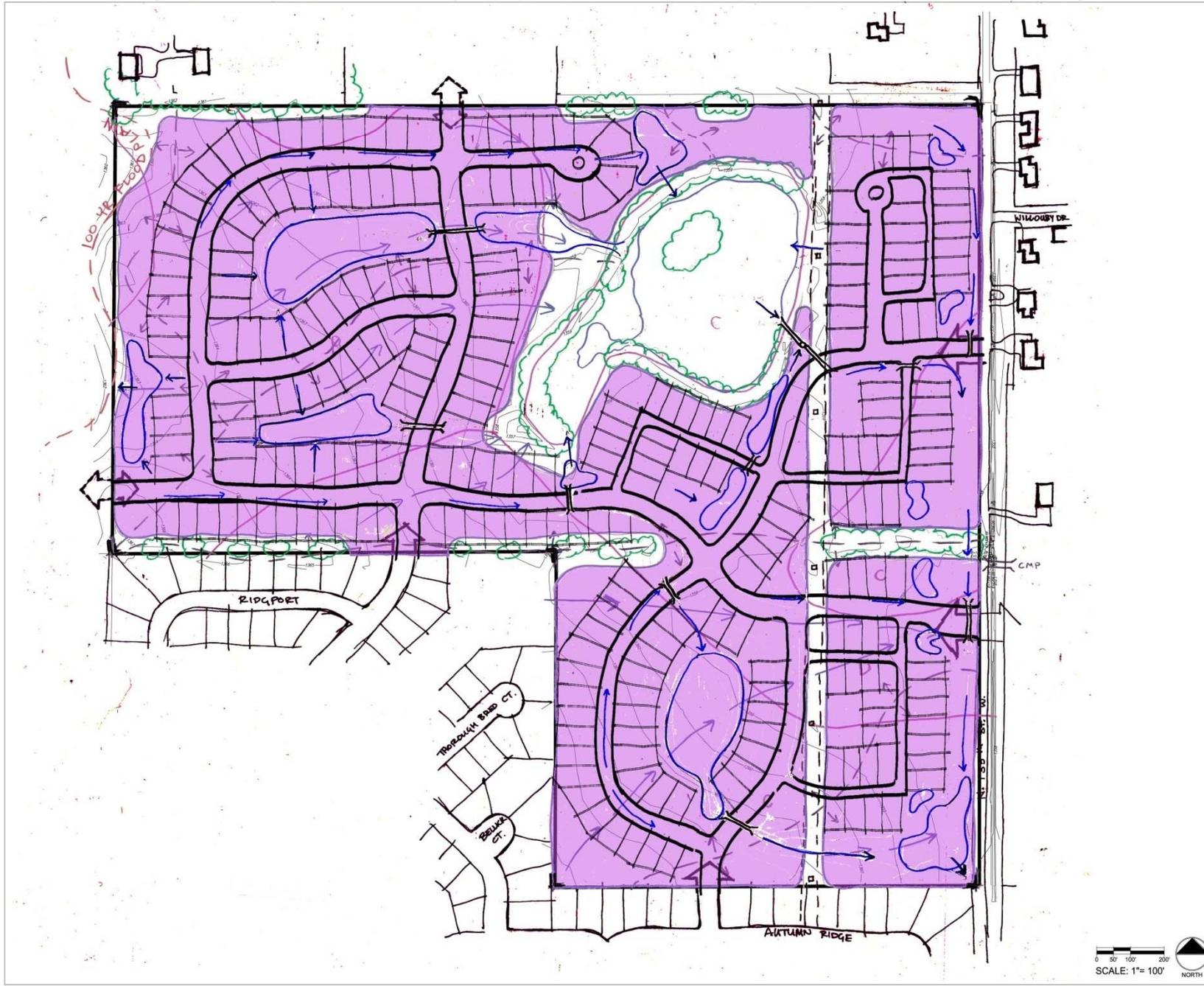
Base Topo + Soils + Ex. Drainage + Woods + Cultural



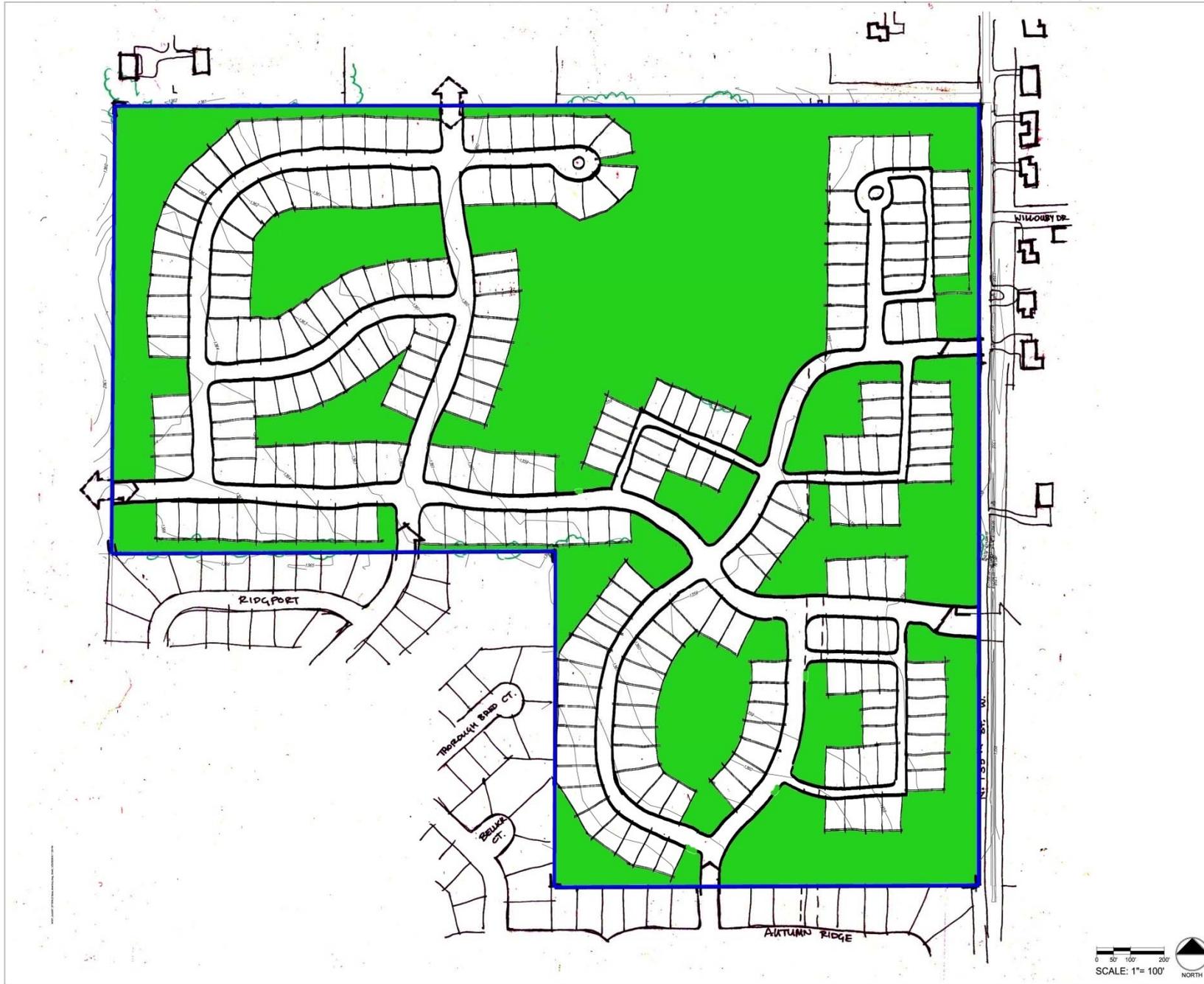
Base Topo + Soils + Ex. Drainage + Woods + Cultural + Dev Zones



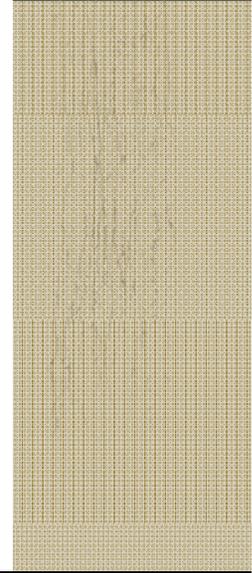
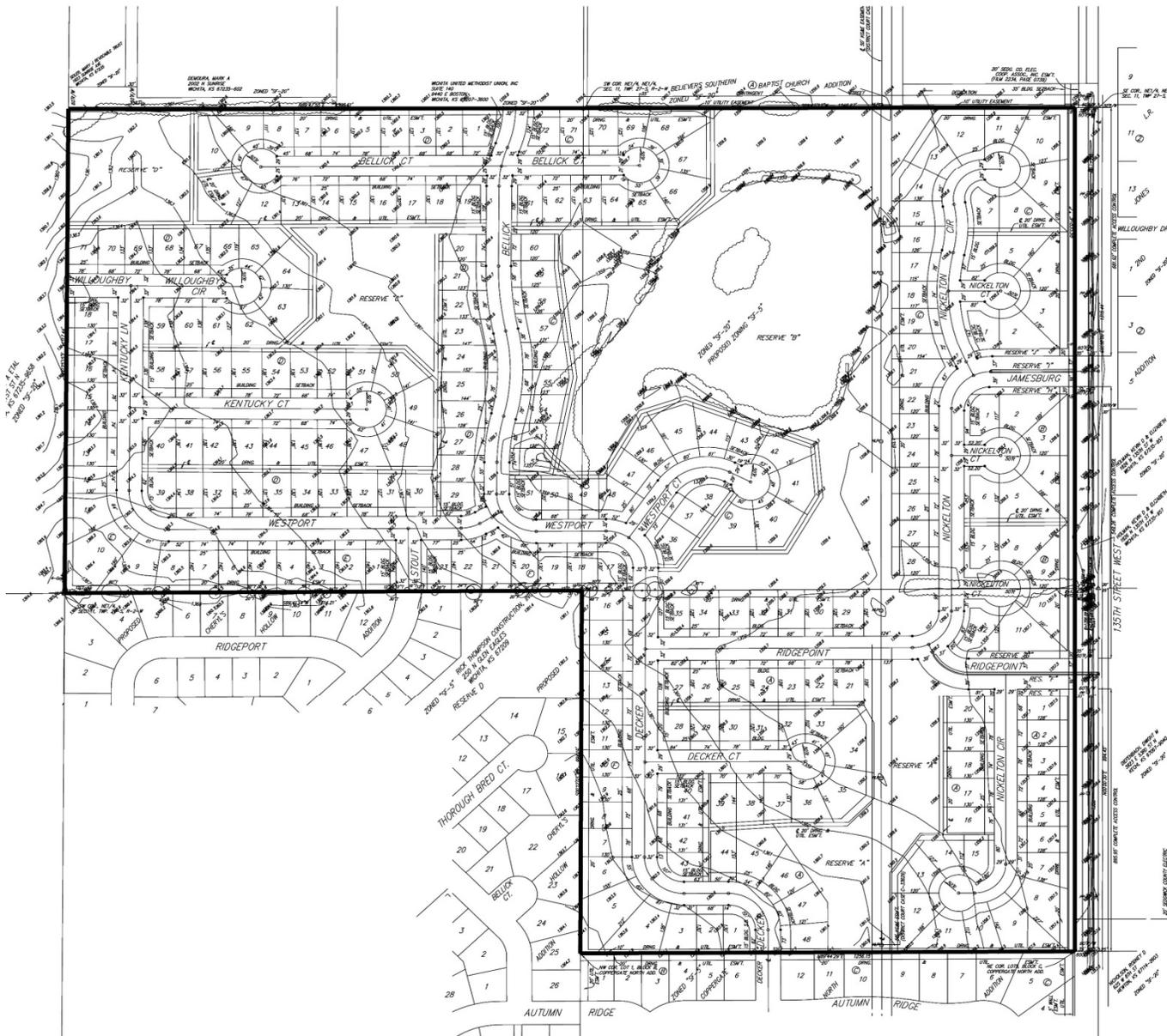
Base Topo + Soils + Ex. Drainage + Woods + Cultural + Dev Zones + Concept



Base Topo + Soils + Ex. Drainage + Woods + Cultural + Dev Zones + Concept + Stormwater



Concept + Open Space



Conservation Development

"Goldstone": Conventional Plan



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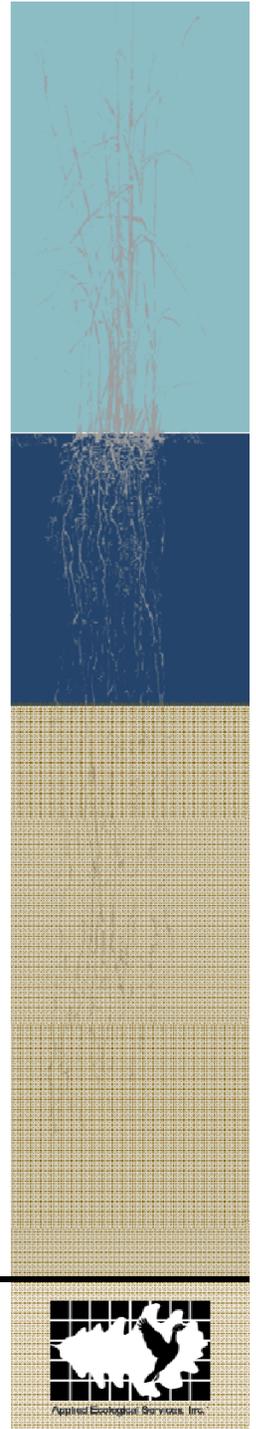
Design Comparison – “Goldstone”

Conventional

Total: 106 ac
Open Space: 27.2 ac
Lots: 244
Lot Area: 62 ac
Roads: 13,096 lf
Pavement: 8.7 ac
Sewers: 17,411 lf
Water: 10,860 lf
Storm: 5,635 lf
Detention: 6.2 ac

Conservation

Total: 106 ac
Open Space: 49.3 ac
Lots: 247
Lot Area: 41.1 ac
Roads: 12,497 lf
Pavement: 5.9 ac
Sewers: 13,051 lf
Water: 12,892 lf
Storm: 882 lf
Detention: 7.3 ac



Construction Costs – “Goldstone” Conventional

Project #	448-90238	468-84243	468-84345	472-84459	448-90239	448-90240	472-84461	472-84460	468-84244	468-84245	1767 PPS	*468-84681						
OCA #	735366	744233	744234	766152	735413	735414	766203	766205	744278	744279	607861	751490						
Date	May 2007	May 2007	May 2007	July 2007	April 2008	April 2008	July 2008	July 2008	April 2008	April 2008	April 2007	Sept 2010						
Type	WDS	San Sew	San Sew	Paving	SWS	WDS	WDS	Paving	SWS	Paving	SWS	San Sew	San Sew	SWS	SWD	SWD	Total	%
Paving				\$307,188.00				\$266,304.75		\$314,900.00							\$888,392.75	28.84%
Storm Water					\$105,011.00				\$161,437.00		\$138,303.00			\$3,294.00	\$19,186.00		\$427,231.00	13.87%
Sidewalk/Wheelchair Ramp				\$11,218.47	\$3,941.63			\$8,745.72	\$5,360.28	\$12,531.40	\$5,370.60						\$47,168.10	1.53%
Grading				\$8,834.68	\$3,104.07			\$29,223.08	\$17,910.92	\$22,659.35	\$9,711.15				\$499,800.00	\$93,804.00	\$685,047.25	22.24%
Traffic				\$2,960.00	\$1,040.00			\$691.30	\$423.70	\$742.00	\$318.00						\$6,175.00	0.20%
Site Clearing & Restoration	\$200.00	\$3,500.00	\$9,000.00	\$11,704.00	\$3,696.00	\$175.00	\$200.00	\$10,983.30	\$6,731.70	\$3,850.00	\$1,650.00	\$2,400.00	\$3,550.00	\$1,042.00	\$51,078.00	\$12,600.00	\$122,360.00	3.97%
Erosion Control	\$802.45	\$2,596.00	\$806.00	\$4,616.34	\$1,621.96	\$190.00	\$270.75	\$5,611.25	\$3,439.15	\$3,239.50	\$1,388.36	\$1,525.00	\$3,245.00	\$382.00	\$18,693.00	\$7,651.17	\$56,077.93	1.82%
Water	\$86,202.10					\$64,979.45	\$62,821.95										\$214,003.50	6.95%
Sewer		\$265,068.00	\$104,259.00									\$118,693.00	\$141,610.00				\$629,630.00	20.44%
Direct Drilling	\$3,945.45																\$3,945.45	0.13%
Sub Contract Amount	\$91,150.00	\$271,164.00	\$114,065.00	\$346,521.49	\$118,414.66	\$65,344.45	\$63,292.70	\$321,559.40	\$195,302.75	\$357,922.25	\$156,741.11	\$122,618.00	\$148,405.00	\$4,718.00	\$588,757.00	\$114,055.17	\$3,080,030.98	



POPC – “Goldstone” Conservation

Site Preparation	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Mobilization/Demobilization	1	EA	11600	10904	9988	9,988	Dozers, loaders, backhoes, excav, grader, paver, roller, scrapers, equipment
	Construction Fencing	3500	LF	5	4.7	4	15,068	Delineate protected areas
	Traffic Control	1	LS	7171	6740.74	6175	6,175	Road signage
	Site Superintendent	24	WK	3000	2820	2583	61,995	
	Construction Trailer	6	MO	1200	1128	1033	6,199	Rent, utilities, phone, facilities
							99425	Sub-total
Sanitary Sewer								
Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes	
				Adjustment (94%)	Adjustment (91.6%)			
	Connect to Existing Manhole	1	EA	3300	3102	2841	2,841	
	Doghouse Sanitary Sewer Manhole, Complete and Connect Existing Sewer	2	EA	4200	3948	3616	7,233	
	Directional Drilling	1	LS	4582	4307.08	3945	3,945	Match bid item
	Sanitary Sewer Pipe	13,051	LF	38	36	33	427,022	8" PVC pipe, 10' - 20' deep
	Sanitary Sewer Manhole, Complete	71	EA	4500	4230	3875	275,102	Includes frames and lids, 10' - 20' deep
	Sanitary Sewer Service Pipe	6,351	LF	30	28	26	164,054	6" PVC pipe w/riser
	Compacted Sand backfill (10% of sewer)	1,305	LF	42	39	36	47,197	
	Testing & Televising	13,051	LF	10	9	9	112,374	
							1,039,770	Sub-total
Water Main								
Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes	
				Adjustment (94%)	Adjustment (91.6%)			
	Pressure Connect to Existing Water Main	6	EA	2700	2538	2325	13,949	8" Tapping Sleeve, Valve and Valve Box
	Water Main Pipe	12,892	LF	51	48	44	566,127	8" D.I. pipe, 5' Bury Depth to top of pipe
	Fire Hydrant Assembly, Complete	34	EA	3200	3008	2755	93,681	Hydrant, Valve, Valve Box
	Gate Valve & Well	65	EA	1675	1575	1442	93,746	8" Valve and Box
	Water Services	7,925	LF	36	34	31	245,655	1.5" copper service pipe
	Water Services Apurtenances	259	EA	650	611	560	144,956	Includes Corporate Stops, Curb Stops and Valve Box
							1,158,113	Sub-total
Storm Sewer and On-Site Stormwater Management								
Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes	
				Adjustment (94%)	Adjustment (91.6%)			
	Extended Wetland Detention Ponds	7.3	AC	72500	68150	62425	455,705	3' bounce, 6" - 18" perm. pools, native seed, scraper
	Bio-Swales	3,200	LF	37	35	32	101,947	3' deep, native plugs & seed, dozer
	Culverts	882	LF	38	36	33	28,659	18" CMP (ave.)
	End Sections	20	EA	220	207	189	3,789	
	Outlet Control Structure	1	EA	5000	4700	4305	4,305	dual stage outlet w/low flow restrictor & outlet pipe
							594,605	Sub-total

Street (Local Residential)	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Bituminous Asphalt Pavement	4,430	SY	17	15.98	15	64,845	3" pavement (including strip & grading)
	Aggregate Base	4,430	SY	20	19	17	76,288	12" aggregate @ 110 lbs/in ³ SY
	Concrete Ribbon Curb	8	LF	8	8	7	32,251	machine formed w/5% radius
	Concrete Sidewalk	11,705	S.F.	5	5	4	50,392	4" conc. w/4" aggr. Base
	Street Lights		EA	955	898	822	4,934	
	Street Trees	220	EA	350	329	301	66,300	Shade & ornamental w/ROW landscaping
	Electric Conduit	2,580	LF	27	25	23	59,980	3" dia galv. Steel
	Road-Side Bio-Swale	434	C.Y.	37	34.78	32	13,811	3' deep, plugs & seed, dozer
							368,802	Sub-total
Street (Residential)								
Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes	
				Adjustment (94%)	Adjustment (91.6%)			
	Bituminous Asphalt Pavement	28,220	SY	17	15.98	15	413,075	3" pavement (including strip & grading)
	Aggregate Base	28,220	SY	20	19	17	485,971	12" aggregate @ 110 lbs/in ³ SY
	Concrete Ribbon Curb	20,312	LF	8	8	7	139,916	machine formed w/5% radius
	Concrete Sidewalk	50,780	S.F.	5	5	4	218,618	4" conc. w/4" aggr. Base
	Street Lights		EA	955	898	822	22,202	
	Street Trees	930	EA	350	329	301	280,269	Shade & ornamental w/ROW landscaping
	Electric Conduit	11,184	LF	27	25	23	260,007	3" dia galv. Steel
	Road-Side Bio-Swale	1,881	C.Y.	37	34.78	32	59,918	3' deep, plugs & seed, dozer
							1,879,974	Sub-total
Clearing & Restoration								
Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes	
				Adjustment (94%)	Adjustment (91.6%)			
	Clear & Grub	-	AC	20750	19505	17867	-	Entirely farmed, no trees
	Topsoil Strip/Stockpile		AC	1800	1692	1550	91,442	Open space & Lots (excluding detention and roads)
	Mass Grading		AC	1200	1128	1033	60,962	Open space & Lots (excluding detention and roads)
	Topsoil Re-spread		AC	4400	4136	3789	145,860	Open space & 1/2 Lots (excluding detention)
	Prairie Restoration		AC	2000	1880	1722	68,367	Native seed (including undisturbed areas)
	Nature Trails	12672	LF	22	20.68	19	240,044	4" wood chip w/8" aggr. Base
							606,675	Sub-total
Erosion Control								
Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes	
				Adjustment (94%)	Adjustment (91.6%)			
	Silt Fence	3500	LF	1	0.94	0.86	3,014	Downslope and around topsoil stockpile
	Erosion Blanket	13	AC	7100	6674	6113	79,474	Open space and detention
	Rip-rap	110	TON	40	37.6	34	3,789	Culverts and spillway
	Construction Access Driveway	1	EA	600	564	517	517	50x10'
	Street Sweeping	24	WK	2100	1974	1808	43,396	During construction season
	Water Truck	4	WK	4615	4338.1	3974	15,895	During mass grading
							146,084	Sub-total
							5,893,448	Total

Comparison Summary – “Goldstone”

Conventional

Conservation

	Traditional				Conservation		% Change	Notes					
		Grading	Sub-Total	%	Sub-Total	%							
Paving	\$ 888,393	\$ 60,717	\$ 949,110	30.81%	\$ 2,201,608	37.36%	132%	includes topsoil strip & haul					
Storm Water	\$ 427,231	\$ 624,330	\$ 1,051,561	34.14%	\$ 594,605	10.09%	-43%	includes bio-swales & detention					
Sidewalk/Wheelchair Ramp	\$ 47,168		\$ 47,168	1.53%	\$ 47,168	0.80%	0%	match bid					
Traffic	\$ 6,175		\$ 6,175	0.20%	\$ 6,175	0.10%	0%	match bid					
Site Clearing & Restoration	\$ 122,360		\$ 122,360	3.97%	\$ 699,925	11.88%	472%	includes mobilization & restoration of undisturbed areas					
Erosion Control	\$ 56,078		\$ 56,078	1.82%	\$ 146,084	2.48%	161%	includes street sweeping & water trucks					
Water	\$ 214,004		\$ 214,004	6.95%	\$ 1,158,113	19.65%	441%	ductile iron with mechanical joints					
Sewer	\$ 629,630		\$ 629,630	20.44%	\$ 1,035,824	17.58%	65%	along roads, 10% trench backfill					
Direct Drilling	\$ 3,945		\$ 3,945	0.13%	\$ 3,945	0.07%	0%	match bid					
	\$ 2,394,984	\$ 685,047	\$ 3,080,031	100.00%	\$ 5,893,448	100.00%	91%						

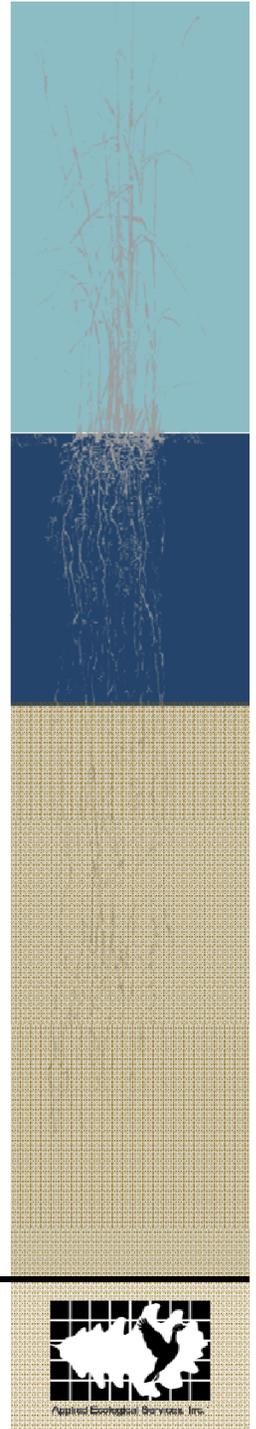
Like Unit Costs – “Goldstone”

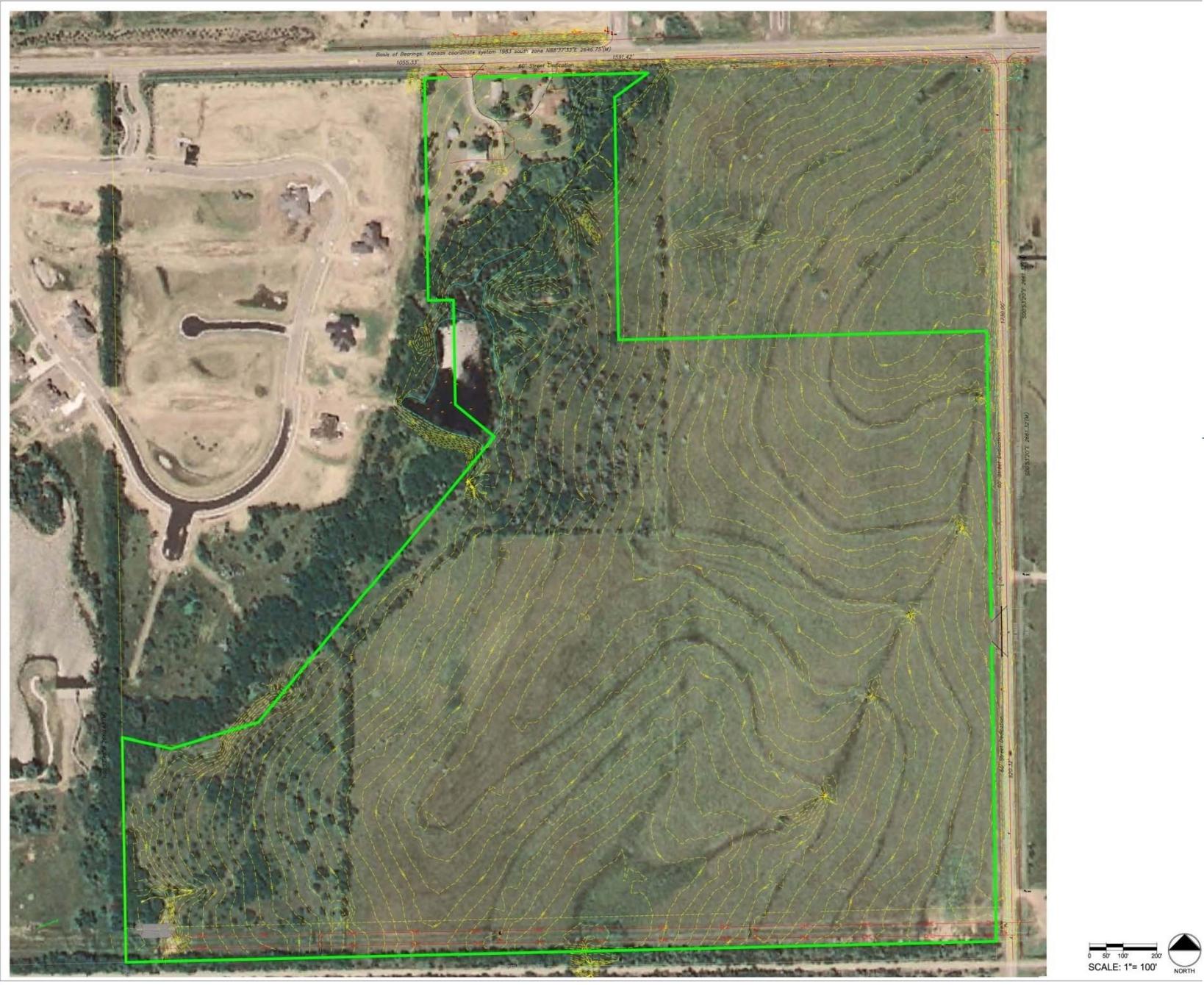
Conventional

Conservation

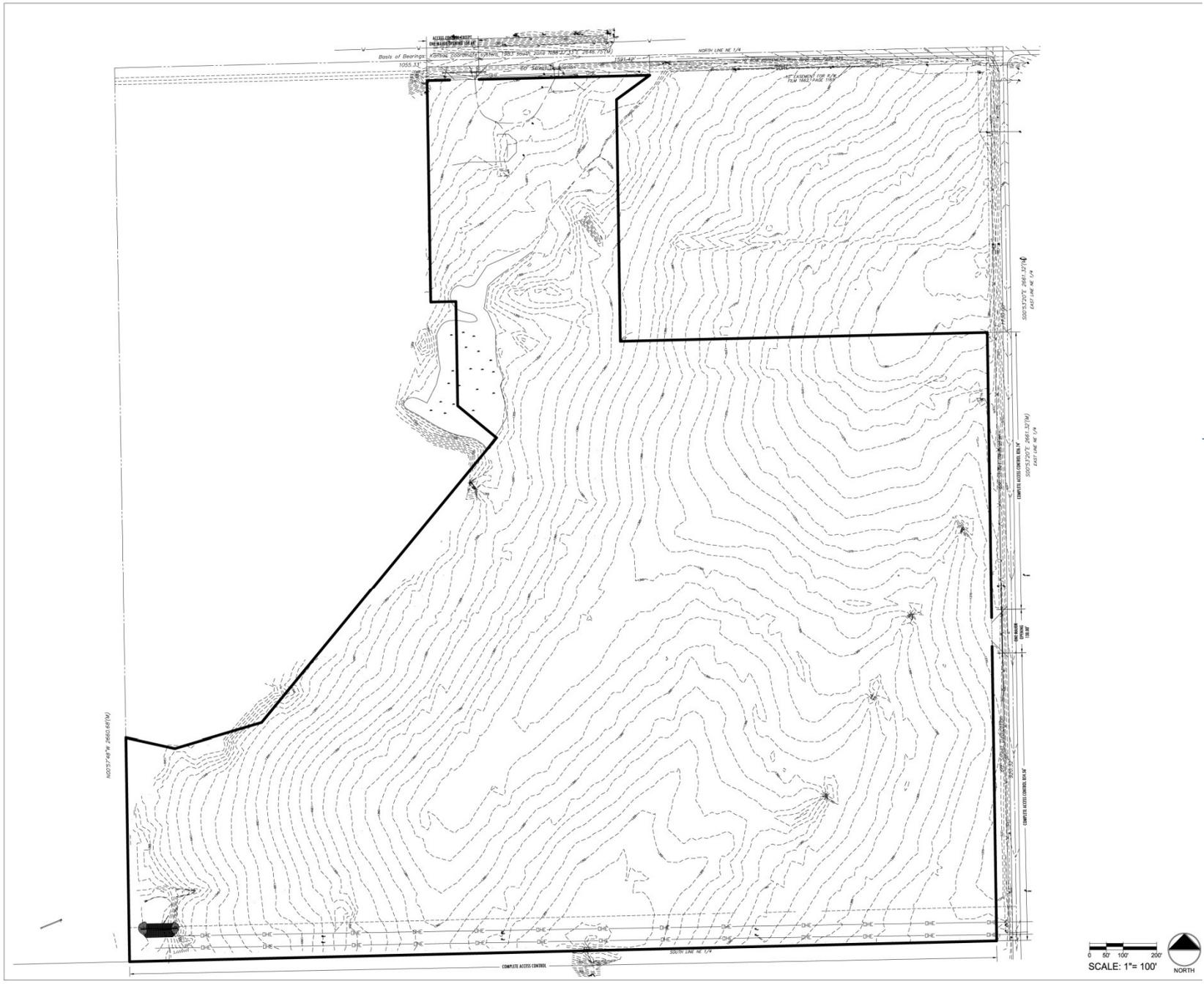
	Traditional			Conservation									
		Sub-Total	%	Sub-Total	%	% Change	Notes						
Paving	\$ 2,414,247	\$ 2,414,247	39.96%	\$ 2,201,608	37.36%	-9%	includes topsoil strip & haul						
Storm Water	\$ 579,506	\$ 579,506	9.59%	\$ 594,605	10.09%	3%	includes bio-swales & detention						
Sidewalk/Wheelchair Ramp	\$ 47,168	\$ 47,168	0.78%	\$ 47,168	0.80%	0%	match bid						
Traffic	\$ 6,175	\$ 6,175	0.10%	\$ 6,175	0.10%	0%	match bid						
Site Clearing & Restoration	\$ 544,160	\$ 544,160	9.01%	\$ 699,925	11.88%	29%	includes mobilization & restoration of undisturbed areas						
Erosion Control	\$ 146,084	\$ 146,084	2.42%	\$ 146,084	2.48%	0%	includes street sweeping & water trucks						
Water	\$ 1,068,882	\$ 1,068,882	17.69%	\$ 1,158,113	19.65%	8%	ductile iron with mechanical joints						
Sewer	\$ 1,231,790	\$ 1,231,790	20.39%	\$ 1,035,824	17.58%	-16%	along roads, 10% trench backfill						
Direct Drilling	\$ 3,945	\$ 3,945	0.07%	\$ 3,945	0.07%	0%	match bid						
	\$ 6,041,957	\$ 6,041,957	100.00%	\$ 5,893,448	100.00%	-2.5%							

Conservation Design Overlay Process "Prairie"

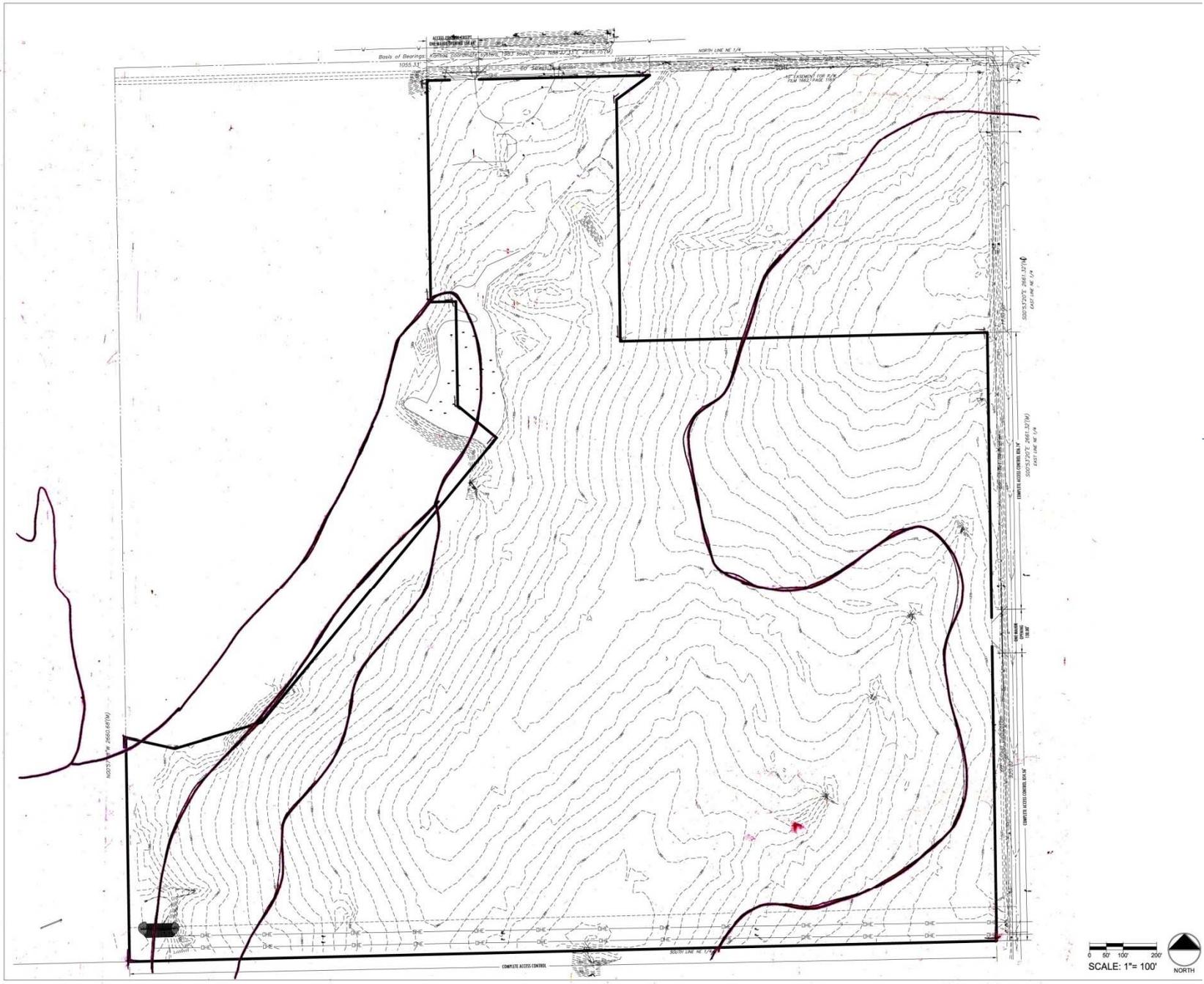




Aerial Photo + Topo



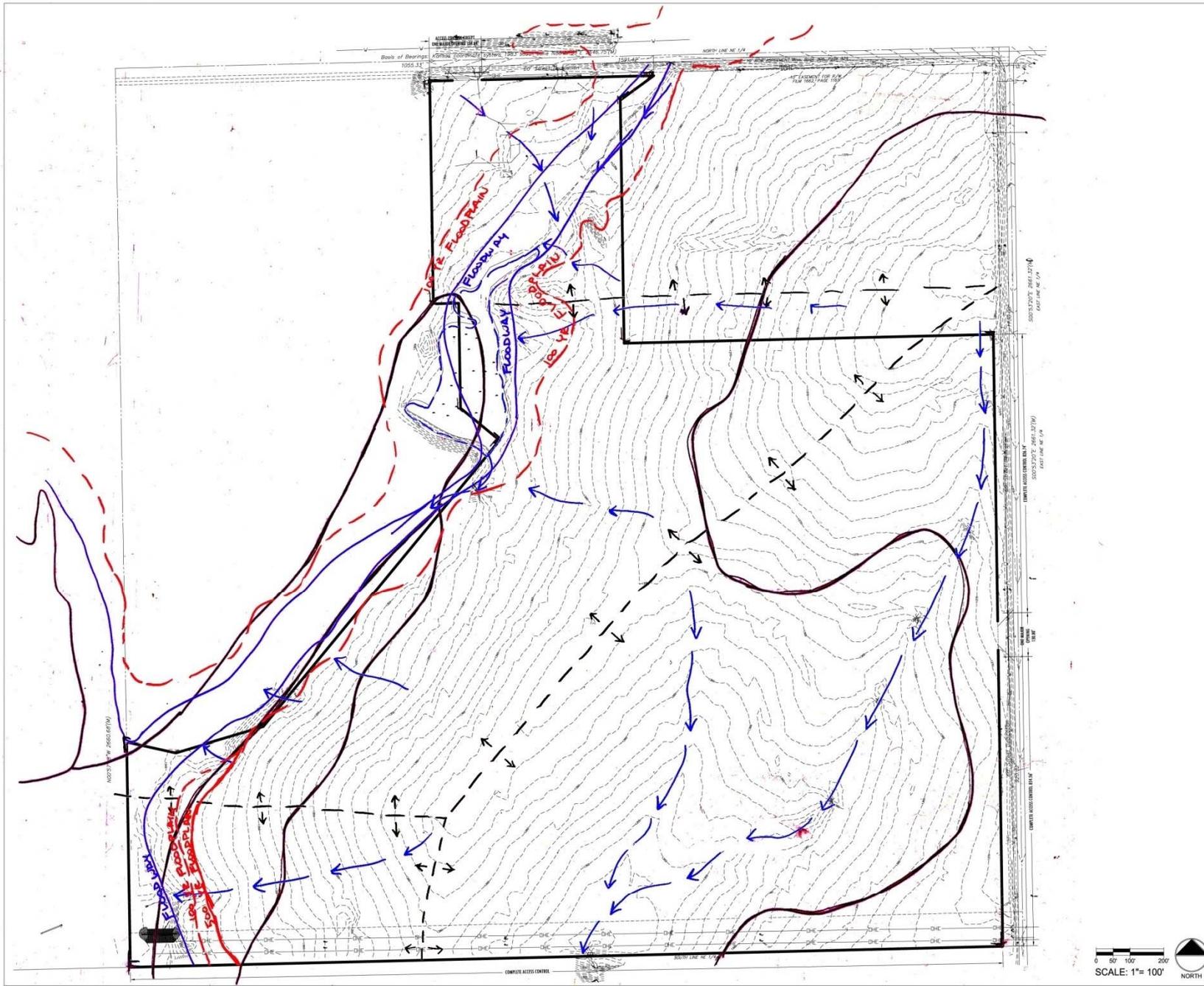
Base Topo



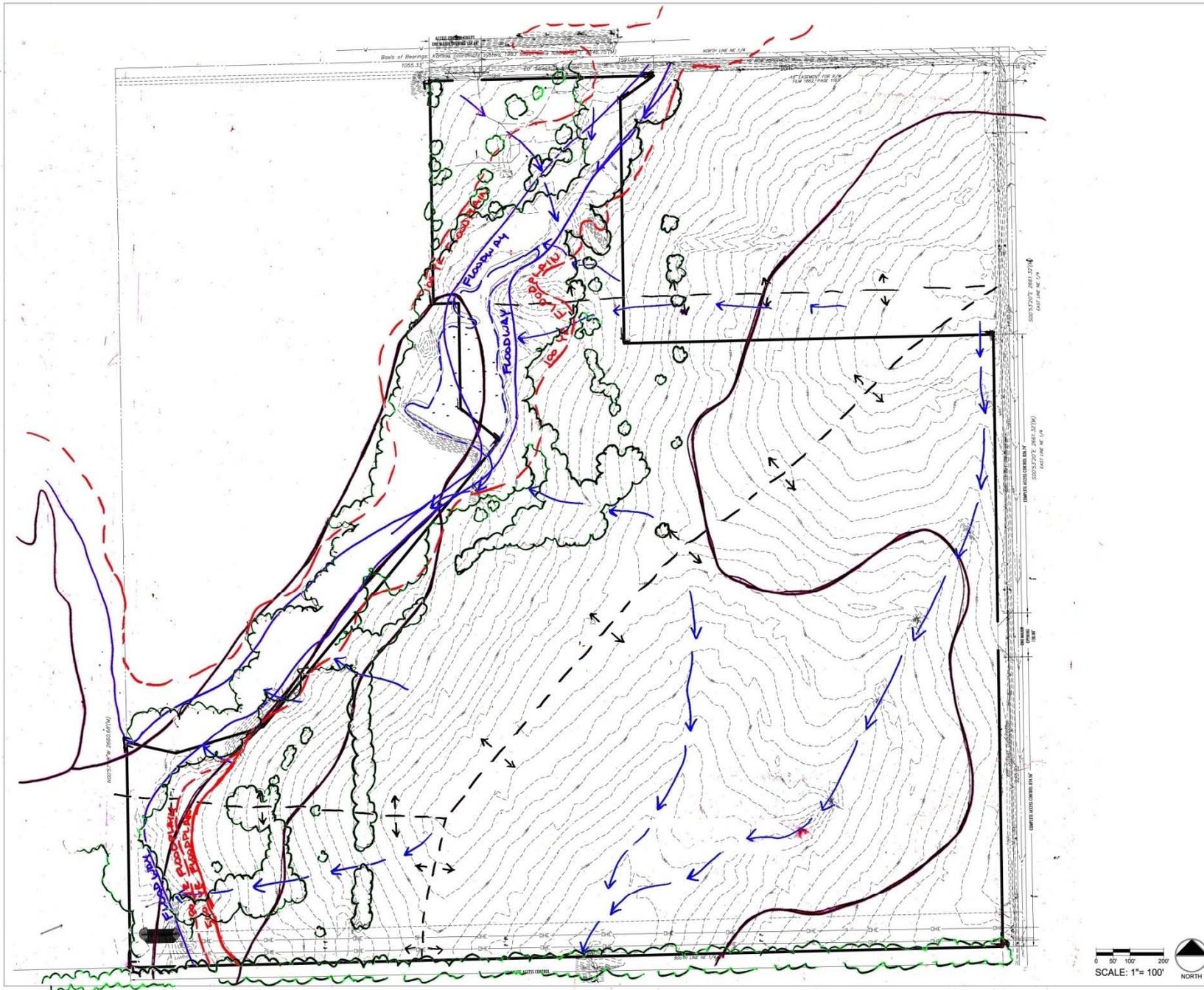
Base Topo + Soils



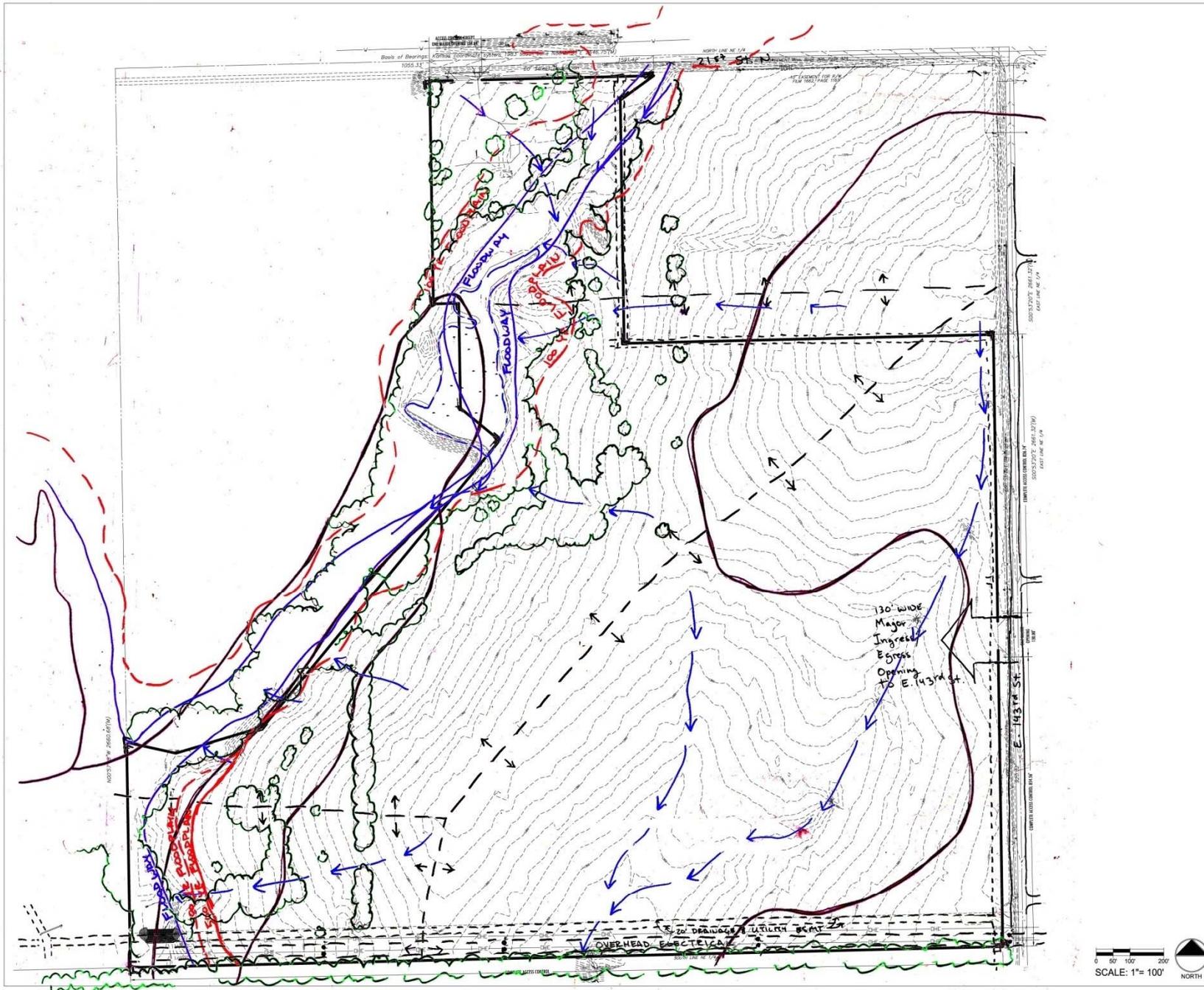
Base Topo + Soils + Ex. Drainage



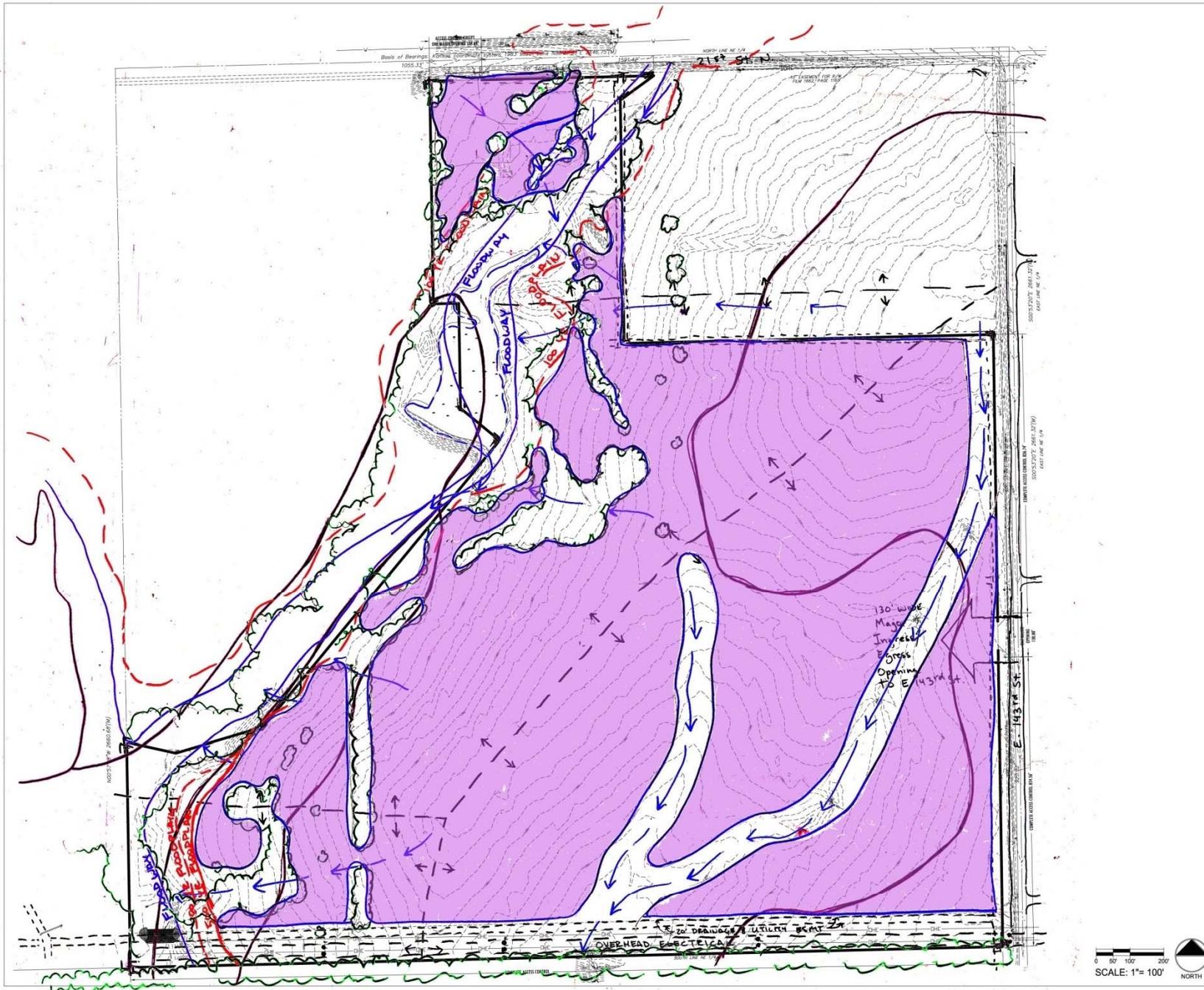
Base Topo + Soils + Ex. Drainage + Floodplain



Base Topo + Soils + Ex. Drainage + Floodplain + Woods



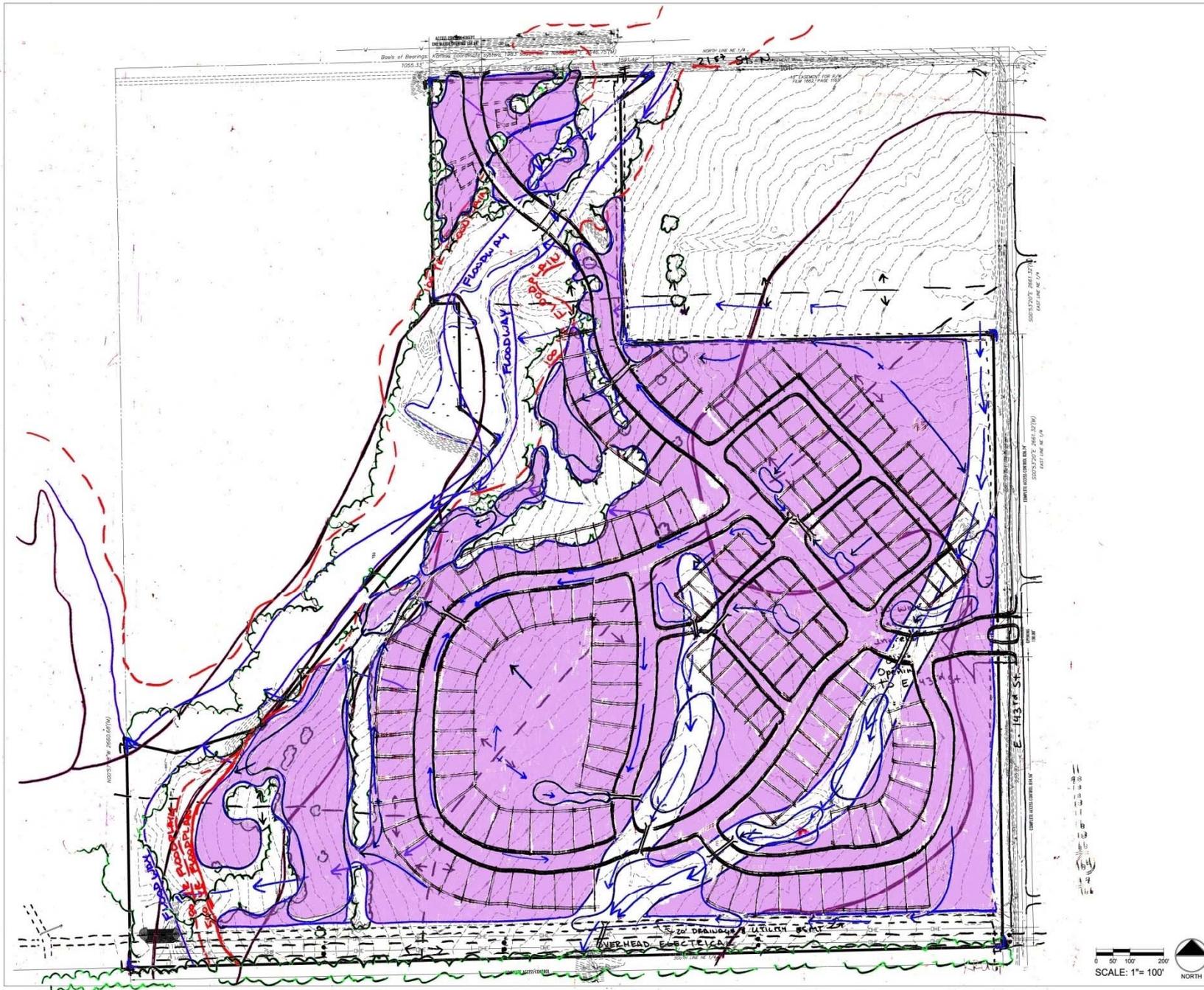
Base Topo + Soils + Ex. Drainage + Floodplain + Woods + Cultural



Base Topo + Soils + Ex. Drainage + Floodplain + Woods + Cultural + Dev Zones



Base Topo + Soils + Ex. Drainage + Floodplain + Woods + Cultural + Dev Zones + Concept



Base Topo + Soils + Ex. Drainage + Floodplain + Woods + Cultural + Dev Zones + Concept + Stormwater

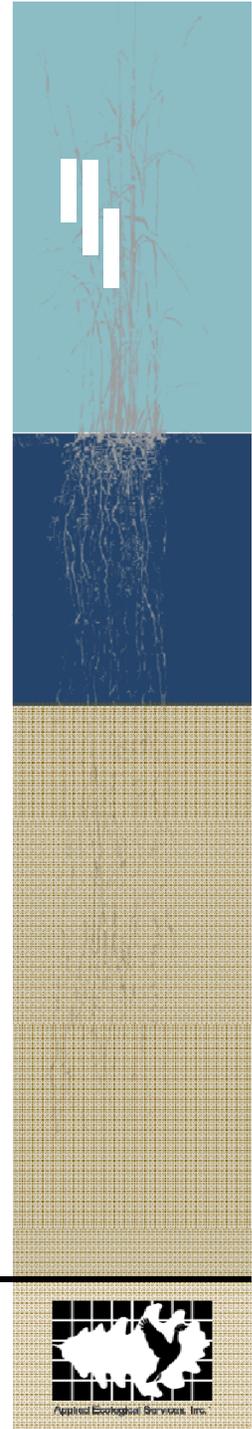


Concept + Open space



"Prairie": Conventional Plan

Conservation Development



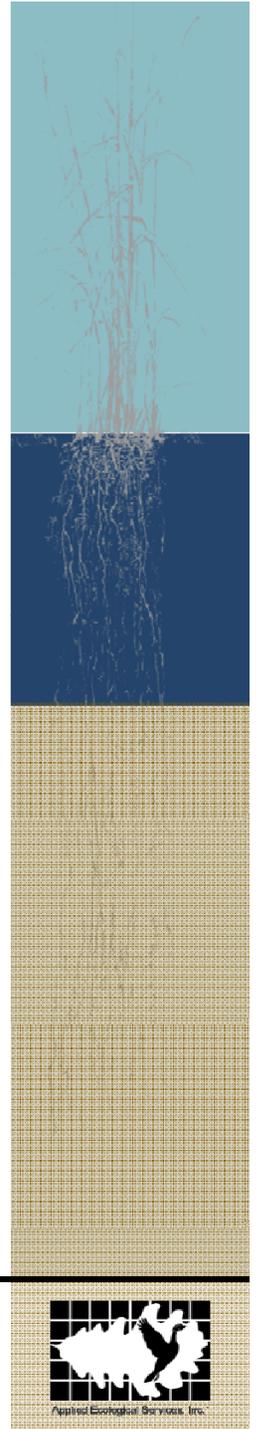
Design Comparison – “Prairie”

Conventional

Total: 96 ac
Open Space: 12.1 ac
Lots: 163
Lot Area: 67.8 ac
Roads: 12,085 lf
Pavement: 8.1 ac
Sewers: 20,069 lf
Water: 20,409 lf
Storm: 5,460 lf
Detention: 17.4 ac

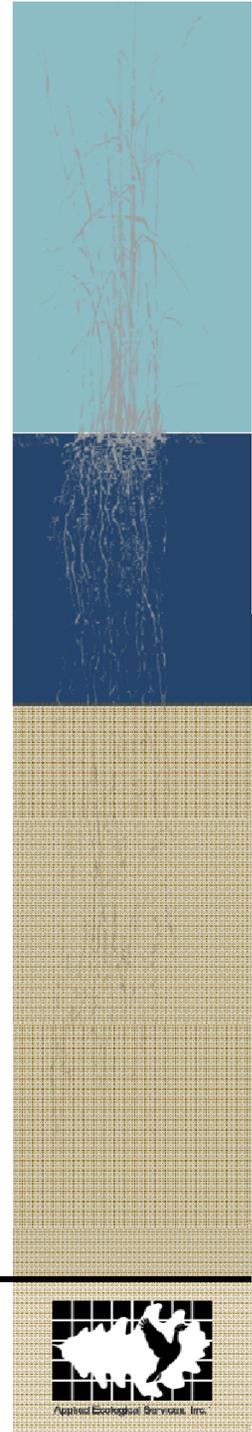
Conservation

Total: 96 ac
Open Space: 59.9 ac
Lots: 166
Lot Area: 24.4 ac
Roads: 9,998 lf
Pavement: 4.6 ac
Sewers: 10,108 lf
Water: 10,314 lf
Storm: 846 lf
Detention: 9.0 ac



Construction Costs – “Prairie” Conventional

Project #	468-84323	448-90277	468-84321	468-84327	468-84325	472-84521			
OCA #	751439	735354	744218	751440	751441	766128			
Date	April 2007	March 2007	January 2007	May 2007	May 2007	July 2007			
Type	Bridge	WDS	San Sew	SWD	SWS	Paving	SWS	Total	%
Paving						\$549,928.60		\$549,928.60	23.64%
Storm Water	\$231,550.00		\$106,210.00				\$24,108.00	\$361,868.00	15.56%
Sidewalk/Wheelchair Ramp						\$55,046.40	\$2,293.60	\$57,340.00	2.47%
Grading			\$7,900.00	\$231,957.90	\$355,159.00	\$16,656.00	\$694.00	\$612,366.90	26.33%
Traffic						\$5,203.20	\$216.80	\$5,420.00	0.23%
Site Clearing & Restoration	\$3,250.00	\$2,610.00	\$45,200.00	\$26,198.40	\$23,100.16	\$7,848.00	\$327.00	\$108,533.56	4.67%
Erosion Control	\$1,200.00	\$100.00	\$17,498.50		\$5,958.54	\$9,806.40	\$408.60	\$34,972.04	1.50%
Water	\$2,000.00	\$130,095.80						\$132,095.80	5.68%
Sewer			\$456,550.00					\$456,550.00	19.63%
Direct Drilling		\$6,790.00						\$6,790.00	0.29%
Sub Contract Amount	\$238,000.00	\$139,595.80	\$633,358.50	\$258,156.30	\$384,217.70	\$644,488.60	\$28,048.00	\$2,325,864.90	



POPC – "Prairie" Conservation

Site Preparation	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
								Dozers, loaders, backhoes, excav., grader, paver,
	Mobilization/Demobilization	1	EA.	11600	10904	9988	9,988	roller, scrapers, equipment
	Construction Fencing	3500	LF	5	4.7	4	15,068	Delineate protected areas
	Traffic Control	1	EA.	6295	5917.3	5420	5,420	Road signage
	Site Superintendent	24	WK	3000	2820	2583	61,995	
	Construction Trailer	6	MO	1200	1128	1033	6,199	Rent, utilities, phone, facilities
							98671	Sub-total
Sanitary Sewer	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Connect to Existing Manhole	1	EA.	3300	3102	2841	2,841	
	Sanitary Force Main	400	LF	23	21.62	20	7,922	6" PVC, open cut
								Avg Flow 57,750 GPD / Peak Flow 231,000 GPD
	Sanitary Lift Station, Complete	1	EA	100000	94000	86104	86,104	Rim=1338.4, Inv=1328.40, H=10.95', 400' pipe
	Directional Drilling	1	LS	7886	7412.84	6790	6,790	Match bid item
	Sanitary Sewer Pipe	9,598	LF	38	36	33	314,042	8" PVC pipe, 10' - 20' deep
	Sanitary Sewer Manhole, Complete	61	EA.	4500	4230	3875	236,355	Includes frames and lids, 10' - 20' deep
	Sanitary Sewer Service Pipe	4,200	LF	30	28	26	108,491	6" PVC pipe w/riser
	Compacted Sand backfill (10% of sewer)	960	LF	42	39	36	34,710	
	Testing & Televising	9,598	LF	10	9	9	82,643	
							879,898	Sub-total
Water Main	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Pressure Connect to Existing Water Main	2	EA.	2700	2538	2325	4,650	8" Tapping Sleeve, Valve and Valve Box
	Water Main Pipe	10,314	LF	51	48	44	452,919	8" D.I. pipe, 5' Bury Depth to top of pipe
	Fire Hydrant Assembly, Complete	26	EA.	3200	3008	2755	71,639	Hydrant, Valve, Valve Box
	Gate Valve & Well	41	EA.	1675	1575	1442	59,132	8" Valve and Box
	Water Services	4,700	LF	36	34	31	145,688	1.5" copper service pipe
	Water Services Apurtenances	165	EA.	650	611	560	92,347	Includes Corporate Stops, Curb Stops and Valve Box
							826,374	Sub-total
Storm Sewer and On-Site Stormwater Management	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Extended Wetland Detention Ponds	9.0	AC.	72500	68150	62425	561,829	3' bounce, 6" - 18" perm. pools, native seed, scraper
	Bio-Swales	4,205	LF	37	35	32	133,965	3' deep, native plugs & seed, dozer
	Culverts	846	LF	38	36	33	27,681	18" CMP (ave.)
	End Sections	21	EA.	220	207	189	3,978	
	Large Diameter Road Culvert	96	LF	265	249	228	21,905	Incl. conc. Headwall w/wingwalls
	Outlet Control Structure	1	EA.	5000	4700	4305	4,305	dual stage outlet w/low flow restrictor & outlet pipe
							753,662	Sub-total

Street (Local Residential)	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Bituminous Asphalt Pavement	4,450	SY	17	15.98	15	65,138	3" pavement (including strip & grading)
	Aggregate Base	4,450	SY	20	19	17	76,633	12" aggregate @ 110 lbs/in ³ SY
	Concrete Ribbon Curb	8	LF	8	8	7	32,458	machine formed w/5% radius
	Concrete Sidewalk	11,780	S.F.	5	5	4	50,715	4" conc. w/4" aggr. Base
	Street Lights		EA	955	898	822	4,111	
	Street Trees	220	EA	350	329	301	66,300	Shade & ornamental w/ ROW landscaping
	Electric Conduit	2,280	LF	27	25	23	53,006	3" dia galv. Steel
	Road-Side Bio-Swale	436	C.Y.	37	34.78	32	13,890	3' deep, plugs & seed, dozer
							362,251	Sub-total
Street (Residential)	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Bituminous Asphalt Pavement	21,250	SY	17	15.98	15	311,051	3" pavement (including strip & grading)
	Aggregate Base	21,250	SY	20	19	17	365,942	12" aggregate @ 110 lbs/in ³ SY
	Concrete Ribbon Curb	15,284	LF	8	8	7	105,281	machine formed w/5% radius
	Concrete Sidewalk	38,210	S.F.	5	5	4	164,502	4" conc. w/4" aggr. Base
	Street Lights		EA	955	898	822	13,979	
	Street Trees	700	EA	350	329	301	210,955	Shade & ornamental w/ ROW landscaping
	Electric Conduit	7,397	LF	27	25	23	171,966	3" dia galv. Steel
	Road-Side Bio-Swale	1,415	C.Y.	37	34.78	32	45,080	3' deep, plugs & seed, dozer
							1,388,755	Sub-total
Cleaning & Restoration	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Clear & Grub	3	AC	20750	19505	17867	53,600	Large trees, chip & grind stumps
	Topsoil Strip/Stockpile	44.9	AC	1800	1692	1550	69,589	Open space & Lots (excluding detention and roads)
	Mass Grading	44.9	AC	1200	1128	1033	46,393	Open space & Lots (excluding detention and roads)
	Topsoil Re-spread	32.7	AC	4400	4136	3789	123,886	Open space & 1/2 Lots (excluding detention)
	Prairie Restoration	48.1	AC	2000	1880	1722	82,832	Native seed (including undisturbed areas)
	Nature Trails	9504	LF	22	20.68	19	180,033	4" wood chip w/8" aggr. Base
							556,333	Sub-total
Erosion Control	Item	Quantity	Unit	Unit Cost (\$)	City	2007	Sub-total	Notes
					Adjustment (94%)	Adjustment (91.6%)		
	Silt Fence	5000	LF	1	0.94	0.86	4,305	Downslope and around topsoil stockpile
	Erosion Blanket	14	AC	7100	6674	6113	85,587	Open space and detention
	Rip-rap	120	TON	40	37.6	34	4,133	Culverts and spillway
	Construction Access Driveway	2	EA	600	564	517	1,033	50x10'
	Street Sweeping	24	WK	2100	1974	1808	43,396	During construction season
	Water Truck	4	WK	4615	4338.1	3974	15,895	During mass grading
							154,350	Sub-total
							5,020,294	Total



Comparison Summary – “Prairie”

Conventional

Conservation

	Traditional				Conservation		% Change	Notes					
	Grading	Sub-Total	%		Sub-Total	%							
Paving	\$ 549,929	\$ 16,656	\$ 566,585	24.36%	\$ 1,693,666	33.74%	199%	includes topsoil strip & haul					
Storm Water	\$ 361,868	\$ 587,811	\$ 949,679	40.83%	\$ 753,662	15.01%	-21%	includes bio-swales & detention					
Sidewalk/Wheelchair Ramp	\$ 57,340		\$ 57,340	2.47%	\$ 57,340	1.14%	0%	match bid					
Traffic	\$ 5,420		\$ 5,420	0.23%	\$ 5,420	0.11%	0%	match bid					
Site Clearing & Restoration	\$ 108,534		\$ 108,534	4.67%	\$ 649,584	12.94%	499%	includes mobilization & restoration of undisturbed areas					
Erosion Control	\$ 34,972		\$ 34,972	1.50%	\$ 154,350	3.07%	341%	includes street sweeping & water trucks					
Water	\$ 132,096		\$ 132,096	5.68%	\$ 826,374	16.46%	526%	ductile iron with mechanical joints					
Sewer	\$ 456,550	\$ 7,900	\$ 464,450	19.97%	\$ 873,108	17.39%	88%	along roads, 10% trench backfill					
Direct Drilling	\$ 6,790		\$ 6,790	0.29%	\$ 6,790	0.14%	0%	match bid					
	\$ 1,713,498	\$ 612,367	\$ 2,325,865	100.00%	\$ 5,020,294	100.00%	116%						

Like Unit Costs – “Prairie”

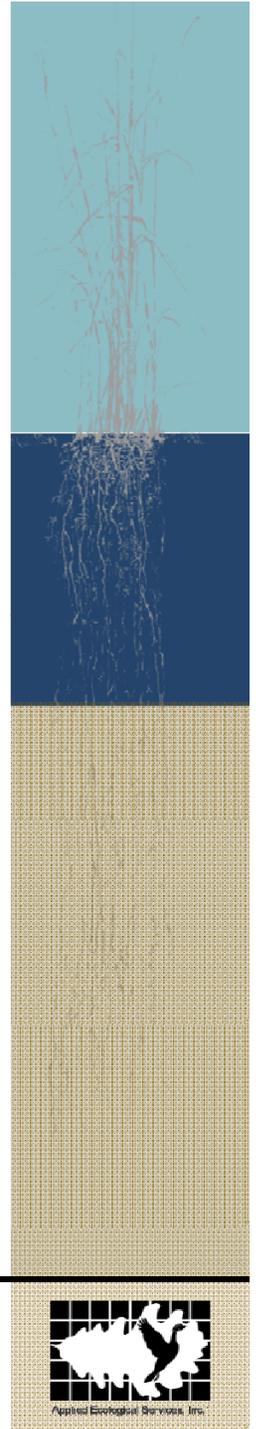
Conventional

Conservation

	Traditional		Conservation		% Change	Notes
	Sub-Total	%	Sub-Total	%		
Paving	\$ 2,229,779	32.47%	\$ 1,693,666	33.74%	-24%	includes topsoil strip & haul
Storm Water	\$ 1,273,134	18.54%	\$ 753,662	15.01%	-41%	includes bio-swales & detention
Sidewalk/Wheelchair Ramp	\$ 57,340	0.83%	\$ 57,340	1.14%	0%	match bid
Traffic	\$ 5,420	0.08%	\$ 5,420	0.11%	0%	match bid
Site Clearing & Restoration	\$ 527,516	7.68%	\$ 649,584	12.94%	23%	includes mobilization & restoration of undisturbed areas
Erosion Control	\$ 154,350	2.25%	\$ 154,350	3.07%	0%	includes street sweeping & water trucks
Water	\$ 1,269,676	18.49%	\$ 826,374	16.46%	-35%	ductile iron with mechanical joints
Sewer	\$ 1,343,741	19.57%	\$ 873,108	17.39%	-35%	along roads, 10% trench backfill
Direct Drilling	\$ 6,790	0.10%	\$ 6,790	0.14%	0%	match bid
	\$ 6,867,745	100.00%	\$ 5,020,294	100.00%	-27%	

Conservation Development vs. Conventional Where Does That Leave Us?

- Storm Water Infrastructure Lower Cost
- Construction Means and Methods Equal
- Balance the Sustainability Paradigm
- Address the Intangibles...



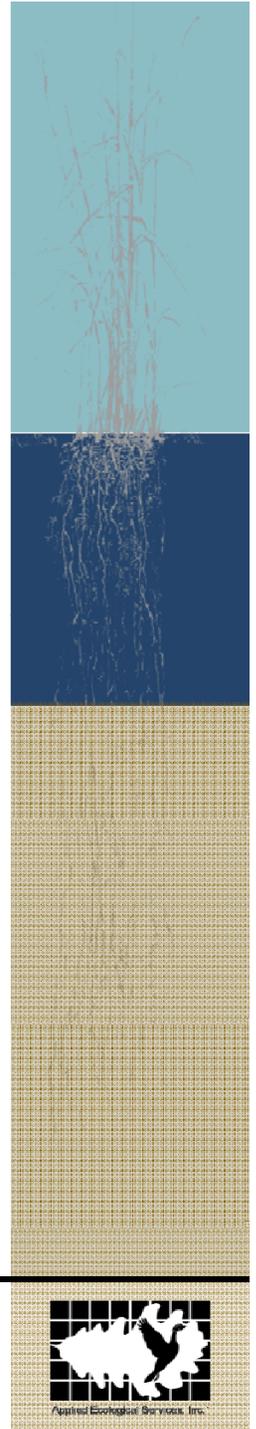
Conservation Development vs. Conventional Additional & Intangible Items

Additional Items

- Misc. Dewatering
- Electric/Phone/Cable TV
- Off-site Improvements
- Contingency & Taxes
- Insurance & Bonding
- Engineering & Inspection
- Surveying
- FEMA LOMR
- Impact Fees

Intangibles

- Water Quality
- \$/Load Reduction
- Maintenance
- Habitat/Recreation
- Property Value/Tax Base
- Pilot Programs





The logo consists of a white silhouette of a bird in flight, positioned over a black grid pattern. The grid is composed of thick black lines forming a series of squares. The bird is facing right, with its wings spread. The entire logo is contained within a white rectangular box with a black border.

Applied Ecological Services, Inc.™