



# Appendix B

## Template Alternatives

The seven land use templates outlined in the Blackberry Creek Watershed Alternatives Futures Analysis report are described in this appendix. The templates are presented in seven booklets that compare and contrast the differences between the conservation and conventional versions of each land use. Each booklet contains a side-by-side comparison of the templates, including the principles involved in designing the templates and the evaluation modeling results. The booklets include graphic representations of the templates, basic statistics regarding lot size and other site details, and the results of the stormwater modeling used to evaluate the difference in runoff response between the templates.

The seven template categories are:

- ***Commercial/Industrial***
- ***Moderate Density Residential***
- ***Rural Residential***
- ***Estate Residential***
- ***Agriculture***
- ***Stream Corridors***
- ***Depressional Wetlands***



# BLACKBERRY CREEK WATERSHED ALTERNATIVE FUTURES ANALYSIS PROJECT

## COMMERCIAL/INDUSTRIAL TEMPLATES



Town Square - Wheaton, Illinois

**Commercial & Industrial Lands:** Retail, light industrial and office development, including various scales of development from large scale “big box” retail stores and light industrial and office park development, to smaller scale restaurants, shops, and individual offices.

This booklet has been prepared as part of the Blackberry Creek Watershed Alternative Futures Analysis project funded by a grant from USEPA to IDNR and Kane County. Under this project, two “visions” for the watershed have been developed and evaluated. One vision is composed of “Conservation” template land uses that conserve a high level of watershed integrity. The other vision is composed of “Conventional” template land uses that generally will have a negative impact on watershed hydrology and biology.

This booklet presents descriptions and evaluation results of the Conservation and Conventional versions of the Commercial/Industrial Templates. Watershed scale results are presented in the Alternative Futures Analysis Report.

# ~ CONVENTIONAL ~

## Commercial/Industrial Guidelines and Conceptual Images

### Conventional Template Description

Conventional commercial/industrial development typical of what is represented in this template is single-story, automobile accessed, commercial big box or strip mall development. These sites typically have a large amount of surface parking, often exceeding the needs of the businesses during the majority of the year.

Landscaping is typically limited to raised islands at the ends of parking isles. Turf grass is typically planted around detention basins and within the strip between the access roads and the parking lot and the buildings.

On some sites, the outlying or roadside lots are developed for fast food, banks, and other businesses. These outlots generally have their own parking, and are accessible only by cars. Sidewalks are provided sometimes along main roads and in front of the mall entrances, but generally not between the main mall and the outlots.

Commercial and industrial developments typically use flat roofs on buildings and standard asphalt paving with impervious percentages of 80% to 90% and higher. Stormwater is conveyed via storm sewer inlets to large detention basins. Because of the large amount of impervious cover, water level fluctuations in the detention basins are often large and frequent, leading to the use of rip rap to protect the shoreline from erosion. As with many detention basins, geese frequent the turf covered shorelines, contributing significant nutrient and bacteria loadings.



Disconnected yet adjacent commercial properties require the use of an automobile for convenience and safety. Minimal landscaping is provided except to meet code.



Outlot development adjacent to major commercial parking lot and facility with access from only one side of the road.



Conventional commercial sites have a high percentage of impervious surface, and can require significant amounts of storm sewer and detention.



Detention ponds with rip rap edges provide no water quality benefits and have limited aesthetic quality.

# ~ CONSERVATION ~

## Commercial/Industrial Guidelines and Conceptual Images

### Conservation Template Description

Conservation commercial and industrial development includes mixed-use commercial, office and light industrial development designed to minimize negative impacts to hydrology and water quality.

Sustainable technologies and designs are incorporated into conservation commercial developments to minimize the impact of impervious surfaces. These systems encourage infiltration and retention and discourage stormwater discharge directly to natural surface waterbodies for most storm events. Accessible green roofs can be designed into new conservation commercial buildings to intercept and absorb a portion of the rainfall, and provide additional insulation and outdoor leisure space for second story offices or residences.

Parking lots can be constructed of porous paving materials for infiltration, and include large canopy trees for cooling and wind-breaks. Parking lots built with bioswales and underground infiltration beds help to reduce runoff, eliminate the need for storm inlets, and contribute to groundwater recharge.

Conservation commercial development may include residential or office development on upper floors. Interconnected street systems with pedestrian and bicycle connections and infrastructure throughout make the public accessible to a variety of modes of transportation. Conservation commercial developments can be designed to fit any scale, and mix uses to encourage trip linking, day and night activity and reduced peak parking demands.



Main Street-like commercial development with second stories allowing office or residential uses.



Neighborhood commercial center within a new residential development.



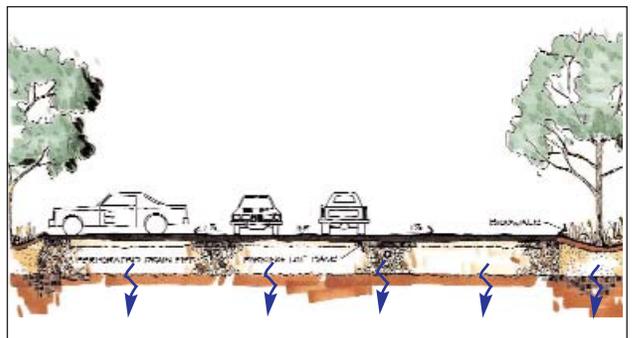
Chicago City Hall green roof insulates the building, provides wildlife habitat, and reduces roof runoff.



Porous paving systems encourage infiltration and retention or runoff.



Parking lot with bioswale to filter and absorb runoff. Shade trees reduce heat gain.

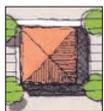


Parking lot with bioswale & under parking infiltration system.

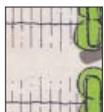
# ~ CONVENTIONAL ~ Commercial/Industrial Template

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Appendix B



Commercial Building



Impervious Parking/Driving Lane

# ~ CONSERVATION ~

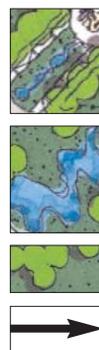
## Commercial/Industrial Template



Commercial Building

Porous Pavement Parking Lot with Bioswales

Paved Patio



Bioswale Infiltration

Naturalized Detention

Canopy Trees

Stormwater Flow Direction

# Commercial/Industrial Template Standards

|   | Conventional                          | Conservation  |
|---|---------------------------------------|---|
| <b>Retail Space</b>                         | 332,500 sf (7.6 acres or 19% of site) | 332,500 sf (7.6 acres or 19% of site)                                 |
| <b>Open Space<sup>a</sup> / Landscaping</b> | 8.7 acres (22% of site)               | 14.5 acres (36% of site)  |
| <b>Parcel Size</b>                          | 40 acres                              |   |
| <b>Zoning</b>                               | F – District (B1 District - Business) |   |
| <b>Parking Spaces</b>                       | 1,108 (1 space per 300 sf)            |   |
| <b>Parking Setback</b>                      | 20 feet from ROW                      |   |
| <b>Access Roads</b>                         | 24 feet wide                          | 24 – 30 feet wide   |
| <b>Road/Parking Area</b>                    | 23.7 acres (59% of site)              | 17.9 acres (45% of site)  |
| <b>Trees</b>                                | 2 Trees/23 Parking Spaces             | 2 Trees/10 Parking Spaces   |
| <b>Floor Area Ratio</b>                     | 0.19                                  | 0.23 <sup>b</sup>   |
| <b>Detention Area</b>                       | 2 acres (5% of site)                  | 2.9 acres (7% of site)  |
| <b>Allowable Detention Release Rate</b>     | 0.10 cfs/acre                         |   |
| <b>Required Permanent Pool Storage</b>      | 0.75 inches/impervious acre           |   |
| <b>Development Bonus</b>                    | None                                  | 62,100 sf (additional retail, office, residential space) <sup>b</sup> |

<sup>a</sup> Includes detention areas and excludes green roofs.

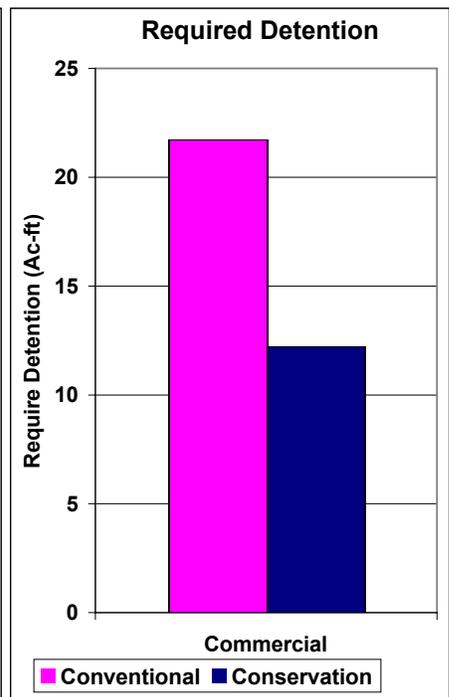
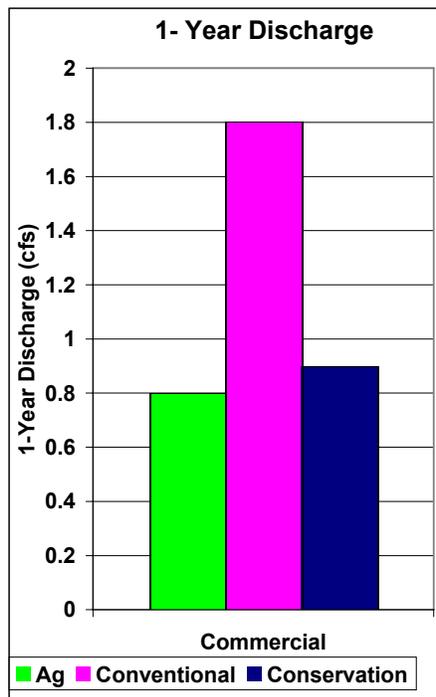
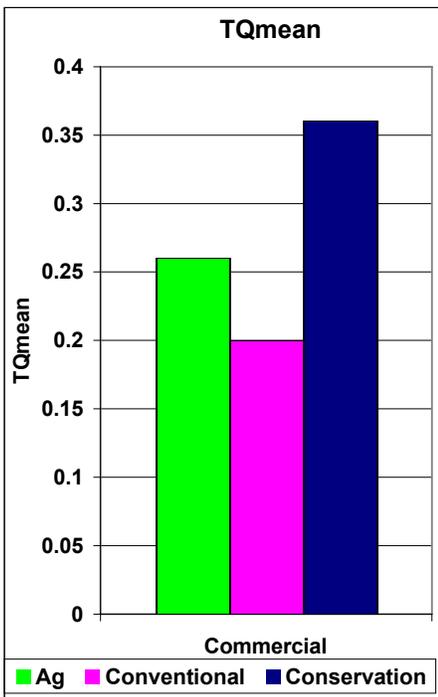
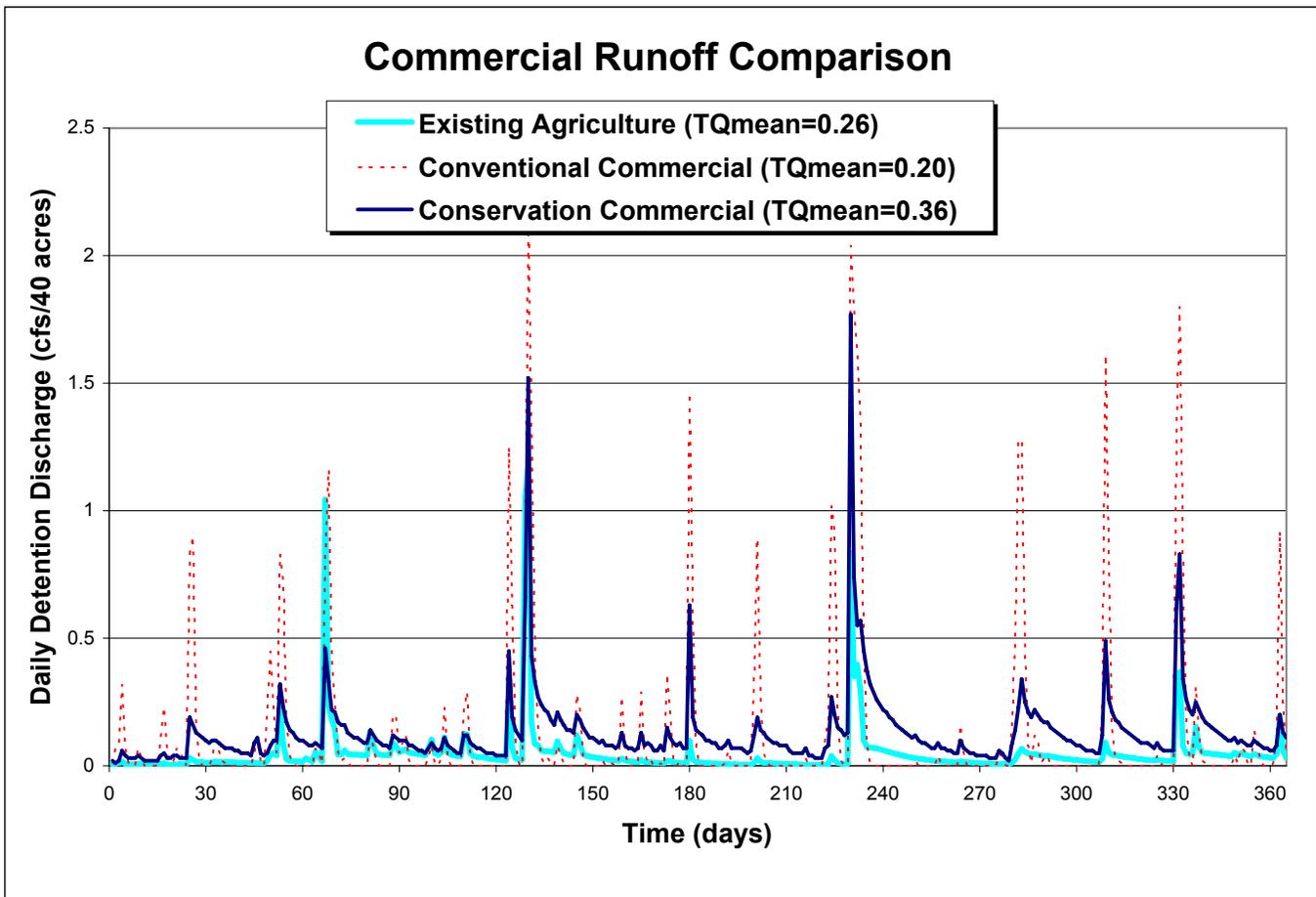
<sup>b</sup> Due to this figure being potential bonus additional square footage, and not defined as either office, retail or residential, parking requirements could not be calculated and added to the total. Shared parking could address most of the additional parking requirement, minimizing the need for additional spaces. Also, there is room to fit additional and/or temporary parking that could be reserved for periods of peak parking demand.

## Commercial/Industrial Template Performance

Continuous simulation hydrologic computer modeling was used to evaluate the performance of the conventional and conservation templates. The results are presented on the facing page as flow hydrographs showing the daily average flow leaving the site under the two versions of the template and under an assumed existing condition of agriculture. Also provided are three statistics used to characterize the runoff response of the templates. The statistics are:

- **TQmean** is the percentage of time that the flow rate is above the mean flow and is indicator of the stability of the flow - the higher the value, the more stable and less flashy the flow. It has been found that higher biological quality in streams is typically associated with higher values of TQmean.
- The **1-year discharge rate** is an indicator of the “channel forming” flow. Increases in the 1-year discharge rate will typically result in increases in streambank erosion as the channel adjusts to the new flow regime.
- The **required detention volume** is the volume required to meet the Kane County 100-year release rate of 0.1 cfs/acre of site. The required detention volume is an indicator of the total runoff leaving the site and the higher the value, the greater the potential for cumulative flood impacts downstream.

The results are discussed on the page following the hydrographs and bar charts.



# Commercial/Industrial Template Performance

## Conclusions

The Conventional Commercial/Industrial Template is approximately 85% impervious, which results in very flashy conditions relative to an assumed existing condition of Conventional Agriculture. Under the Conventional Template, most every rainfall event produces a sharp hydrograph peak that quickly rises and then quickly falls back to zero. The Conservation Template hydrograph also exhibits greater runoff volume than agriculture. However, the additional runoff occurs as a sustained baseflow that should be beneficial to downstream waterbodies. The prolonged baseflow of the Conservation Template is a result of the infiltration storage within the porous paving parking lots and bioswales. The prolonged baseflow of the Conservation template produces a much higher TQ<sub>mean</sub> value than both the existing and Conventional Template.

The decrease in TQ<sub>mean</sub> under the Conventional Template would be expected to have a negative impact on the biology of the receiving waterbody while the increase in TQ<sub>mean</sub> under the Conservation Template suggests that use of the principals and practices of that template could contribute to improved biological conditions within the receiving streams and wetlands.

The increase in groundwater driven baseflow under the Conservation Template suggests that there is also the potential for an increase in deep groundwater recharge, which is important for municipal and private water supplies.

The 1.1-year discharge rate under the Conventional Template is more than double the rate for the assumed existing condition of agriculture, which could lead to significant increases in streambank erosion. However, under the Conservation Template, the 1.1-year discharge rate is only slightly greater than the existing condition and should not contribute to increases in streambank erosion.

The Conservation Template required detention volume is approximately 45% less than the Conventional Template indicating much lower surface runoff volumes being discharged downstream and therefore less potential for flooding.

# BLACKBERRY CREEK WATERSHED ALTERNATIVE FUTURES ANALYSIS PROJECT

## MODERATE DENSITY

### RESIDENTIAL TEMPLATES



Mill Creek Subdivision - Geneva, Illinois

**Moderate Density Residential Development:** Residential development with lots ranging from 6,000 to 15,000 square feet, a gross density of around 2 units per acre, and municipal water and sewer service. Typically, these developments are under municipal jurisdiction, but may occur in unincorporated areas as part of planned unit developments (PUDs).

This booklet has been prepared as part of the Blackberry Creek Watershed Alternative Futures Analysis project funded by a grant from USEPA to IDNR and Kane County. Under this project, two “visions” for the watershed have been developed and evaluated. One vision is composed of “Conservation” template land uses that conserve a high level of watershed integrity. The other vision is composed of “Conventional” template land uses that generally will have a negative impact on watershed hydrology and biology.

This booklet presents descriptions and evaluation results of the Conservation and Conventional versions of the Moderate Density Residential template. Watershed scale results are presented in the Alternative Futures Analysis Report.

# ~ CONVENTIONAL ~

## Moderate Density Residential Guidelines and Conceptual Images

### Conventional Template Description

Conventional moderate density residential development is designed to drain runoff from streets, driveways, and lawns as quickly as possible and then to temporarily hold the runoff in detention basins at the end of the storm sewer system before releasing it offsite. While detention is quite effective at controlling the rate of runoff, it does little to address the increased volume of runoff, and hence its effectiveness decreases with increasing watershed size.

Due to the impervious surfaces and hardened drainage systems, there is a shift from groundwater dominated hydrology to surface water dominated hydrology. As a result, stream discharge becomes “flashier” with higher high flows and lower low flows, which, in turn has significant impacts on downstream aquatic ecosystems adapted to more stable hydrology characterized by variations in flow related to season much more than to individual rainfall events.

Parking areas for residences are required to be paved and usually include both interior and exterior parking space, with room for at least four cars per single family housing unit. Driveways are typically paved with impervious materials, which increase ambient air temperatures and create additional stormwater runoff.

Detention basins are typically either dry or wet and ringed with rip rap, have little or no natural habitat value for plants, animals or other wildlife, and do not enhance the aesthetics of the neighborhood.

Public open space is often limited to road rights-of-way and small, isolated park lands. Lot sizes are standardized as much as possible, with little variety. Street trees may be required on each lot or every 50 feet or so, depending upon the particular subdivision code. Other landscaping within the site is generally limited to turf grass.



Reliance on conventional detention as a sole stormwater management technique leads to unaesthetic conditions and decreases quality of life.



Conventional residential developments have large setbacks increasing driveway and front yard turf area.



Wide roads in conventional residential development developments increase runoff and air temperature and encourage higher speed traffic.

# ~ CONSERVATION ~

## Moderate Density Residential Guidelines and Conceptual Images

### Conservation Template Description

Conservation moderate density residential developments cluster housing at the same gross density as conventional development to preserve and/or create ecological, stormwater and cultural corridors. Clustering also creates opportunities to develop neighborhood amenities, including parks and recreation facilities. Lot sizes are intentionally varied to provide a richer diversity of housing opportunities for potential residents.

Clustering and decreased lot sizes allow for every lot to front or back onto naturalized open space and/or park land that is also part of the drainage system. Restored native landscaping in these areas increases habitat potential for wildlife as well. Parks and naturalized open space are designed in an interwoven pattern across the entire development to connect habitats, provide stormwater infiltration and conveyance, and provide recreational and transportation opportunities to residents.

The stormwater system is designed to replicate or preserve the site's natural hydrology. No stormwater discharge occurs directly to streams or wetlands or even to the site detention area. Instead, much of the landscape is used to filter and retain runoff. Driveways, parking areas and streets can use porous paving materials. Detention areas are naturalized and designed to mimic natural wetlands and are part of a network of open space within and outside the development.

Streets are narrowed to reduce traffic speeds and decrease impervious cover. Shallow street parkway bioswales retain street and front yard runoff. Excess runoff is directed along curbs to rear yard swales to provide filtration and infiltration opportunities.

Conservation developments are connected to the local community through various alternative transportation systems (e.g., handicapped accessible trails, sidewalks, streets, bicycle paths and mass transit). Sidewalks are constructed on both sides of the street with crosswalks at intersections to encourage and allow the safe use of alternative modes of transportation.



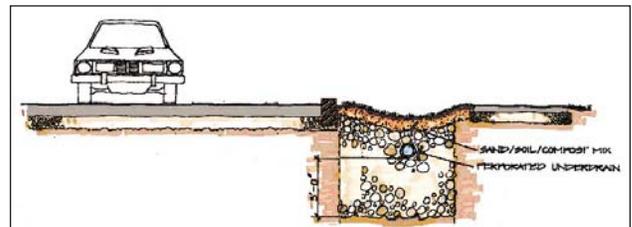
Clustering of houses and lots allows for open space that can be used for neighborhood connectivity, community activity areas, parks, naturalized stormwater systems and wildlife habitat areas. (Prairie Crossing, Greyslake, Illinois)



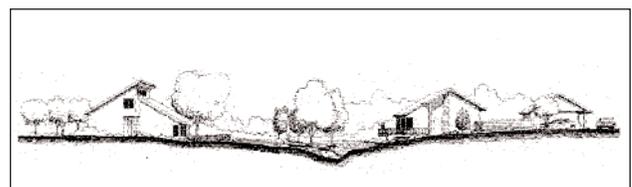
Conservation residential developments have reduced setbacks and narrow streets to minimize the overall amount of impervious surface, while at the same time creating a safe, friendly and walkable streetscape. (Prairie Crossing, Greyslake, Illinois)



Conservation residential developments may use porous pavers for driveways and off-street parking areas. (However, the evaluation modeling assumed no porous paving.)



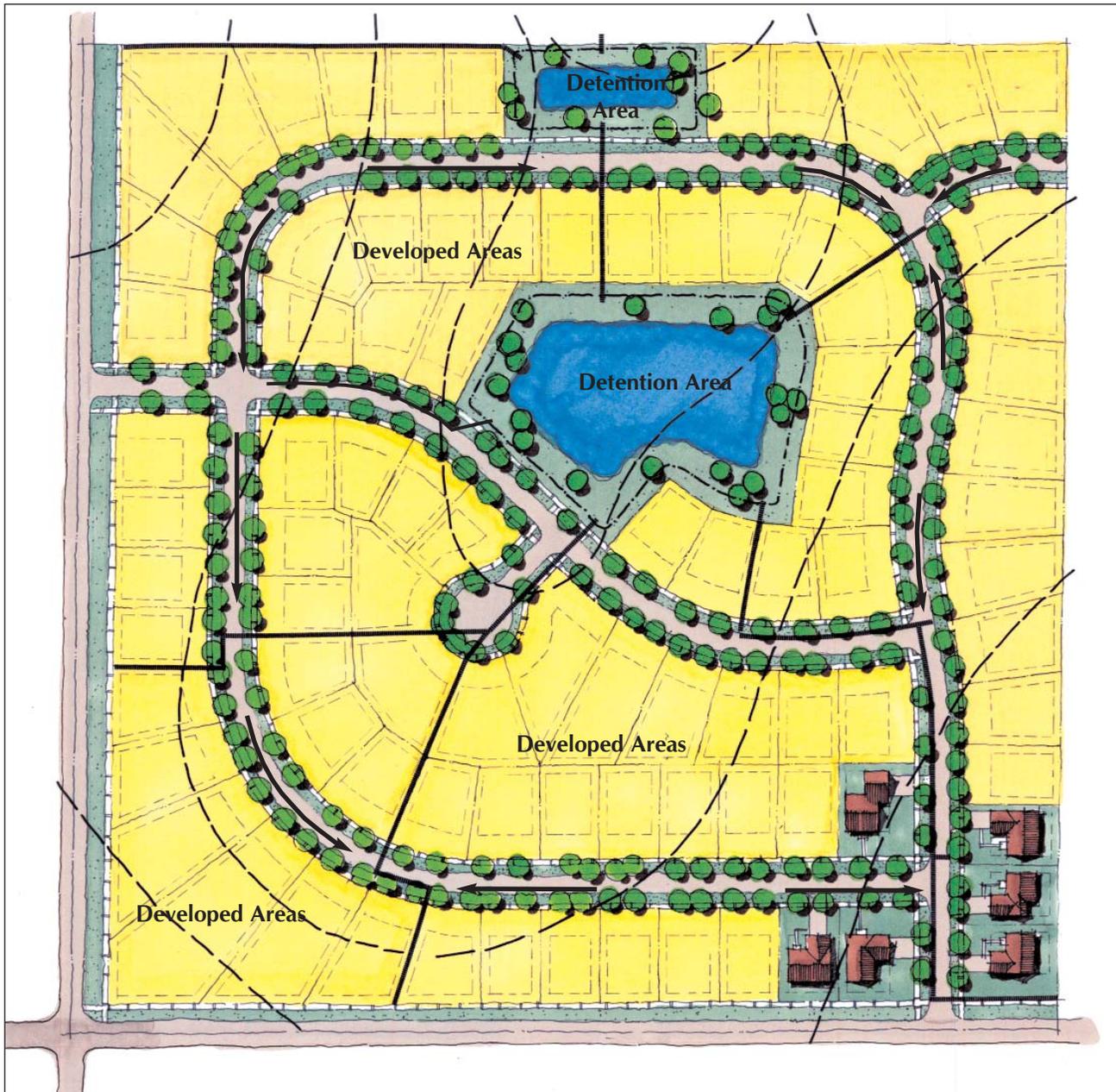
Street parkway bioswales filter and infiltrate street and front yard runoff.



Naturalized back yard drainage swales provide public open space, habitat and stormwater retention. (Village Homes, Davis, CA)

# ~ CONVENTIONAL ~

## Moderate Density Residential Template



Housing



Development Lot Line



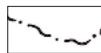
Contour Lines



Stormwater Infrastructure



Stormwater Flow Direction

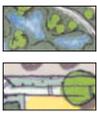
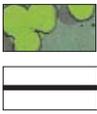


Detention Pond Boundary

# ~ CONSERVATION ~

## Moderate Density Residential Template



- |   |                             |   |                           |
|---|-----------------------------|---|---------------------------|
|  | Housing                     |  | Vegetated Swales          |
|  | Community/Commercial Center |  | Roadside Bioswales        |
|  | Development Lot Line        |  | Canopy Trees              |
|  | Contour Lines               |  | Stormwater Infrastructure |
|   |                             |  | Stormwater Flow Direction |
|   |                             |  | Stormwater Level Spreader |

# Moderate Density Residential Template Standards

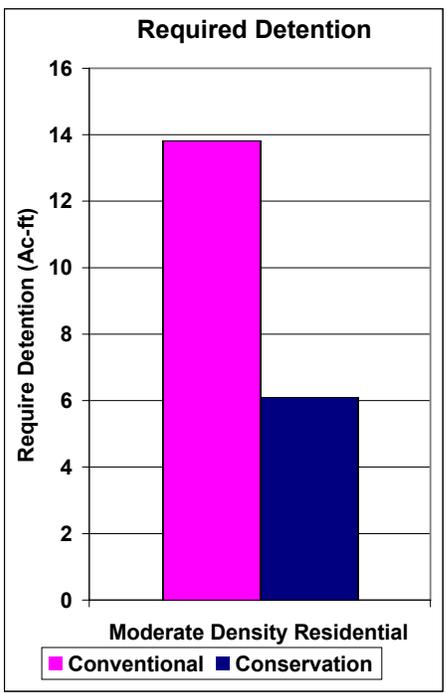
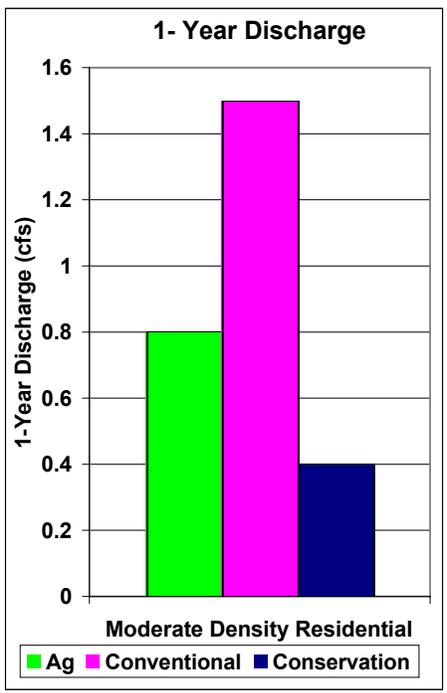
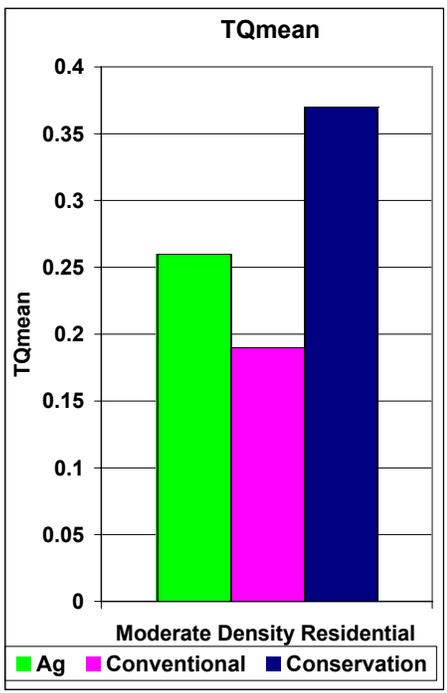
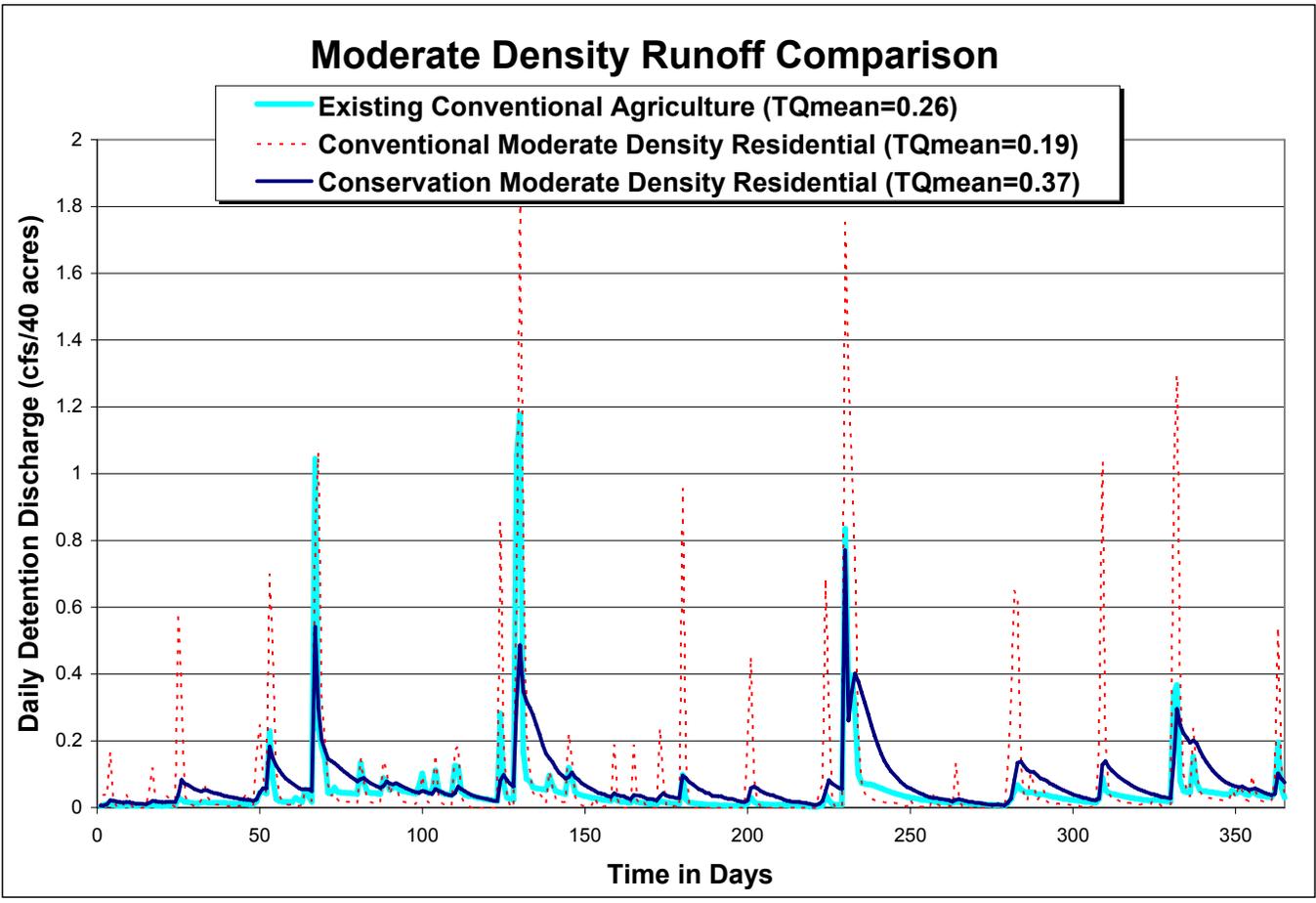
|  | Conventional   | Conservation  |
|--|--|---|
| <b>Number of Lots</b>                  | 89 (25.5 acres or 63.8% of site)                         | 89 (15.7 acres or 39.2% of site):<br>45 @ 6,000 sf; 35 @ 8,000 sf; 9 @ 15,000 sf    |
| <b>Open Space</b>                      | 3.6 acres, including stormwater treatment (9.0% of site) | 15.1 acres, including stormwater treatment (37.8% of site)                          |
| <b>Parcel Size</b>                     | 40 Acres   |   |
| <b>Gross Density</b>                   | 2.23 units/acre  |   |
| <b>Zoning</b>                          | F - District   |   |
| <b>Lot Width</b>                       | 80 feet  | 60, 80, 100 feet  |
| <b>Lot Depth</b>                       | 125 feet   | 100, 150 feet   |
| <b>Setbacks</b>                        | Front – 35 ft;<br>Rear/Side – 10 ft;<br>Corner – 35 ft   | Front – 20 ft, 50 ft;<br>Rear – 10 ft, 25 ft; Side – 3 ft, 10 ft;<br>Corner – 20 ft |
| <b>Lot Area</b>                        | 10,000 sf (ranging up to 33,000 sf)                      | 6,000 sf, 8,000 sf, 15,000 sf   |
| <b>Roadway</b>                         | 32 feet minimum  | 28 ft and 32 ft   |
| <b>Roadway Area</b>                    | 4.8 acres (12.0% of site)                                | 4.3 acres (10.8% of site)   |
| <b>ROW</b>                             | 66 feet minimum  | 50 feet minimum   |
| <b>ROW Area</b>                        | 10.9 acres (27.2% of site)                               | 9.2 acres (23% of site)   |
| <b>Waste Water</b>                     | Development served by City                               |   |
| <b>Potable Water</b>                   | Development served by City                               |   |
| <b>Allowable Release Rate</b>          | 0.10 cfs/acre  |   |
| <b>Required Permanent Pool Storage</b> | 0.75 inches/impervious acre                              |   |

## Moderate Density Residential Template Performance

Continuous simulation hydrologic computer modeling was used to evaluate the performance of the conventional and conservation templates. The results are presented on the facing page as flow hydrographs showing the daily average flow leaving the site under the two versions of the template. Also provided are three statistics used to characterize the runoff response of the templates. The statistics are:

- **TQmean** is the percentage of time that the flow rate is above the mean flow and is indicator of the stability of the flow - the higher the value, the more stable and less flashy the flow. It has been found that higher biological quality in streams is typically associated with higher values of TQmean.
- The **1-year discharge rate** is an indicator of the “channel forming” flow. Increases in the 1-year discharge rate will typically result in increases in streambank erosion as the channel adjusts to the new flow regime.
- The **required detention volume** is the volume required to meet the Kane County 100-year release rate of 0.1 cfs/acre of site. The required detention volume is an indicator of the total runoff leaving the site and the higher the value, the greater the potential for cumulative flood impacts downstream.

The results are discussed on the page following the hydrographs and bar charts.



# Moderate Density Residential Template Performance Conclusion

Examination of the hydrographs, TQmean values, and the 1.1-year discharge rates shows that the Conventional Moderate Density Residential Template is much more "flashy" than the assumed existing condition of agriculture. The peaks are higher and briefer and the baseflows between events are lower. Conversely, the Conservation Template has similar or lower maximum daily flows but has a more prolonged baseflow than the existing condition. The prolonged baseflows produce a significantly higher TQmean value. The prolonged baseflow of the Conservation Template is a result of the infiltration storage within the roadside bioswales that include infiltration storage.

The decrease in TQmean under the Conventional Template would be expected to have a negative impact on the biology of the receiving waterbody while the increase in TQmean under the Conservation template suggests that use of the principals and practices of that template could contribute to improved biological conditions within the receiving streams and wetlands.

The increase in groundwater driven baseflow under the Conservation Template suggests that there is also the potential for an increase in deep groundwater recharge, which is important for municipal and private water supplies.

The 1.1-year discharge rate under the Conventional Template is nearly double the rate for the assumed existing condition of agriculture, which could lead to significant increases in streambank erosion. However, under the Conservation Template, the 1.1-year discharge rate is only half that of the existing condition.

The required detention volume for the Conservation Template is less than half that required for the Conventional Template indicating much lower surface runoff volumes being discharged downstream and therefore less potential for flooding.

# BLACKBERRY CREEK WATERSHED ALTERNATIVE FUTURES ANALYSIS PROJECT

## RURAL RESIDENTIAL TEMPLATES



Prairie Crossing, Greyslake, Illinois

**Rural Residential Development:** Residential development with lots averaging approximately 1.25 acres, a gross density of 0.55 units per acre, served by private wells and septic systems. Typically, rural residential development is limited to unincorporated areas. However, more recently, many developments of this density have come under municipal jurisdiction, and would often be served by municipal water and sewer.

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This booklet presents descriptions and evaluation results of the Conservation and Conventional versions of the Rural Residential template. Watershed scale results are presented in the Alternative Futures Analysis Report.

# ~ CONVENTIONAL ~

## Rural Residential Guidelines and Conceptual Images

### Conventional Template Description

Conventional rural residential developments are designed like moderate density developments, but have a density of around 0.55 units per acre.

While many developments at this density have open drainage systems, these developments increasingly use curb and gutter drainage with storm sewers. This is particularly true of large lot developments occurring within municipalities. While swales provide a level of infiltration, hydrology is still dominated by surface runoff.

Detention basins at the edge of the development are used to temporarily store runoff and release it at the allowable rate. Detention basins include permanent pool storage as required by code to provide water quality benefits. However, many are lined with rip rap or have turf down to the shoreline and provide very little habitat benefit. Wet detention surrounded by turf quickly becomes permanent Canada goose habitat. The majority of non-paved areas are typically planted in turf grass as well.

Setbacks are large, necessitating long paved driveways, increasing impervious cover. Roads are generally wider than necessary for the traffic they support, increasing stormwater runoff, while at the same time heating runoff water well above naturally occurring temperatures. Wide streets also encourage higher speeds than may be safe for a residential neighborhood.

Although sometimes sidewalks are included in conventional large lot developments, typically they are not, unless required by code. This establishes the automobile as the primary mode of transportation. Culs-de-sacs are commonly used, creating disjointed neighborhoods that can make navigation confusing.



Turf grass stormwater drainage systems often lead to dead grass and bare ground due to wet conditions and subsequent erosion.



Turf lined stormwater detention typical of conventional development leads to shoreline erosion and supports excessive goose populations that cause water quality problems and reduces recreational use.



Large setbacks increase total pavement and imperviousness. Street “eyebrows” and curb radii increase impervious surface area and encourage inappropriately high automobile speeds.

# ~ CONSERVATION ~

## Rural Residential Guidelines and Conceptual Images

### Conservation Template Description

Conservation rural residential developments have the same gross density as conventional developments. However, reduced lot sizes and clustering allow for shared common open space and conservation easements to protect natural areas and preserve or create habitat and stormwater infiltration corridors. Individual home sites may use low-impact design techniques to reduce runoff from each lot, including rain-barrels, porous pavement, and ecologically sensitive native landscaping.

The objective of the stormwater system is to utilize significant common open space to filter and absorb runoff and replicate the natural site hydrology. There is no concentrated direct discharge of stormwater into streams or wetlands. Wastewater systems could include individual septic tanks that lead to a common on-site but municipally managed treatment system and drainage field rather than individual leach fields. Detention areas are naturalized, enhancing overall ecological integrity, while at the same time improving the aesthetic quality and rural character of the site.

Wildlife habitat and native landscaping occur in large areas on the front and back sides of home sites. Because less area of the site is needed for septic fields, remnant woodland, prairie and wetland landscapes can be preserved. All lots feature naturalized open space on at least one side. Turf grass is limited to lawn areas immediately surrounding each home and developed public recreation areas.

Roads in conservation large lot developments are narrower on average, and are designed at a human scale as well as for slower, more appropriate speeds for neighborhoods. Roads and streets have naturalized swales for immediate cooling and retention of stormwater.

Trail systems connect all parcels to each other, by using the natural areas and roadways. Trail systems also connect the site to adjacent residential developments and other nearby amenities. Both permeable and conventional pavement can be used for pedestrian and bicycle amenities found throughout the site, creating a low-impact, multi-modal network of transportation options for all residents.



Clustering large lot residences allows for accessible connected open space, which is preferable for recreation, stormwater retention and native habitat.

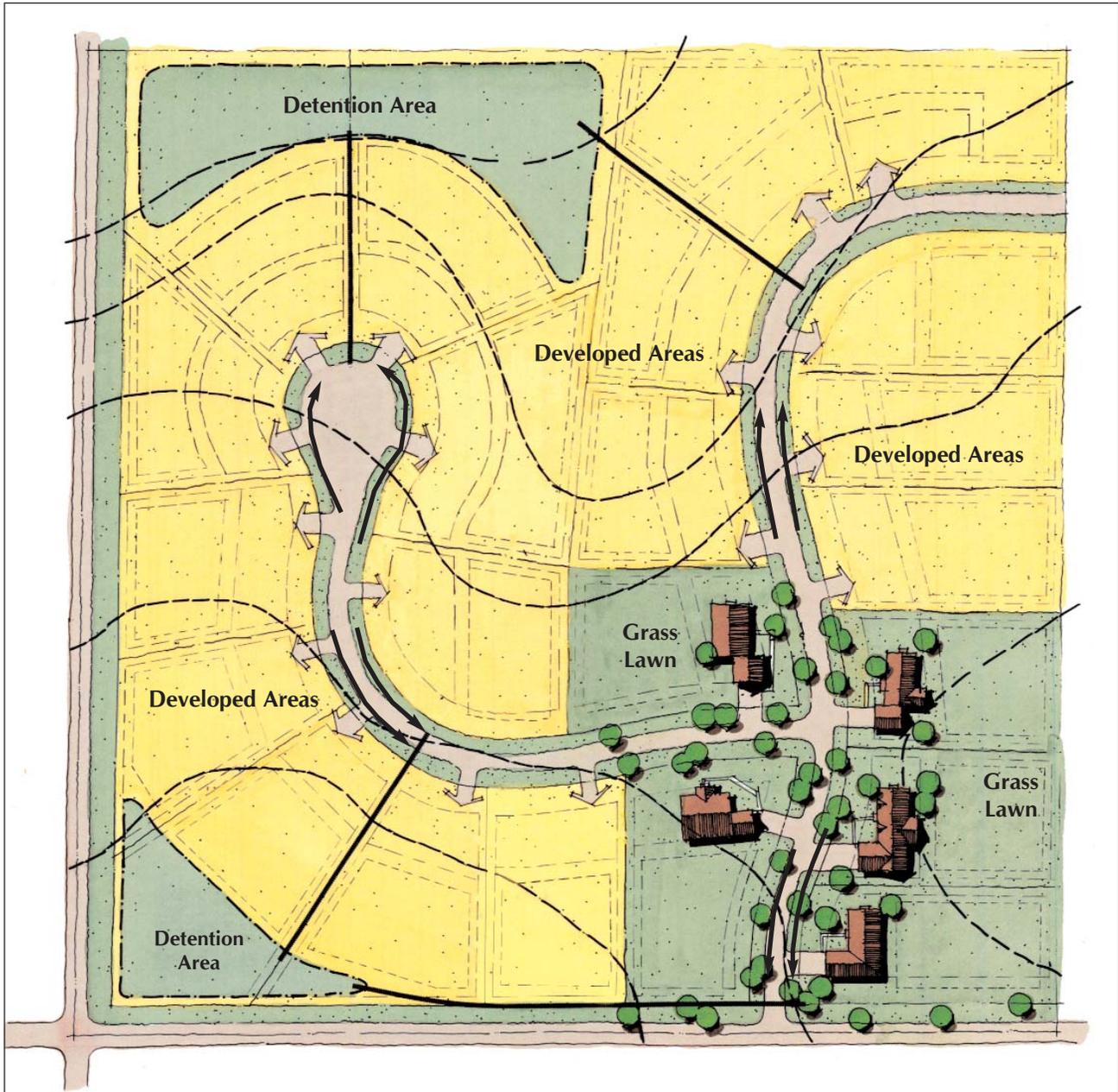


Naturalized detention provides desirable stormwater treatment and wildlife habitat while discouraging geese and enhancing rural character.



Swales with native plantings retain and cleanse stormwater runoff. Narrow lanes reduce pavement area and travel speed.

# ~ CONVENTIONAL ~ Rural Residential Template



Housing



Development Lot Line



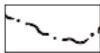
Contour Lines



Stormwater Infrastructure



Stormwater Flow Direction



Detention Pond Boundary

# ~ CONSERVATION ~

## Rural Residential Template



- |   |                      |   |                           |
|---|----------------------|---|---------------------------|
|  | Housing              |  | Vegetated Swales          |
|  | Recreational Shelter |  | Roadside Swales           |
|  | Development Lot Line |  | Canopy Trees              |
|  | Contour Lines        |  | Stormwater Infrastructure |
|   |                      |  | Stormwater Flow Direction |
|   |                      |  | Stormwater Level Spreader |

# Rural Residential Template Standards

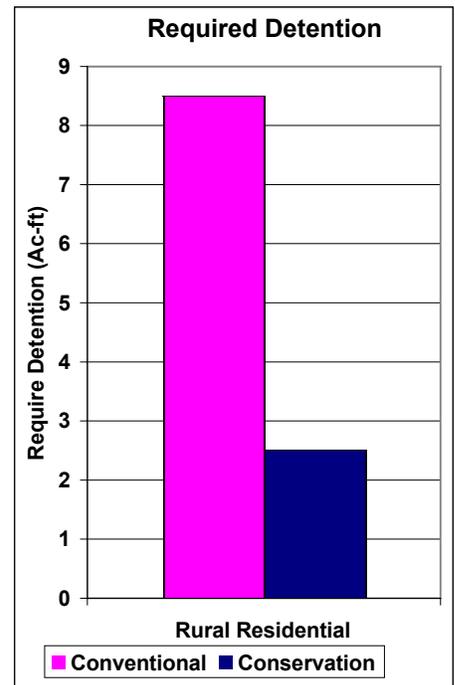
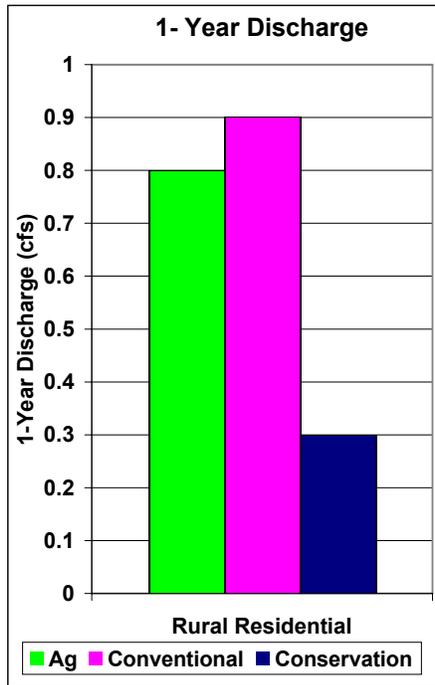
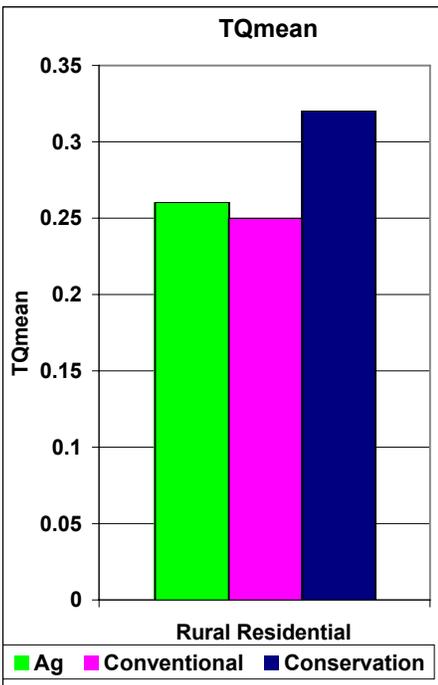
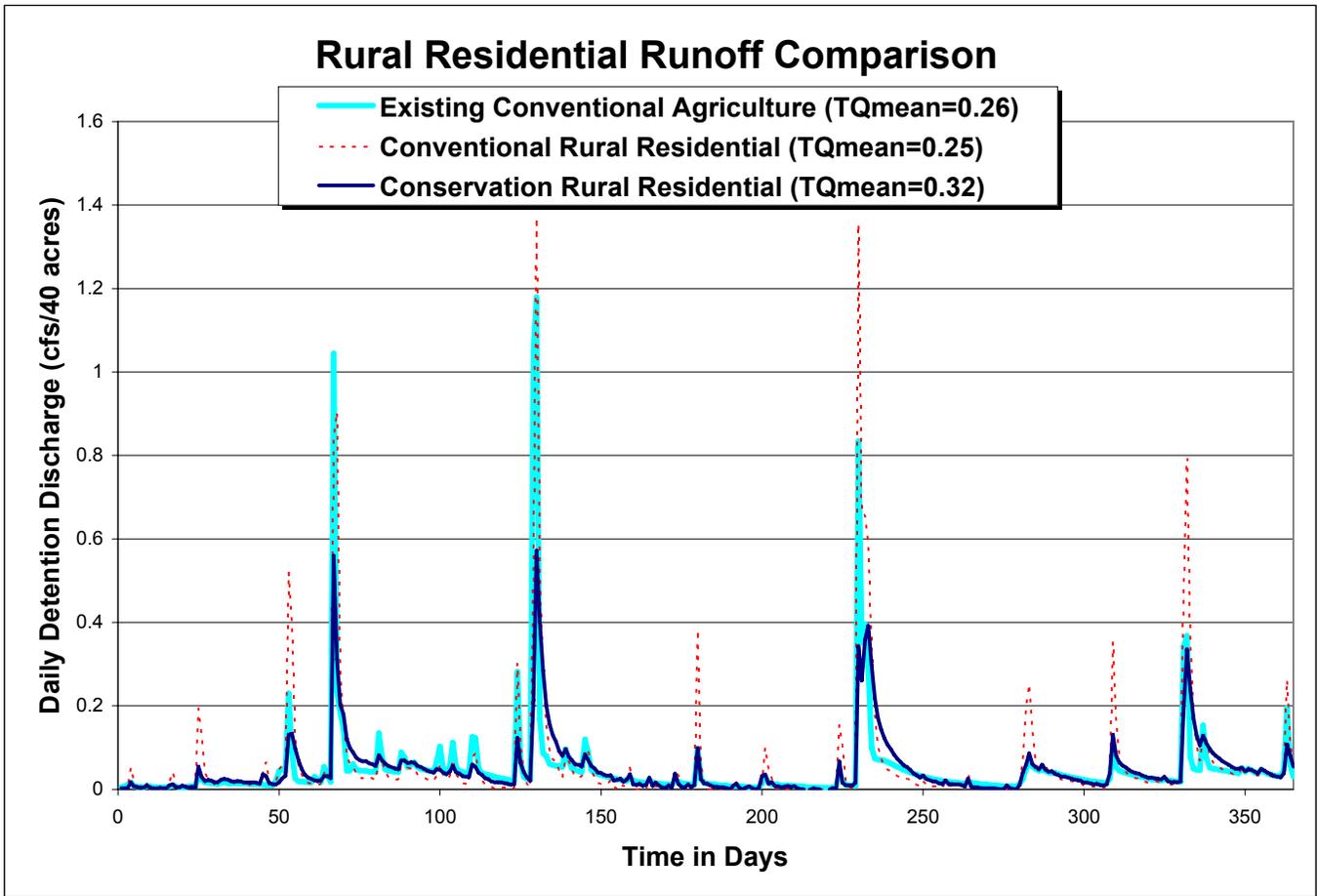
|   | Conventional  | Conservation  |
|---|---|---|
| <b>Number of Lots</b>                   | 22<br>(29.4 acres or 73.5% of site)                           | 22<br>(10.8 acres or 27.0% of site)   |
| <b>Open Space</b>                       | 3.8 acres, including stormwater treatment area (9.5% of site) | 21.6 acres, including storm water and wastewater treatment area (54.0% of site) |
| <b>Parcel Size</b>                      | 40 acres  |   |
| <b>Gross Density</b>                    | 0.55 units/acre   |   |
| <b>Zoning</b>                           | E3-PUD  |   |
| <b>Lot Width</b>                        | 200 feet  | 100 feet  |
| <b>Lot Depth</b>                        | 300 feet  | 150 feet  |
| <b>Lot Area</b>                         | 60,000 square feet  | 15,000 square feet  |
| <b>Setbacks</b>                         | Front – 35 ft;<br>Rear/Side – 10 ft;<br>Corner – 35 ft        |   |
| <b>Roadway</b>                          | 24 ft, 28 ft  | 20 ft, 24 ft  |
| <b>Roadway Area</b>                     | 2.6 acres (6.5% of site)                                      | 2.5 acres (6.2% of site)  |
| <b>ROW</b>                              | 66 feet minimum.  |   |
| <b>ROW Area</b>                         | 6.8 acres (17.0% of site)                                     | 7.6 acres (19.0% of site)   |
| <b>Wastewater</b>                       | Private septic tank with individual leach field.              | Private septic tank with common treatment and leach field system.               |
| <b>Water Supply</b>                     | Individual well.  |   |
| <b>Allowable Detention Release Rate</b> | 0.10 cfs/acre   |   |
| <b>Required Permanent Pool Storage</b>  | 0.75 inches/impervious acre                                   |   |

## Rural Residential Template Performance

Continuous simulation hydrologic computer modeling was used to evaluate the performance of the conventional and conservation templates. The results are presented on the facing page as flow hydrographs showing the daily average flow leaving the site under the two versions of the template. Also provided are three statistics used to characterize the runoff response of the templates. The statistics are:

- **TQmean** is the percentage of time that the flow rate is above the mean flow and is indicator of the stability of the flow - the higher the value, the more stable and less flashy the flow. It has been found that higher biological quality in streams is typically associated with higher values of TQmean.
- The **1-year discharge rate** is an indicator of the “channel forming” flow. Increases in the 1-year discharge rate will typically result in increases in streambank erosion as the channel adjusts to the new flow regime.
- The **required detention volume** is the volume required to meet the Kane County 100-year release rate of 0.1 cfs/acre of site. The required detention volume is an indicator of the total runoff leaving the site and the higher the value, the greater the potential for cumulative flood impacts downstream.

The results are discussed on the page following the hydrographs and bar charts.



# Rural Residential Template Performance

## Conclusion

The relatively low imperviousness of even the Conventional Rural Residential Template resulted in a similar TQmean value and 1.1- year discharge rate as the agricultural template. The small differences in TQmean and 1.1- year discharge values between the conventional and agriculture templates were not found to be statistically significant. However, examination of the hydrographs shows a significant difference in runoff response between the Conventional and agricultural templates, particularly for the smaller summertime events. The peaks of the Conventional Template hydrograph are greater and the recession is quicker.

The runoff response of the Conservation Template is quite similar to agriculture for the smaller rainfall events with similar maximum daily flows and recession rates. However, for the larger events, the maximum daily flows of the Conservation Template are significantly lower than the agricultural template. The lower peaks are consistent with the greater TQmean and 1.1-year discharge values of the Conservation Template relative to the Conventional and agricultural templates.

The Conservation Template has similar groundwater driven baseflows as the existing condition and greater than the Conventional Template. This suggests that deep groundwater recharge should also be maintained, which is important for municipal and private water supplies.

The greater TQmean and lower 1.1-year discharge rates of the Conservation Template suggest that use of the principals and practices of that template could contribute to improved biological conditions in receiving streams and wetlands.

The required detention volume for the Conservation Template is less than one third that required for the Conventional Template indicating much lower surface runoff volumes being discharged downstream and therefore less potential for flooding.

# BLACKBERRY CREEK WATERSHED ALTERNATIVE FUTURES ANALYSIS PROJECT

## ESTATE RESIDENTIAL TEMPLATES



**Estate Residential Development:** Residential development, with lots averaging approximately 2.5 acres in size, a gross density of approximately 0.2 units per acre, served by private well and septic. Estate residential developments occur almost exclusively in unincorporated areas.

This booklet has been prepared as part of the Blackberry Creek Watershed Alternative Futures Analysis project funded by a grant from USEPA to IDNR and Kane County. Under this project, two “visions” for the watershed have been developed and evaluated. One vision is composed of “Conservation” template land uses that conserve a high level of watershed integrity. The other vision is composed of “Conventional” template land uses that generally will have a negative impact on watershed hydrology and biology.

This booklet presents descriptions and evaluation results of the Conservation and Conventional versions of the Estate Residential Template. Watershed scale results are presented in the Alternative Futures Analysis Report.

# ~ CONVENTIONAL ~

## Estate Residential Guidelines and Conceptual Images

### Conventional Template Description

Conventional estate residential development consists of 2.5 acre or greater lots, and often a single access road culminating in a cul-de-sac.

Requirements for stormwater detention are met through the provision of turf grass depressions, or occasionally with constructed ponds. Stormwater is conveyed via roadside swales and culverts, which are also typically planted in turf grass.

Driveways in conventional estate residential developments tend to be long and paved with standard impermeable asphalt and may include a dropoff area and several outdoor parking spaces, increasing the per household imperviousness.

Environmentally speaking, even though there is generally less runoff in an estate residential development due to the low density and low relative amount of impervious surface, conventional residential developments pose several other problems to the local ecology. Grass lawns require a great deal of fertilizer, pesticides, and herbicides, as well as irrigation, to maintain them in the desired condition. Added chemicals run off and work their way slowly into local streams and wetlands. Turf lawns, especially in the magnitude seen in conventional estate residential developments, not only require mowing, but allocate more underutilized mown acres per person than other more dense or more naturally landscaped developments. Turf lawns also have very little habitat value and produce more runoff than virtually any other non-impervious surface.

Conventional estate residential developments offer few safe and convenient alternatives to driving, and thus pose challenges to networked road systems. Day to day trips, either to and from work, or to and from shopping, school and other destinations typically can only be achieved by driving a car.



Stormwater detention in some cases is designed as a naturalized system. However, “flashy” hydrology and excessive nutrient loading can lead to dominance by invasive and non-native plant species.



Although producing less runoff than curb and gutter systems, turf swales subject to wet conditions may lead to bare ground and subsequent erosion as well as reduced aesthetics.



Turf grass lawns make up a majority of estate residential landscapes, requiring fertilization and mowing and providing little wildlife habitat value.

# ~ CONSERVATION ~

## Estate Residential Guidelines and Conceptual Images

### Conservation Template Description

Conservation estate developments are laid out in a similar pattern to conventional ones, but are otherwise very different. Although the same gross density is maintained and actual lot sizes are the same, the area impacted by development is much smaller as only the ground necessary for structures and septic systems is disturbed by equipment. The remaining areas are preserved or restored to a native landscape.

The goal for stormwater is to preserve and replicate the natural site hydrology. This is achieved by minimizing disturbed areas, using existing natural drainageways, and utilizing native landscapes to filter and retain runoff. Retention areas are designed as natural elements of the overall landscape. Because the stormwater system responds to the natural features of the site, potentially important or remnant habitat can more easily be protected. There is no concentrated direct discharge of stormwater into nearby streams or wetlands.

Design features are also used to enhance conservation estate development. Turf grass is limited to lawn areas immediately surrounding the home, while deep-rooted native plants occupy outer lawn areas and land within conservation easements. Swales along roadways are naturalized and planted with native species throughout the site.

The conservation estate road system is similar to the conventional, but here the cul-de-sac has a vegetated island in the middle, which becomes part of the stormwater retention system. Also, bicycles and pedestrians may use non-automobile transportation trail easements, which allow low-impact access to natural areas and other nearby developments. Thus, the conservation design encourages and allows residents to use modes of transportation other than the automobile, if they so desire.

Structures are moved slightly closer to the road to increase the amount of contiguous conservation easement land in the rear of lots. Conservation easements can be maintained by a land trust, local municipality, local community cooperative group or other organization. Monitoring of proper maintenance of natural areas can pose challenges in some cases.



Naturalized infiltration systems are aesthetic and ecological amenities, and provide ample space for public open space opportunities.



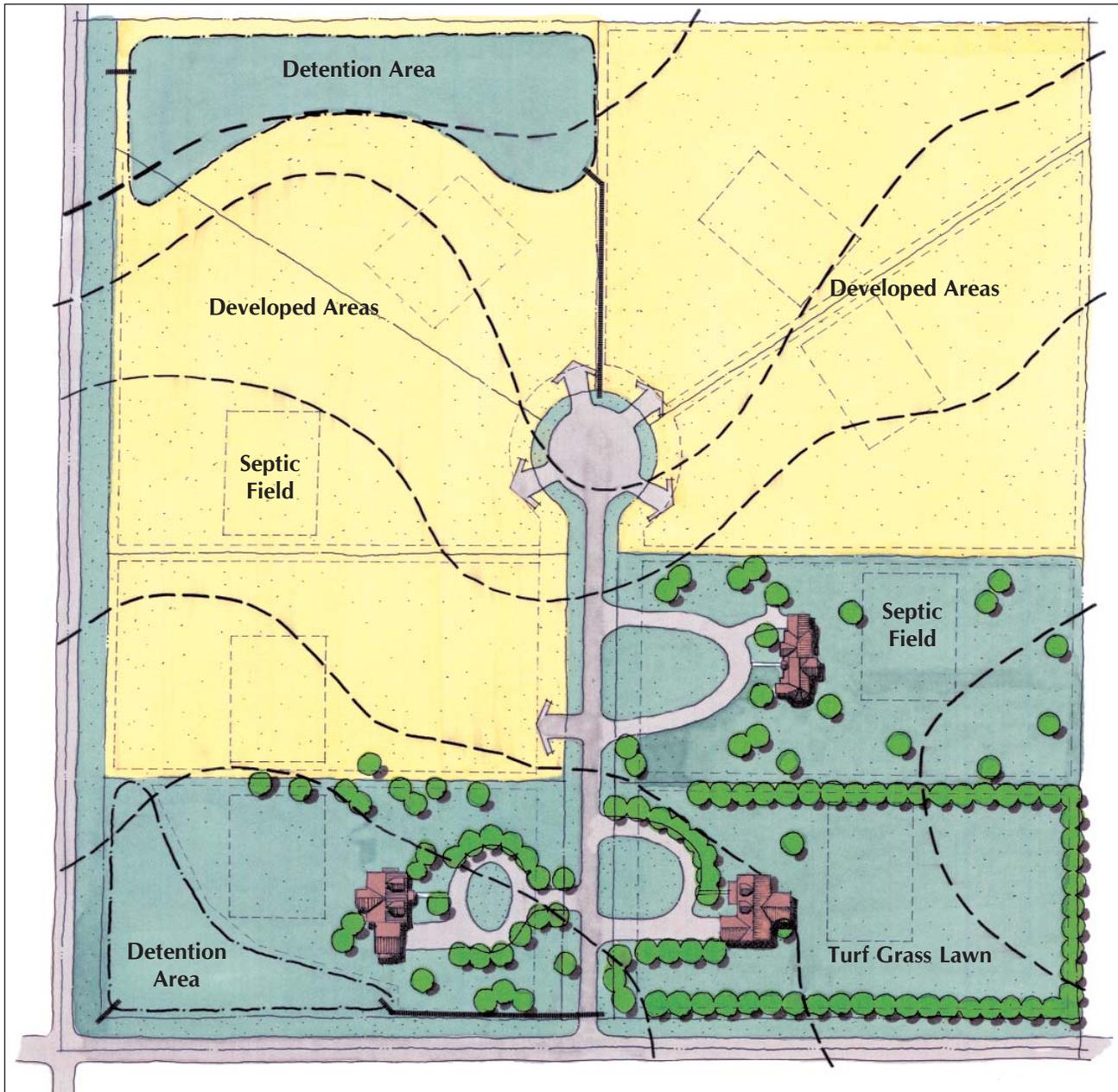
Conservation estate residential developments have human-scale roads designed for slow and safe automobile travel speeds and other transportation modes, including bicycles and pedestrians.



Conservation estate residential landscaping uses native plants instead of turf grass for their aesthetic qualities and their beneficial impacts on ecological (habitat) and hydrologic systems.

# ~ CONVENTIONAL ~

## Estate Residential Template



Housing



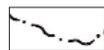
Development Lot Line



Contour Lines



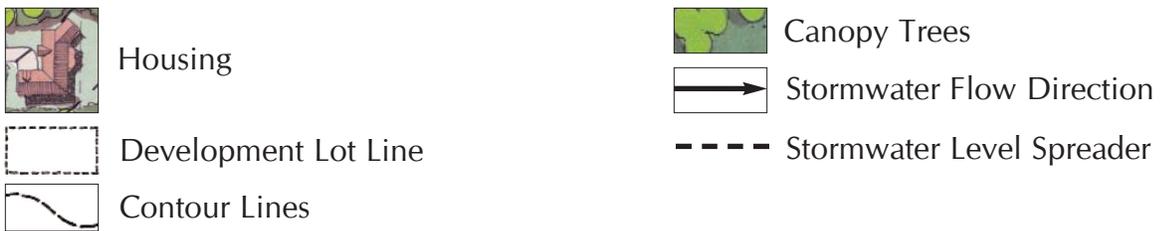
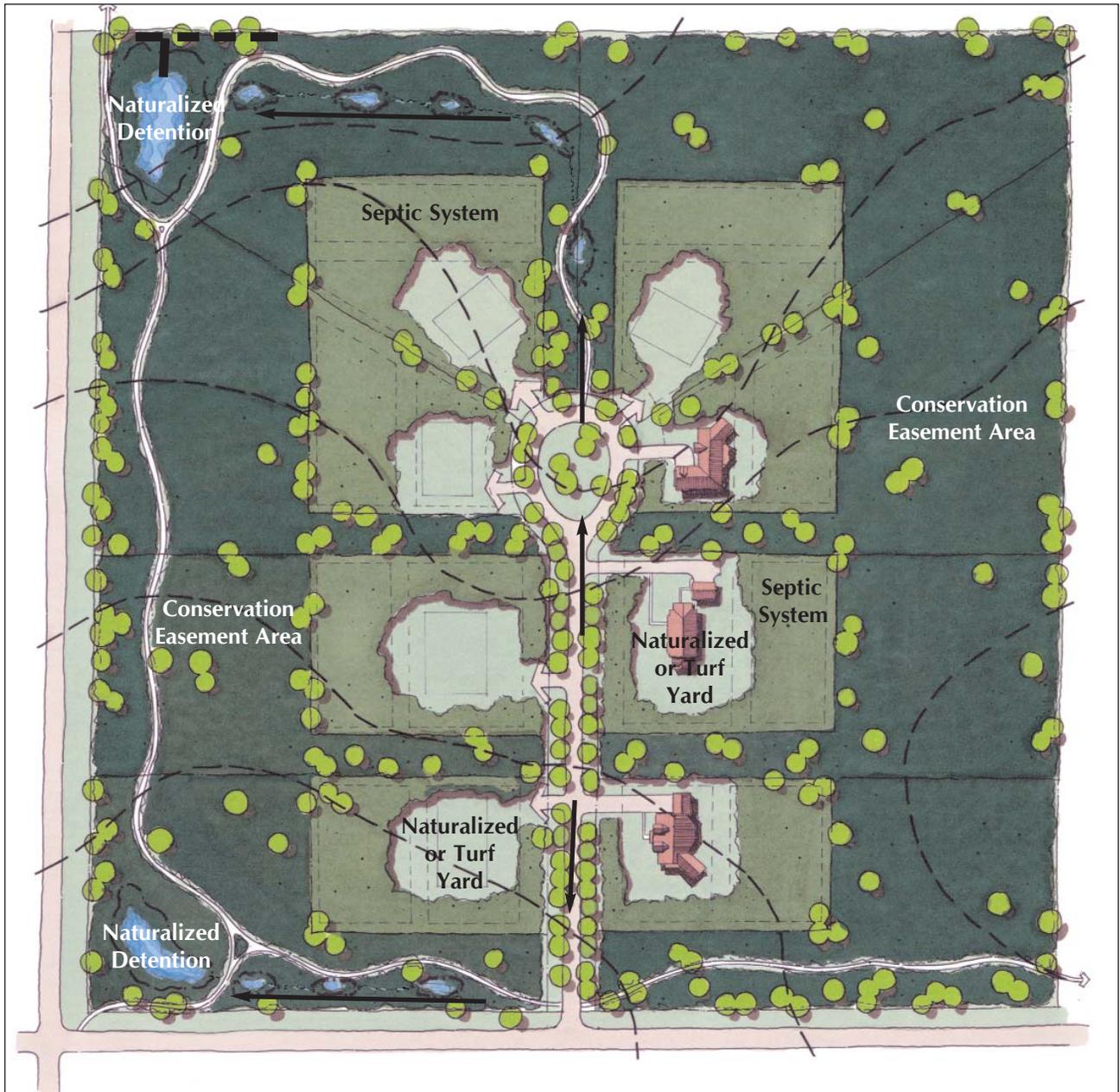
Stormwater Infrastructure



Detention Pond Boundary

# ~ CONSERVATION ~

## Estate Residential Template



# Estate Residential Template Standards

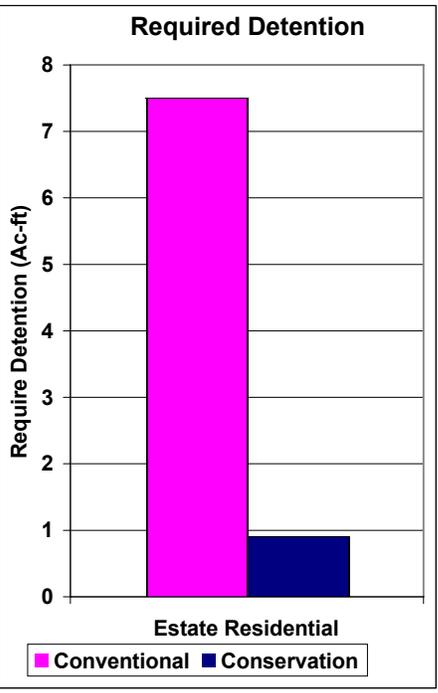
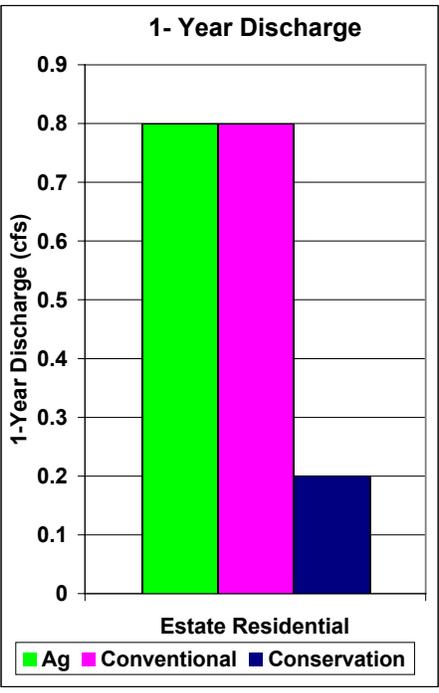
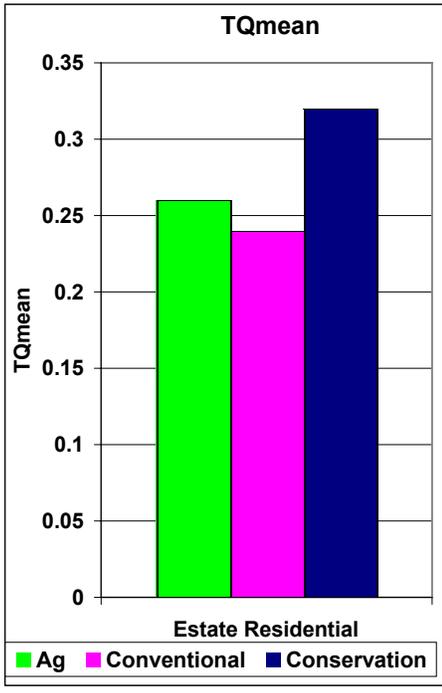
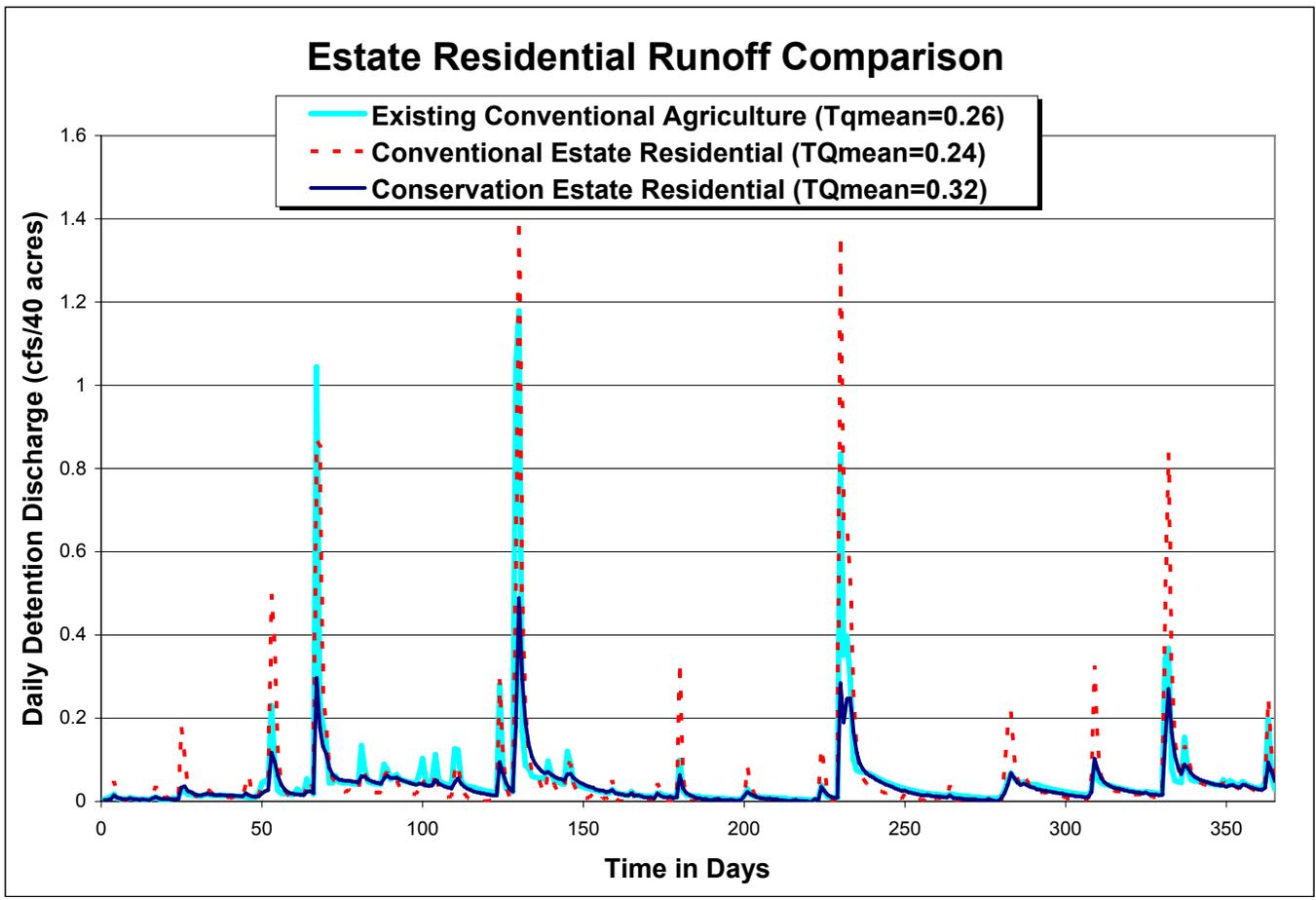
|   | Conventional   | Conservation   |
|---|--|--|
| <b>Number of Lots</b>                   | 8 (35.3 acres or 88.2 % of site)                                 |  |
| <b>Open Space</b>                       | No officially designated open space (detention is part of lots). | No officially designate open space but 20 acres protected through conservation easements |
| <b>Parcel Size</b>                      | 40 acres   |  |
| <b>Gross Density</b>                    | 0.2 units/acre   |  |
| <b>Zoning</b>                           | E3-PUD   |  |
| <b>Lot Width</b>                        | 300 feet   | 200 feet   |
| <b>Lot Depth</b>                        | 600 feet   | 300 feet   |
| <b>Lot Area</b>                         | 180,000 sf   | 180,000 sf   |
| <b>Setbacks</b>                         | Front – 35 ft;<br>Rear/Side – 10 ft;<br>Corner – 35 ft           | Front – 35 ft;<br>Rear/Side – 10 ft;<br>Corner – 35 ft                                   |
| <b>Roadway</b>                          | 24 feet  |  |
| <b>Roadway Area</b>                     | 1.6 acres (4.0% of site)   | 1.5 acres (3.8% of site)   |
| <b>ROW</b>                              | 66 feet minimum.   |  |
| <b>ROW Area</b>                         | 4.7 acres (11.8% of site)  |  |
| <b>Wastewater</b>                       | Private septic system.   |  |
| <b>Water Supply</b>                     | Private well.  |  |
| <b>Allowable Detention Release Rate</b> | 0.10 cfs/acre  |  |
| <b>Required Permanent Pool Storage</b>  | 0.75 inches/impervious acre                                      |  |

## Estate Residential Template Performance

Continuous simulation hydrologic computer modeling was used to evaluate the performance of the conventional and conservation templates. The results are presented on the facing page as flow hydrographs showing the daily average flow leaving the site under the two versions of the template. Also provided are three statistics used to characterize the runoff response of the templates. The statistics are:

- **TQmean** is the percentage of time that the flow rate is above the mean flow and is indicator of the stability of the flow - the higher the value, the more stable and less flashy the flow. It has been found that higher biological quality in streams is typically associated with higher values of TQmean.
- The **1-year discharge rate** is an indicator of the “channel forming” flow. Increases in the 1-year discharge rate will typically result in increases in streambank erosion as the channel adjusts to the new flow regime.
- The **required detention volume** is the volume required to meet the Kane County 100-year release rate of 0.1 cfs/acre of site. The required detention volume is an indicator of the total runoff leaving the site and the higher the value, the greater the potential for cumulative flood impacts downstream.

The results are discussed on the page following the hydrographs and bar charts.



# Estate Residential Template Performance

## Conclusion

The relatively low imperviousness of even the Conventional Estate Residential Template resulted in a similar TQmean value and 1.1- year discharge rate as the cropland template. The small differences in TQmean and 1.1- year discharge values between the conventional and agriculture templates were not found to be statistically significant. However, examination of the hydrographs shows a significant difference in runoff response between the conventional and agricultural templates, particularly for the smaller summertime events. The peaks of the Conventional Template hydrograph are greater and the recession is quicker.

The runoff response of the Conservation Template is somewhat similar to agriculture for the smaller rainfall events with slightly lower maximum daily flows and recession rates. However, for the larger events, the maximum daily flows of the Conservation Template are significantly lower than the agricultural template. The lower peaks are consistent with the greater TQmean and 1.1-year discharge values of the Conservation Template relative to the conventional and agricultural templates.

The Conservation Template has similar groundwater driven baseflows as the existing condition and greater than the Conventional Template. This suggests that deep groundwater recharge should also be maintained, which is important for municipal and private water supplies.

The greater TQmean and lower 1.1-year discharge rates of the Conservation Template suggest that use of the principals and practices of that template could contribute to improved biological conditions in receiving streams and wetlands.

The required detention volume for the Conservation Template is less than 15% of that required for the Conventional Template indicating much lower surface runoff volumes being discharged downstream and therefore less potential for flooding.

# BLACKBERRY CREEK WATERSHED ALTERNATIVE FUTURES ANALYSIS PROJECT

## AGRICULTURE TEMPLATES



Rissman Organic Farm - Waterman, IL

**Agricultural Lands:** Land that is cultivated and manipulated for the production of food crops and/or livestock for sale beyond the immediate use of the farmer or landowner.

This booklet has been prepared as part of the Blackberry Creek Watershed Alternative Futures Analysis project funded by a grant from USEPA to IDNR and Kane County. Under this project, two “visions” for the watershed have been developed and evaluated. One vision is composed of “Conservation” template land uses that conserve a high level of watershed integrity. The other vision is composed of “Conventional” template land uses that generally will have a negative impact on watershed hydrology and biology.

This booklet presents descriptions and evaluation results of the Conservation and Conventional versions of the Agricultural Template. Watershed scale results are presented in the Alternative Futures Analysis Report.

# ~ CONVENTIONAL ~

## Agriculture Guidelines and Conceptual Images

### Conventional Template Description

The conventional agricultural template assumes typical industrial, row-crop agriculture, that includes the use of fertilizers, herbicides, pesticides, tillage of the soil, and single crop plantings. “conservation tillage” and no-till farming are becoming more common in Illinois. However, conventional tillage practices still occur on many farms. Conventional crops generally consist of either soybeans or corn, but crop types do vary depending upon local soil types and climate.

Farming within the floodplain is common and often occurs up to the edge of streams and wetlands. Runoff from agricultural fields is not regulated or buffered from the stream corridor.

Isolated wetlands and hydric soils that have been drained to reduce wetness are often plowed and used for crop production even though the crop is lost in many years due to continued wet conditions.

As soil resources are depleted of their organic and nutrient content, increasing amounts of fertilizers are required. Irrigation is also becoming increasingly necessary to support production.

Stream buffer requirements for conventional agriculture only apply when the land use changes from agriculture to urban uses. Therefore, stream buffers often do not exist. The conventional template does not show potential or existing conservation easements, and assumes the maximum allowable amount of land utilized for conventional agricultural production.



Conventional agriculture requires pesticide and fertilizer application, which impacts air, soil, and water quality.



Conventional row-crop agriculture typically relies on one or two crops (corn and soybeans in the case of Illinois), applied over large parcels of land.



Stream buffers of 5 to 15 feet may occur as some recognize the streambank stabilization benefits of buffers. However, crops are often planted right up to the stream edge.



Conventional agriculture generally does not take into account the natural features of the landscape, including wetlands.

# ~ CONSERVATION ~

## Agriculture Guidelines and Conceptual Images

### Conservation Template Description

The conservation agriculture template includes a variety of techniques and environmentally sound agricultural practices that may improve or at least have less impact on the hydrologic systems of a watershed. Sustainable agriculture is an attempt to mimic more closely ecological and hydrological systems using natural features and elements of the landscape. The type of production is sensitive to the soil, moisture, and other conditions of the land.

Where streams and wetlands occur, the conservation agriculture template includes a continuous stream corridor of native plants and riparian wetlands. Conservation easements are typically used to protect the stream corridor and floodplain, although other options exist. Adjacent and isolated wetlands are restored, as is the original meandering of stream systems.

For crops that require plowing, plowing occurs along contours and includes periodic filter strips to reduce erosion and soil loss. Although the stream corridors and wetlands are protected from conventional farming, they may still be used for native seed and plant production. Organic farming is resurrected as the primary or sole farming technique, with respect to pesticide and fertilizer application. Bison and other “designer” meat sources, grazing, perennial crops, and native prairie landscape and plant production are other potential agricultural uses that could be implemented as well.

Prior to the introduction of industrial farming practices, farmers typically generated more than one or two different products including crops. This template suggests a range of opportunities, rather than identifying the particular alternative options each farmer might choose. The template is divided into several different types of sustainable agricultural vignettes, including such things as sustainable forestry, intensive crop production, grazing, orchards, native seed production, green houses, and row-cropping. The defined land areas within the conservation template provide space and opportunity for value-added agricultural practices and other trades as well.



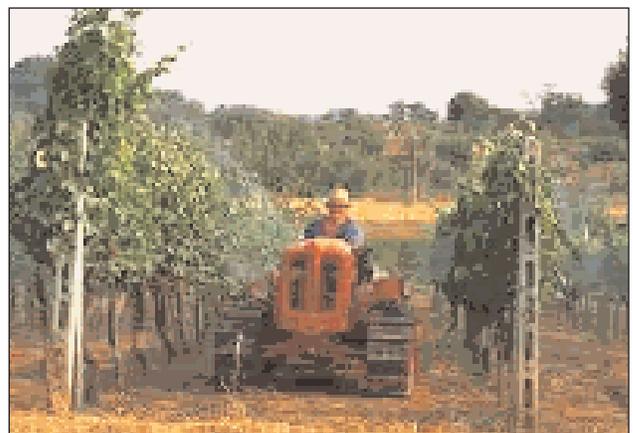
Organic farm photo simulation from the conventional agricultural template, adding a variety of field sizes, filter strips, and providing stream and woodlot corridor buffers for wildlife.



Conservation agriculture includes such alternatives as community supported agriculture.

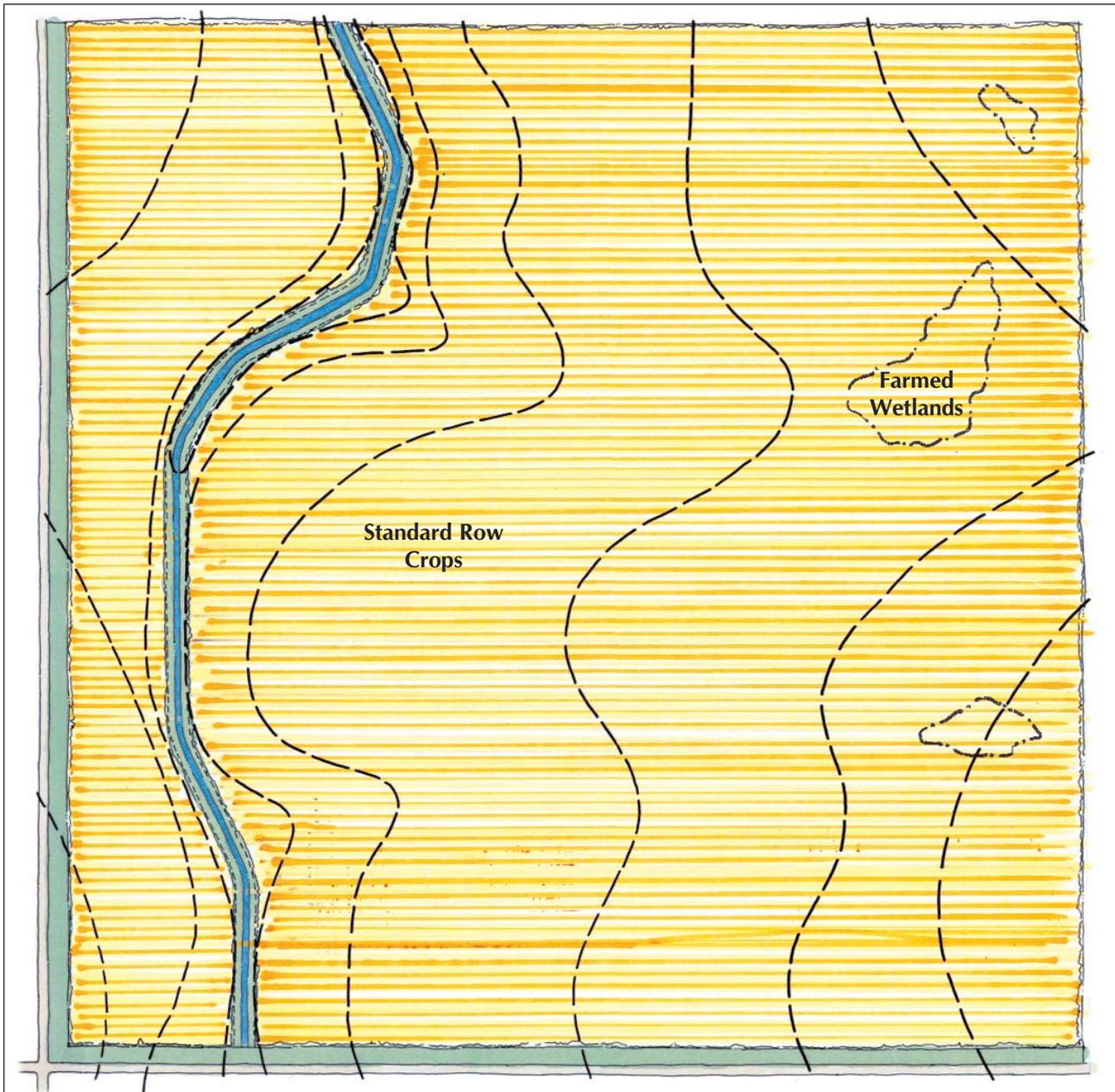


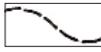
Animal production on Conservation Farms involves free-range, and non-factory farming conditions.



Biodynamic farming and permaculture are environmentally friendly forms of organic, non-chemically based agricultural practices.

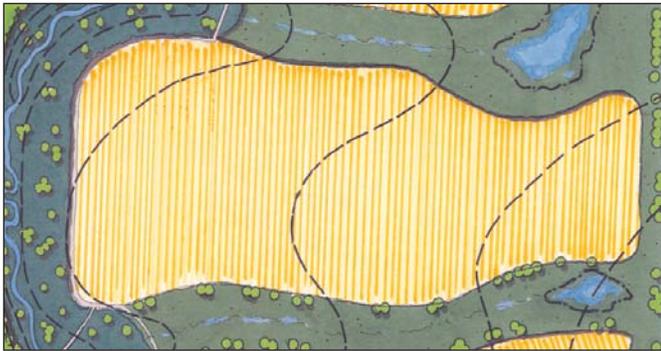
# ~ CONVENTIONAL ~ Agriculture Template



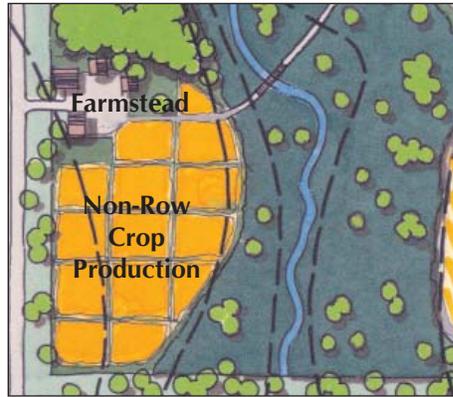
-  Channelized Stream
-  Row Crops or Grazing
-  Contour Lines
-  Wetland Boundary

# ~ CONSERVATION ~

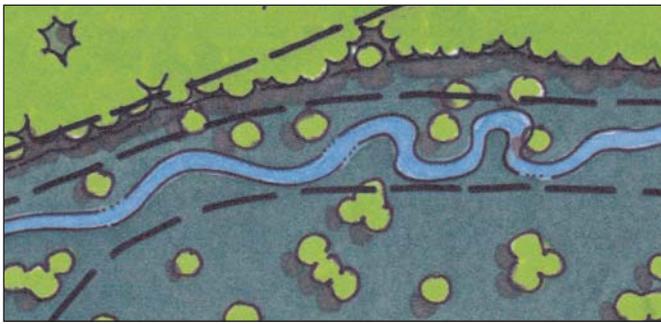
## Agriculture Template



Contour Plowing, Perennial Crops, or Grazing.



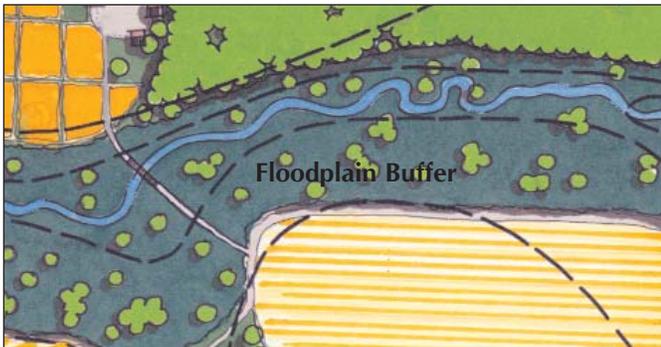
Farmstead & Intensive Non-Row Crop Production - Agritourism such as “pick your own” and pumpkin farms.



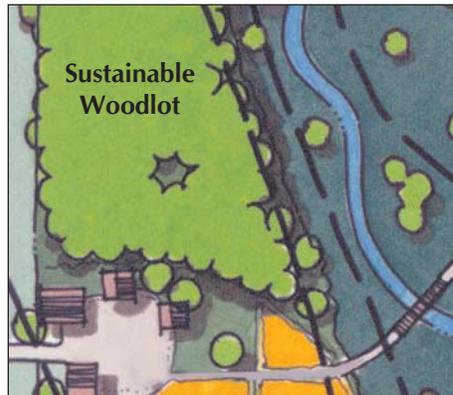
Re-Meandered Stream for habitat and restoration of natural stream-floodplain relationship.



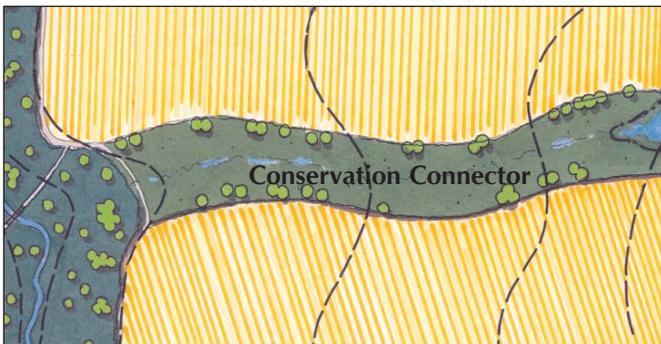
Restored Wetlands for wildlife habitat, hunting, fishing, and native seed production.



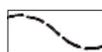
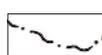
Floodplain Buffer used for native seed production.



Sustainable Woodlot for wood production, wildlife habitat and hunting.



Conservation Connector for buffering & drainage.

-  Canopy Trees
-  Contour Lines
-  Wetland Boundary

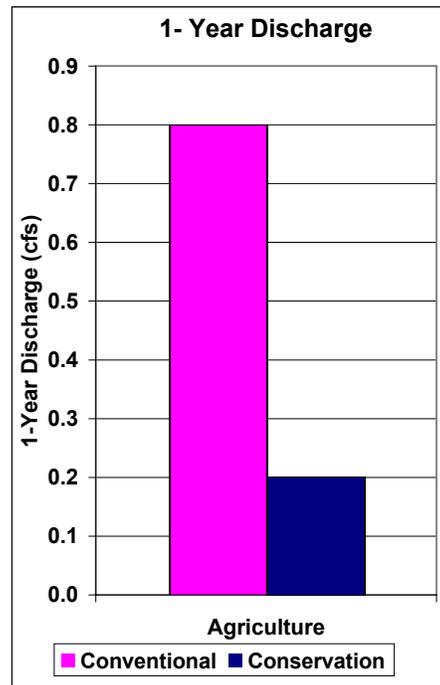
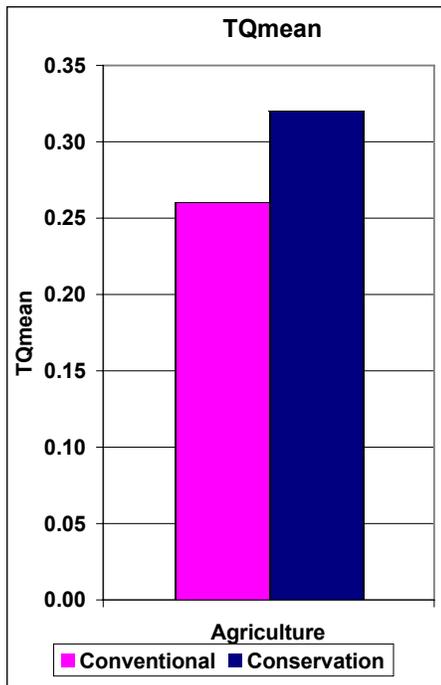
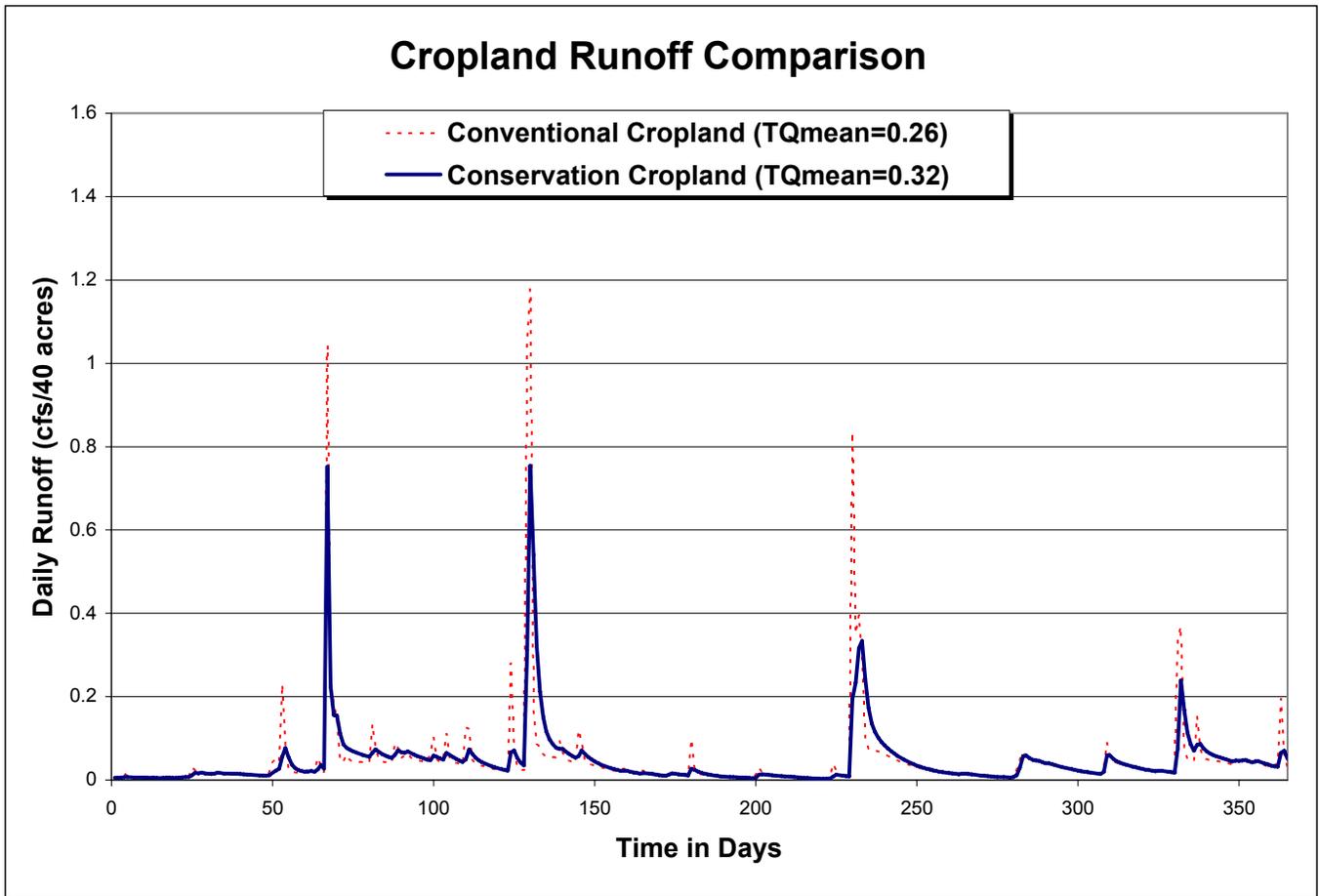
# Agriculture Template Characteristics

|                              | <b>Conventional</b>   | <b>Conservation</b>   |
|------------------------------|---|---|
| <b>Water Requirements</b>    | Crops are typically rain-fed with center-pivot irrigation used in areas with sandy soils.   | Crops are also typically rain-fed with various features and practices that conserve moisture and use it efficiently.  |
| <b>Nutrient Requirements</b> | Nitrogen, phosphorous and potassium delivered through chemical fertilizers and applied in full recommended rates for optimal crop production. | Soil fertility maintained through crop rotations using legumes, grazing animals, composted manure, with some naturally sourced purchased organic products.        |
| <b>Pest Management</b>       | Chemically based.   | Integrated pest management, biological control agents, or other organic control substances when needed.   |
| <b>Weed Management</b>       | Chemically based.   | An attitude of management rather than complete elimination using techniques including timely cultivation, mowing, cover crops and human labor.                    |
| <b>Soil Erosion Control</b>  | Conservation tillage and terracing occasionally used.   | Timely field work, contour planting and tillage, grass or native planted buffers and waterways, crop rotations, restored wetlands, perennial crops and hedgerows. |
| <b>Drainage</b>              | Drain tile, ditching  | Limited tiling, crops targeted to moisture conditions, improved soil structure and organic matter resulting in better infiltration and less runoff.               |

## Agriculture Template Performance

Continuous simulation hydrologic computer modeling was used to evaluate the performance of the conventional and conservation templates. The results are presented on the facing page as flow hydrographs showing the daily average flow leaving the site under the two versions of the template. Also provided are three statistics used to characterize the runoff response of the templates. The statistics are:

- **TQmean** is the percentage of time that the flow rate is above the mean flow and is indicator of the stability of the flow - the higher the value, the more stable and less flashy the flow. It has been found that higher biological quality in streams is typically associated with higher values of TQmean.
- The **1-year discharge rate** is an indicator of the “channel forming” flow. Increases in the 1-year discharge rate will typically result in increases in streambank erosion as the channel adjusts to the new flow regime.



# Agriculture Template Performance Conclusion

The Conservation version of the Agricultural Template has a significantly lower 1.1-year discharge rate and a greater TQmean value than the Conventional Template. Examination of the hydrographs shows that the greatest difference in response is for the larger runoff events. This suggests that use of the Conservation Template could contribute to improved biological conditions in the receiving streams and wetlands.

# BLACKBERRY CREEK WATERSHED ALTERNATIVE FUTURES ANALYSIS PROJECT

## STREAM CORRIDOR TEMPLATES



Nippersink River, Illinois

**Stream Corridors:** Linear corridors along streams, creeks and rivers. The conservation template depicts a healthy stream corridor, and includes wetlands and floodplains adjacent to the stream. The conventional template depicts a degraded stream corridor, and is limited to a minimum buffer of 0 to 50 feet, depending on the drainage area and adjacent land use.

This booklet has been prepared as part of the Blackberry Creek Watershed Alternative Futures Analysis project funded by a grant from USEPA to IDNR and Kane County. Under this project, two “visions” for the watershed have been developed and evaluated. One vision is composed of “Conservation” urban and agricultural template land uses that conserve a high level of watershed integrity and allow preservation of the characteristics depicted under the Conservation version of the stream corridor template. The other vision is composed of “Conventional” template land uses that generally will have a negative impact on watershed hydrology and biology and tend to lead to conditions described under the Conventional (degraded) version of this template.

# ~ CONVENTIONAL ~

## Stream Corridor Guidelines and Conceptual Images

### Conventional Template Description

Stream quality depends on the quality of its water source (groundwater and surface water), hydrodynamics, stream morphology, and stream corridor treatment.

Under the Conventional Template, the stream corridor is limited to a buffer width of 15 to 50 feet on each side of the waterway.

In the Conventional Template, the corridor is often either turf grass or agricultural field. Within newly developing areas, the stream is buffered by 15 to 50 feet of native vegetation, depending upon the size and quality of the stream, according to local standards set within the Countywide stormwater ordinance. These buffer requirements only apply when land uses change to urban uses, and do not apply to areas developed prior to the ordinance effective date (January, 2002).

Conventional, or degraded stream corridors are fed primarily by surface runoff and drain tile discharge during storm events. Baseflows tend to decrease as the watershed develops due to decreased groundwater recharge. As a result, streams tend to become intermittent at larger and larger drainage areas.

Many streams have been channelized, removing natural meanders, pools and riffles to facilitate drainage, and confining the stream to its channel through dredging and its resulting side-cast levees. As a result, streams tend to be isolated from their floodplains and therefore are more subject to erosive forces during high flows. Modification of flood fringe areas continues to be allowed by ordinance provided that floodplain storage is preserved.

Access to the stream in agricultural areas is often uncontrolled and subject to damage from livestock. In urban areas, stormwater is allowed to discharge directly into the stream.

As a result of the modified hydrology, reduced water quality, and physical disturbances, habitat conditions tend to be degraded and biodiversity substantially reduced. Index of Biotic Integrity scores are typically in the 30s or lower.



Conventional channelized stream corridor with 8'-10' side cast pile on left side of creek.



Conventional channelized stream corridor with agricultural development up to the stream edge.



Conventional stream corridor in urban area with significant streambank erosion. (Note exposed storm sewer tiles on left due to bank recession.)

# ~ CONSERVATION ~

## Stream Corridor Guidelines and Conceptual Images

### Conservation Template Description

The corridor of high quality streams typically includes the entire floodplain area. In addition to a natural corridor, high quality streams generally only occur in watersheds where hydrologic modification has not been significant.

Conservation stream corridors have continuous shorelines and buffers consisting of native plants and wetlands and a corridor that generally coincides with the floodplain. Streams are buffered to a fixed distance from the edge of the meander belt width, rather than from the edge of the bank, and are protected through conservation easements. The buffer should be standard for all land uses.

Healthy stream corridors are fed primarily by groundwater, with little direct surface water runoff except during snowmelt conditions. Water level fluctuations are gradual, changing with season according to rainfall, snowmelt and evaporation rates, and are much less sensitive to individual rainfall events.

Adjacent natural features, riparian wetlands, meandering, and riffle-pool sequences of the stream are either preserved or restored. Intermittent streams, hydric soils and other stream-related features are protected as “conservation connectors” adding to a conservation network across the watershed.

Channelization has not occurred, nor has dredging, levee creation, or filling in of the floodplain. Overbank flow occurs only for runoff events with frequencies of one to two years. Direct stormwater and wastewater discharges generally do not occur. Instead, discharges are to buffer areas using level spreaders, swales, created wetlands and other methods of dissipating discharge energy.

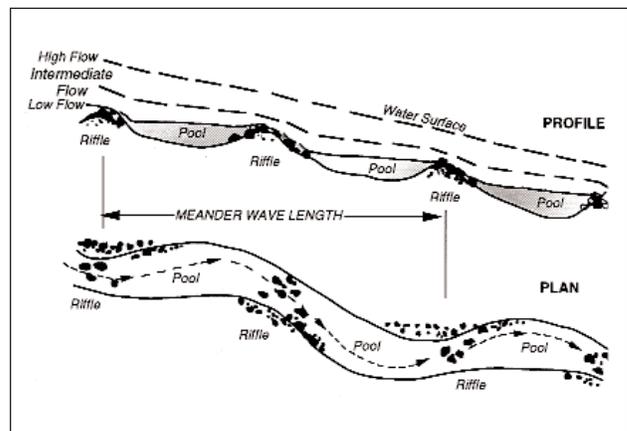
Modification of flood fringe areas does not occur. Access is not restricted and is encouraged, where appropriate. Index of Biotic Integrity scores are typically in the 40s and 50s.



Natural creeks meander through the landscape with pool-riffle sequences determined by hydrologic, soil, and geologic conditions. Connection between the stream and floodplain reduces erosion pressure and provides unique habitat.

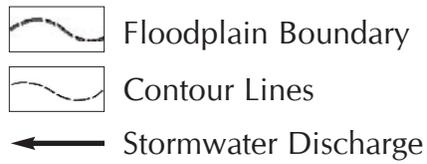
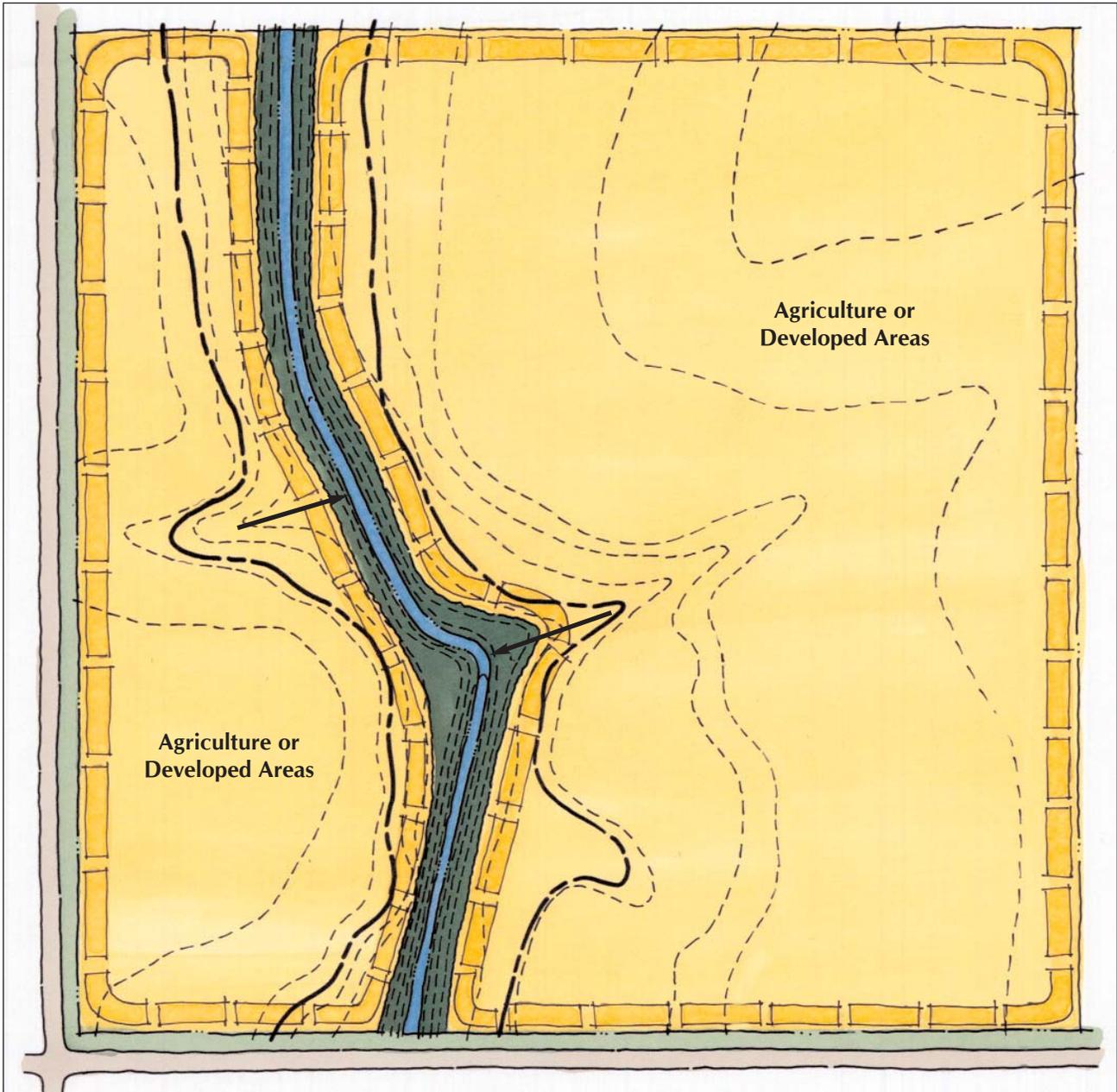


Restoration of a creek meander with adjacent native landscape and public access.



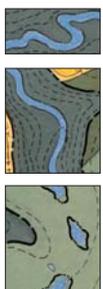
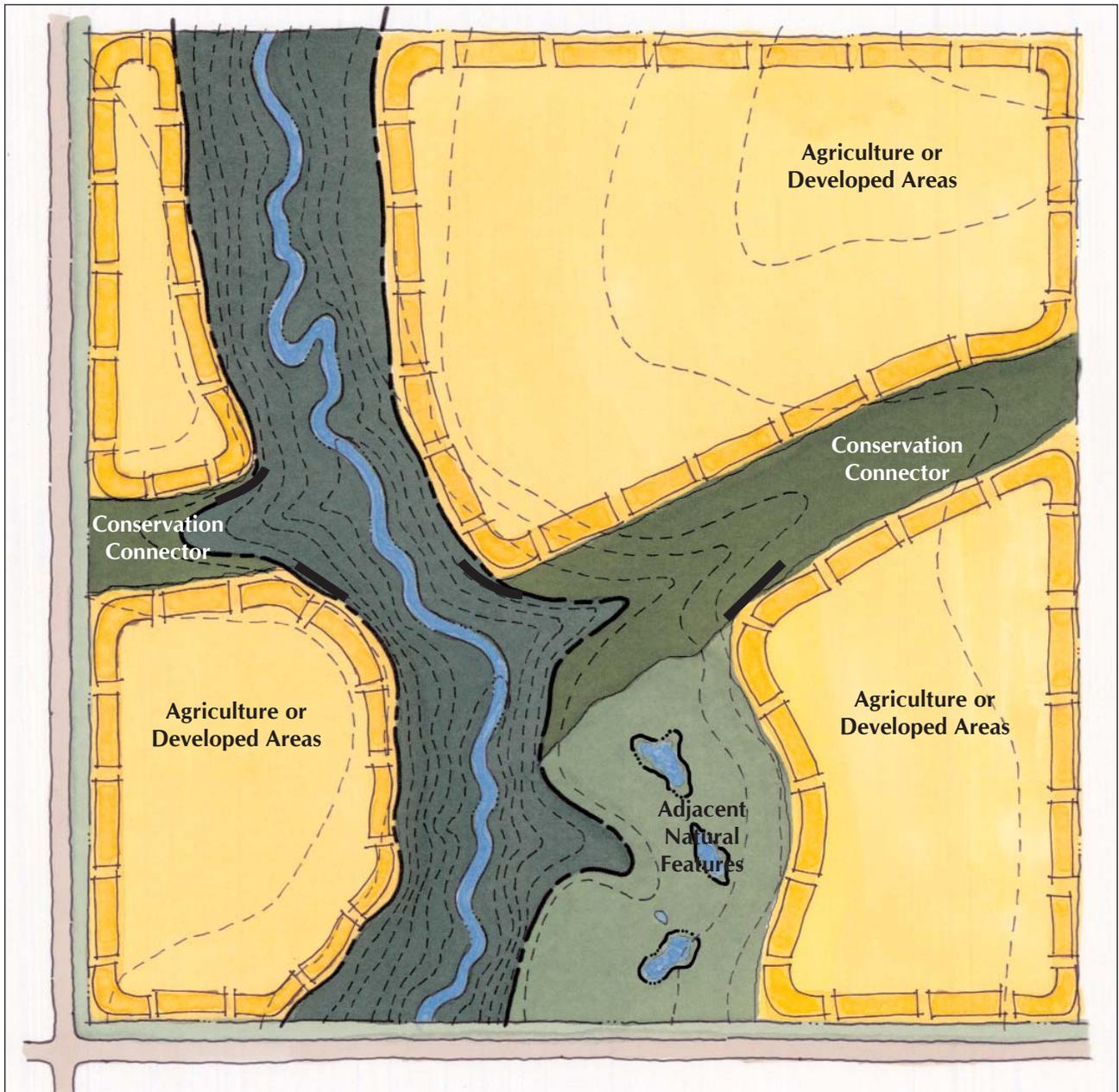
Credit: Newbury & Gaboury, “Stream Analysis and Fish Habitat Design, A Field Manual”, showing naturally occurring stream riffles and pools.

# ~ CONVENTIONAL ~ Stream Corridor Template



# ~ CONSERVATION ~

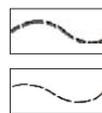
## Stream Corridor Template



Stream

Stream Buffer

Restored Wetlands



Floodplain Boundary

Contour Lines



Stormwater Level Spreader

# Stream Corridor Template Characteristics

|                           | <b>Conventional</b>   | <b>Conservation</b>  |
|---------------------------|---|--|
| <b>Water Source</b>       | Primary source of runoff during storm events is surface runoff and drain tile discharge. Groundwater discharge sustains baseflows but at reduced rate.  | Source of water is predominantly ground-water with little direct surface water runoff entering the stream except during snowmelt conditions.   |
| <b>Hydrodynamics</b>      | Due to decreasing groundwater recharge, streams are increasingly intermittent at larger drainage areas. Variability in streamflow rate is much more related to rainfall events than to season and "flashy" conditions predominate.  | Water level fluctuations are generally seasonal with higher flows occurring during spring time snowmelt conditions. Flow rates are generally low during the growing season when evaporation rates are high. Flow rates are much less affected by routine rainfall events.  |
| <b>Morphology</b>         | Relatively incised stream channel due to both intentional channelization and downcutting resulting from erosive streamflows. Where channelization has occurred, meanders will only be marginally present. However, pool-riffle sequences may be present depending on elapsed time since channelization and present hydrologic conditions. Erosion is typically active. Stream not well connected to the floodplain due to incision and/or channelization. Channel flow cuts into banks, naturally occurring stabilizing meanders are severely diminished. | Streams are characterized by meandering planform and pool-riffle bedform. The channel itself is quite stable but the position of channel may migrate modestly over time. The stream bottoms will generally be silty within meanders and gravely in riffle areas. The stream channel is well connected to the floodplain with the channel having 1- to 2-year capacity to contain stream flow before overflowing into the floodplain. No dams present to obstruct migration of fish and macro-invertebrate populations. |
| <b>Sediment Transport</b> | Degraded streams often have areas of both excessive deposition and excessive erosion as the streams' sediment transport characteristics are "out of synch" with load due to disturbed hydrology, channel modifications, and flow obstructions.  | Depending upon the watershed's geology, streams will generally have a continuous bed load of somewhat coarse sediment. Stream morphology reflects stable sediment delivery.  |
| <b>Vegetation</b>         | Waterway corridor tends to be either densely wooded with non-native, invasive shrubs and trees such as buckthorn, multiflora rose, honeysuckle, weeping and black willow and box elders, or else dominated by reed canary grass and purple loosestrife. Within developed areas, turf grass is often planted right up to the edge. Within the channel, there are either no plants due to active erosion or they are dominated by cattails, reed canary grass and purple loosestrife.   | Intermittent headwater streams may have plants through the bottom of the channel. Permanently wet streams will generally not have vegetation in the bottom of the channel. Shoreline plants will typically be wetland, wet prairie or open woodland with some shrubs.  |
| <b>Aquatic life</b>       | Carp and other tolerant fish species adapted to disturbed and murky waters predominate. Worms and arthropods are dominant macro-invertebrates, depending on water quality.  | A balanced mix of fish and macro-invertebrates. Fish include both game and non-game species. The stream has IBI values greater than 40.  |

# BLACKBERRY CREEK WATERSHED ALTERNATIVE FUTURES ANALYSIS PROJECT

## DEPRESSIONAL WETLAND TEMPLATES



Nelson Lake, Illinois

**Depressional Wetlands:** Depressional landscape features that are distinct from flowing streams and have vegetation, hydrology and soils characteristics of wet conditions. Historically, depressional wetlands were located where the ground dropped below the water table and therefore served as discharge zones or flow-through zones. Where the hydrology has been manipulated through agricultural or urban development, many of these wetlands now receive a much greater percentage of surface runoff as compared to groundwater discharge.

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# ~ CONVENTIONAL ~

## Depressional Wetland Guidelines and Conceptual Images

### Conventional Template Description

Conventional depressional wetlands are generally isolated, and not linked into a network of wetland complexes. In newly developing areas, a native buffer of 15 to 50 feet is required by ordinance around wetlands. The buffer width is dependent on the size and quality of the wetland. These buffer requirements only apply when land uses change to urban uses and do not apply to areas developed prior to the ordinance (effective in January, 2002). Buffers in other areas often consist of turf grass or agricultural field typically up to the wetland edge. Many wetlands have been dredged to create “lakes” or detention basins.

Conventional wetlands are fed primarily by surface water runoff and drain tile discharge. Some wetlands (and former wetlands) have been drained to reduce their area and make more land available for agricultural or urban land uses. These factors lead to increased magnitude and frequency of water level fluctuation, elevated water temperatures, and altered water chemistry.

The value of wetlands is often described in two broad categories. The first is their inherent floristic and habitat value that contributes to the overall health and functioning of the watershed. The second is their watershed protection functional values for downstream areas. These functions include sediment, toxicant, and floodwater retention. Typically, wetlands used to retain sediments, toxicants, or floodwaters will not exhibit high biodiversity values.

No management is typically provided of conventional wetlands, and as a result, their diversity is relatively low. Conventional depressional wetlands do not have controlled access, except where private property restricts access or a public agency has done so. Direct stormwater discharge into and out of conventional wetlands is typical, and in the past many wetlands have been incorporated into stormwater detention basins. The US Army Corps of Engineers and many local jurisdictions no longer allow detention within wetlands.



Many wetlands have been excavated to create lakes with a resulting loss in habitat diversity as well as bank erosion.



Direct discharge into conventional wetlands is typical. Heated and untreated stormwater can disrupt the natural ecology of a wetland.



Farmed wetlands seldomly produce crops, and thus function neither as wetlands nor as productive crop land.

# ~ CONSERVATION ~

## Depressional Wetland Guidelines and Conceptual Images

### Conservation Template Description

Conservation depressional wetlands are generally linked as part of a system or network of wetland complexes of various sizes and qualities, rather than being isolated from other wetlands. Conservation wetlands have a range of buffer types and sizes depending upon such things as adjacent land uses, quality of wetland, size of wetland, topography and soils. Conservation connectors, or extended buffer areas connect isolated and critical recharge areas to the wetland system. Buffer areas are naturalized and consist of native plants. Beyond the buffer areas, adjacent natural features (hydric soils, isolated wetlands, etc.) are also protected as part of the system.

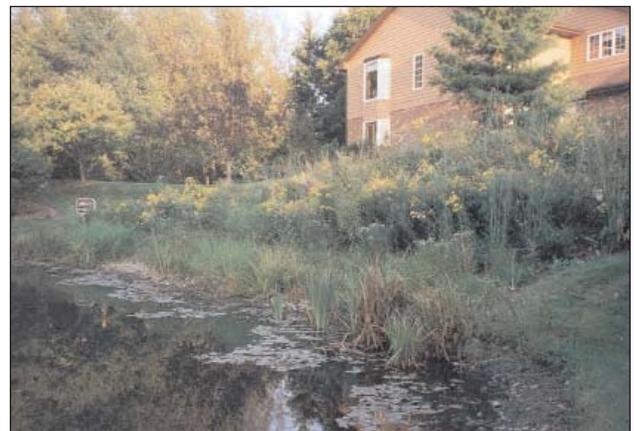
Although groundwater recharge is often listed as a wetland function, high quality wetlands are typically discharge or flow-through zones fed primarily by groundwater with little direct surface runoff except during snowmelt conditions.

Conservation wetlands have high floristic and habitat value and could also provide watershed protection functions. However, if high quality wetlands receive direct stormwater discharges and therefore are called upon to provide significant flow attenuation or pollutant retention, their floristic and habitat values are unlikely to persist.

Conservation wetlands and their buffers are managed through annual burning. Buffers increase habitat diversity, discourage intrusions by cultural activities and provide a zone for management of stormwater. Direct stormwater discharge into conservation wetlands does not occur. Instead, stormwater can be dispersed at the edge of the buffer utilizing level spreaders and other systems to disperse the runoff and more closely mimic historical groundwater hydrology. Conservation easements and/or overlay zoning are employed to protect high quality wetlands. Trails can target access to appropriate locations.



Restored depressional wetland.

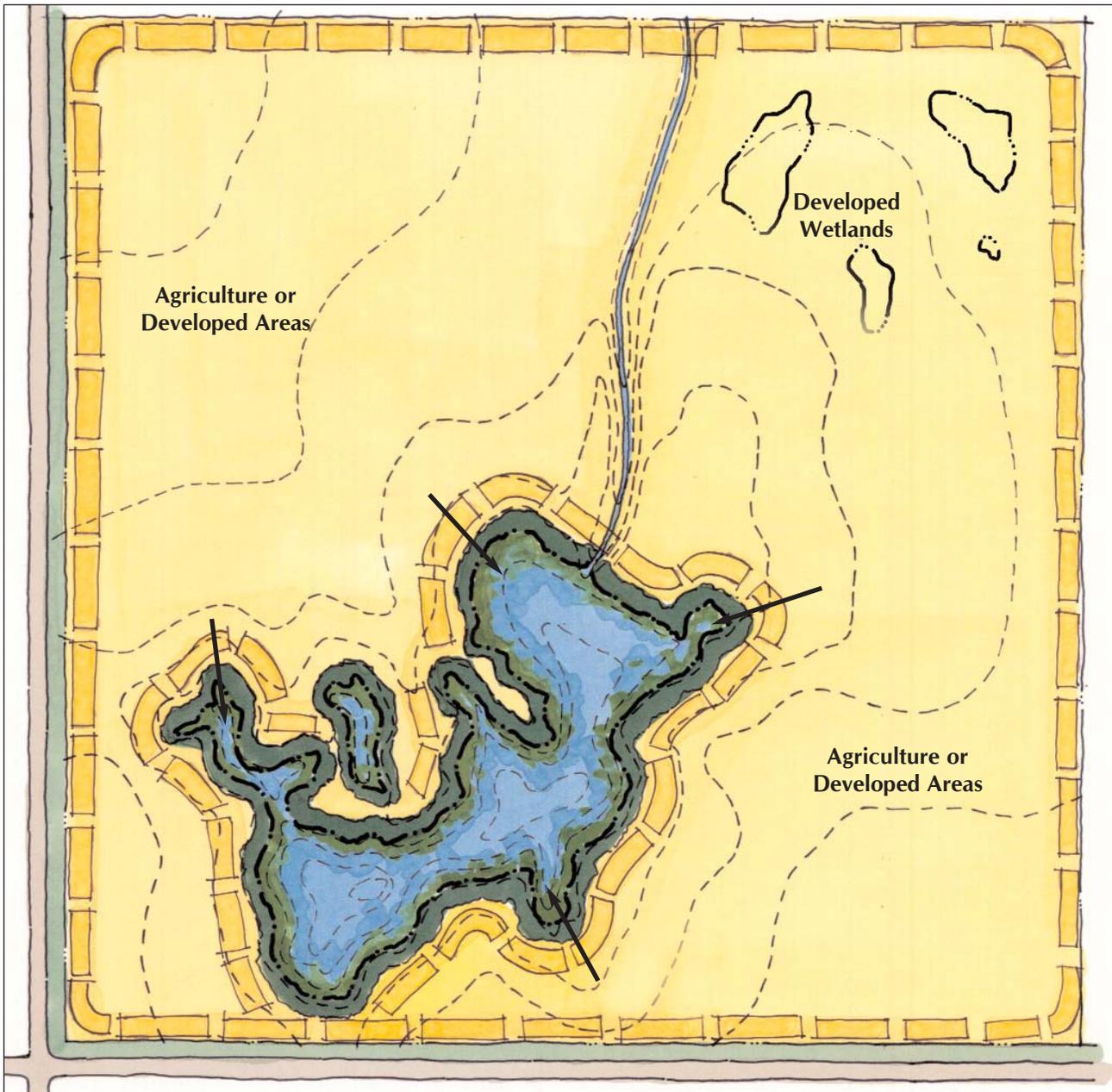


Restored wetlands in residential developments can enhance aesthetics and quality of life, while at the same time improving wildlife habitat.



A fen wetland that is particularly sensitive to groundwater hydrology and chemistry.

# ~ CONVENTIONAL ~ Depressional Wetland Template



Protected Depressional Wetlands



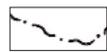
Wetland Buffer



Drainage Ditch



Contour Lines



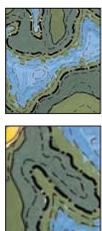
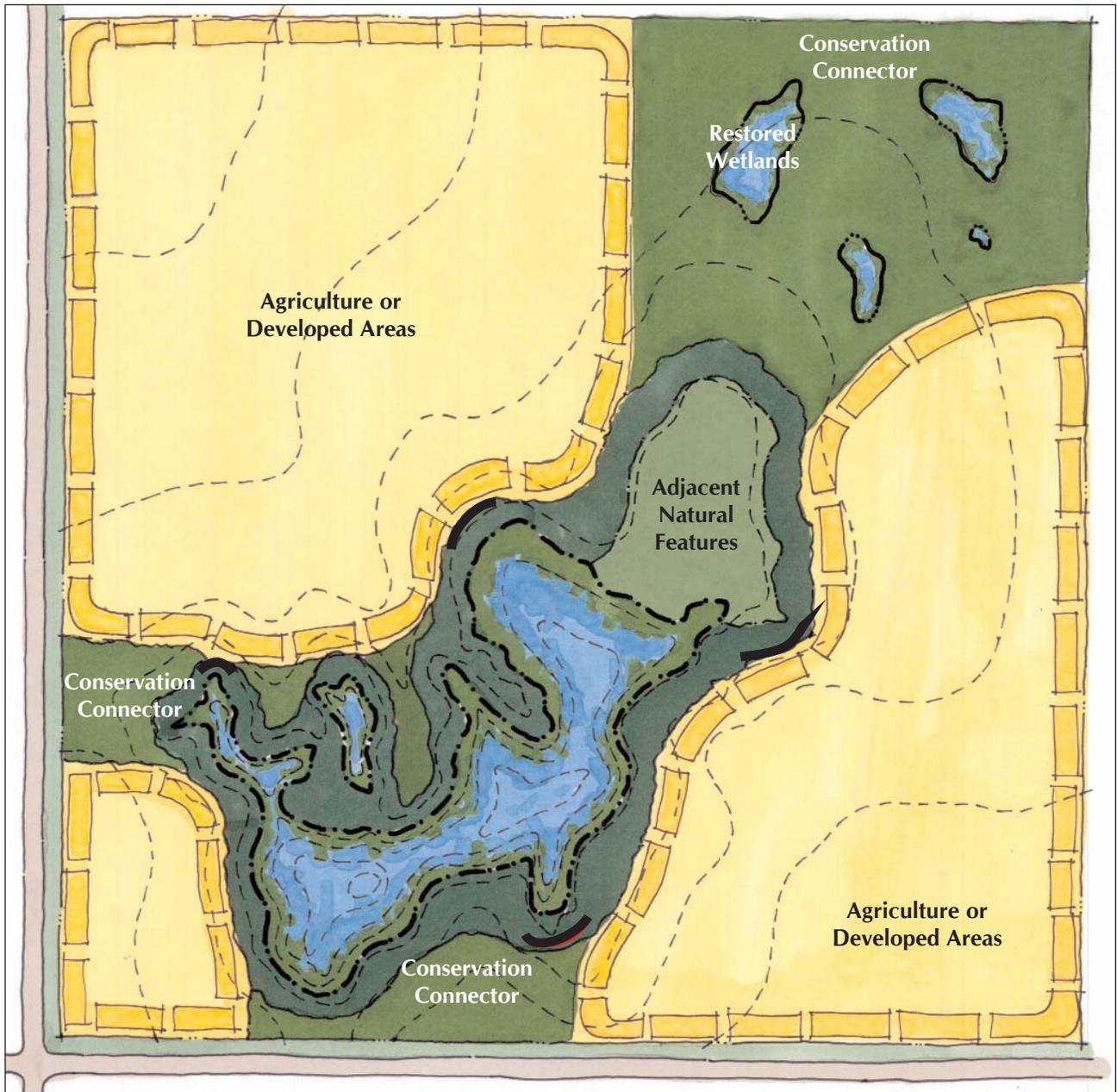
Wetland Boundary



Stormwater Discharge

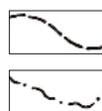
# ~ CONSERVATION ~

## Depressional Wetland Template



Protected Depressional Wetlands

Wetland Buffer



Contour Lines

Wetland Boundary



Stormwater Level Spreader

# Depressional Wetland Template Characteristics

|                      | <b>Conventional</b>  | <b>Conservation</b>   |
|----------------------|--|---|
| <b>Water Source</b>  | Surface runoff and drain tile discharge are a significant percentage of the water source.  | Typically groundwater based hydrology with very little surface discharge. Wetlands are located within a zone of groundwater discharge. In some cases, wetlands may be flow-through wetlands where groundwater enters on one side and leaves on the other. Certain wetlands such as seeps and fens are groundwater fed but release as surface water. |
| <b>Hydrodynamics</b> | Water level fluctuations are generally more erratic and responsive to recent rainfall events in comparison to natural depressional wetlands. Some wetlands may be drained by a surface ditch or drain tiles. | Water level fluctuations are moderate and related to season much more than recent rainfall. Water levels will typically be higher in spring during snowmelt conditions and when evaporation rates are low. Surface water may not be present during the growing season when evaporation rates are high.  |
| <b>Vegetation</b>    | Simple and tolerant vegetation communities are usually present. Conventional wetlands often have an Floristic Quality Index (FQI) less than approximately 15.  | A diverse vegetation community will be present. The wetland will have an FQI greater than approximately 25.   |
| <b>Area</b>          | Wetland typically isolated from other wetlands.  | Wetland area often includes complexes of several wetlands and intervening uplands.  |
| <b>Buffer</b>        | Buffer often nonexistent except where recent regulatory activity has required establishment of a buffer. Where no buffer exists, vegetation within buffer width is often turf grass or agricultural field.   | Buffer width is greater than in the conventional template and determined by topography, soils, and quality of adjacent uplands.   |

<sup>a</sup> FQI is a statistic derived by multiplying Mean Coefficient of conservatism by the square root of the number of native species inventoried on a site. Coefficient of conservatism (C) is ranging from 0 to 10, implying weedy to conservative. In general, sites with FQI values less than 20 are degraded or derelict plant communities, or are very small habitat remnants.