Appendix D

Drainage and Water Quality

Appendix D
Overview of Drainage and Water Quality Design

The drainage system in the study area will be designed to drain both the Prairie Parkway facility and the off-site contributing drainage areas. The proposed drainage system should not adversely impact upstream and downstream properties. In addition, a variety of control measures will be incorporated into the project's design to ensure that water quality is maintained. Following is a summary of the project's drainage and water quality features.

Vegetated Swales

Most of the runoff from the study area will be conveyed through vegetated open-channel drainageways, or vegetated swales. Swales vegetated with grass or other suitable vegetation provide natural conveyance and at the same time filter pollutants and allow for modest infiltration. Their pollutant removal effectiveness is very dependent on vegetation type and height. Native prairie grasses are preferred over conventional turf grass. Removal rates of suspended solids and metals are typically between 30% to 70%. Anticipated removal rates in the study area, based upon available water quality literature including the FHWA's "Evaluation and Management of Highway Runoff Water Quality" are 67% for lead, 63% for zinc, 46% for copper, and 83% for suspended solids.

Ditch Checks and Detention Storage

Detention storage will be provided throughout the entire study area to attenuate the post-development peak discharge rates to pre-development discharge rates for a storm frequency of 50 years. Detention areas (dry detention basins) will be created by placing earthen ditch checks along the vegetated swale. The detention areas are wider than the conveyance channel. The length and width of these detention areas are dependent on the slope of the conveyance channel and the specific location, but are typically between 300 to 500 ft long and 4 to 20 ft wide. Ditch checks may occur as frequently as one per 1000 ft on each side of the roadway. The detention volume also varies depending on location, but is on the order of 1.5 to 2.0 acre-ft per mile throughout the study area. Based upon the FHWA manual for water quality assessments, a maximum removal rate of 30% is anticipated for all pollutants in dry detention basins.

This configuration of vegetated swales with varying widths results in a "meandering" open channel that is both aesthetically pleasing and natural looking. The width variation is subject to topographical, alignment, and profile constraints and is not designed as a feature that will require supplemental right-of-way greater than the conveyance, detention, and infiltration objectives call for. Where additional right-of-way is available in remnant parcels, the main conveyance channels and detention areas may meander in the more traditional

sense, meaning they will have a winding or sinusoidal path. A rendering of the vegetated swale/ditch check configuration is shown in Figure D-1.

Infiltration Facilities

Infiltration facilities are storage facilities where the primary discharge of stormwater is to the groundwater and include either infiltration basins or infiltration trenches. They are used in flat areas along the study area, where minimum grades cannot be established. The available storage volume is equal to the runoff volume. Theoretically, since there is no outflow to surface water, unless the storage capacity is exceeded, pollutant removal efficiencies approach 100 percent. The primary removal mechanisms in infiltration facilities are sedimentation, filtration, and biological uptake. The bottom of the infiltration facility must be at least 5 ft above the seasonably high groundwater table. Soils must be moderately to highly permeable and the recommended storage time is between 24-72 hours. Water table and permeability data are obtained from boring logs. Typical permeability rates in the study area range from 0.2 to 2.0 in/hr. Over time, solids may plug soil voids reducing the infiltration capacity. Therefore, first flush forebays are installed upstream of infiltration facilities to remove as much sediment as possible.

A total of 34 infiltration facilities will be used along the study area, including 24 infiltration basins and 10 infiltration trenches. Their areas typically range from 2 to 4 acres. A summary of the location of the infiltration facilities along the study area is presented in Table D-1 and Chapter 4, Table 4-29; and shown in more detail in Exhibits 1 through 4. Perspective sketches of two infiltration basins at Big Rock Creek (Sta. 4256+00) and Welch Creek (Sta. 4365+00) are shown in Figures D-3 and D-4, respectively.

Retention/Water Quality

Wet detention basins with wetland plantings will be used in areas that have an identified environmentally sensitive outlet. This type of water quality enhancement measure is very effective in reducing pollutant loads in stormwater runoff. A typical wet detention basin with wetland plantings consists of an area planted with native wetland vegetation tolerant of prolonged inundation (wetland area) and a sedimentation basin (micro pool). Pollutant removal is achieved through a combination of filtration, infiltration, and biological activity in the wetland area and settling in the micro pool. In addition, level spreaders at the outlet of the basins enhance water quality by spreading and slowing down the flow, thus minimizing erosion. Typical removal rates of suspended sediments and attached pollutants can be 60 percent to 90+ percent in wet detention basins with wetland plantings. Some dissolved pollutants, including nutrients and organic matter, can be reduced by 40 percent to 80 percent, mainly due to biological activity. However, wet detention basins with wetland plantings are not as effective for chloride. Based upon the FHWA manual for water quality assessments, anticipated

Table D-1.Summary of Infiltration Facilities Location

Roadway Station	Alignment	Side	Type of Facility
1085+00 to 1100+00	B5	Left	Infiltration trench
1085+00 to 1100+00	B5	Right	Infiltration trench
2051+00	B2	Left	Infiltration basin
2078+00	B2	Left	Infiltration basin
2388+17	B5	Left	Infiltration basin
3192+00	B2/B5	Left	Infiltration basin
3192+00	B2/B5	Right	Infiltration basin
3350+00	B2/B5	Right	Infiltration basin
3360+00	B2/B5	Left	Infiltration basin
3384+00	B2/B5	Right	Infiltration basin
4240+00	B2/B5	Left	Infiltration trench
4240+00	B2/B5	Right	Infiltration trench
4247+00	B2/B5	Left	Infiltration basin
4247+00	B2/B5	Right	Infiltration basin
4258+00	B2/B5	Left	Infiltration basin
4258+00	B2/B5	Right	Infiltration basin
4305+00	B2/B5	Right	Infiltration basin
4336+00	B2/B5	Left	Infiltration basin
4360+00	B2/B5	Left	Infiltration basin
4360+00	B2/B5	Right	Infiltration basin
4368+00	B2/B5	Left	Infiltration basin
4368+00	B2/B5	Right	Infiltration basin
4380+00	B2/B5	Right	Infiltration basin
4650+00	B2/B5	Right	Infiltration basin
5170+11 to 5189+95	B2	Left	Infiltration trench
5193+25 to 5207+05	B2	Left	Infiltration trench
5207+05 to 5215+00	B2	Left	Infiltration trench
5388+03 to 5410+55	B2	Left	Infiltration trench
5463+00 to 5469+94	B2	Left	Infiltration trench
5501+68 to 5517+83	B2	Left	Infiltration trench
335+00 (I-88 Int. Ramp B)	B2/B5	Left	Infiltration basin
835+00 (I-88 Int. Ramp H)	B2/B5	Left	Infiltration basin
55+00 Dauberman	B2/B5	Left	Infiltration basin
42+00 Faxon	B2/B5	Right	Infiltration basin

removal rates in the study area are 65-95% for lead, 65-95% for zinc, 65-95% for copper, and 32-91% for suspended solids.

The volume of water contained in the wet detention basins with wetland plantings is referred to as retention volume, or water retained below the primary gravity outlet. The volume above the primary gravity outlet is referred to as detention volume, which is released through a restrictor pipe. The wetland area has a depth that varies between 6 to 12 inches below the primary gravity outlet. The micro pool area requires a depth of at least 3 ft below the primary gravity outlet to minimize the resuspension of bottom sediments. The water in the retention area is released either by infiltration into the ground or by being displaced by new runoff after pollutants have had an opportunity to settle. The retention volume below the primary gravity outlet will be equal to the first ¾-inch of runoff from the actual impervious area within the right-of-way. This exceeds the Kane County requirement, which requires retention only for hydraulically connected areas. A roadway whose primary conveyance is through vegetated swales is not considered hydraulically connected. Finally, it is important to note that the retention area will be able to retain the smaller, more frequent storms. The vast majority of water, on an annual basis, and corresponding pollutants will be conveyed by these common smaller events.

The waterways that have been identified as environmentally sensitive for pollutant loading along the study area are the Fox River, Big Rock Creek, Welch Creek, Aux Sable Creek, and Nettle Creek. In addition to these major waterways, Hollenbeck Creek and O'Brien Run are small streams receiving substantial roadway drainage and are considered sensitive as well. As many as four wet detention basins with wetland plantings are proposed for each sensitive waterway, in order to treat runoff from both sides of the roadway and from discharge locations along both river banks. Each basin is approximately 50 ft wide with varying length. The location of each wet detention basin with wetland plantings is shown in Exhibits 1 through 4 and summarized in Table D-2 and Chapter 4, Table 4-30; a perspective sketch of a wet detention basin with wetland plantings at the north bank of the Fox River (Sta. 3264+00) is shown in Figure D-2.

Due to groundwater contamination concerns, there are no wet detention basins with wetland plantings proposed near the south bank of the Fox River. Clay lined ditches will convey roadway runoff from the south of the Fox River instead.

Table D-2.Summary of Wet Detention Basins Location

Roadway Station	Alignment	Side
1000+00	B5	Right
2635+43	B5	Left
2635+59	B5	Right
3042+83	B2/B5	Right
3043+43	B2/B5	Left
3043+50	B2/B5	Right
3044+05	B2/B5	Left
3072+40	B2/B5	Right
3073+09	B2/B5	Left
3264+30	B2/B5	Left
3264+42	B2/B5	Right
4068+55	B2/B5	Left
4070+54	B2/B5	Right
4079+15	B2/B5	Left
4081+46	B2/B5	Right
4634+87	B2/B5	Left
4634+87	B2/B5	Right
5027+25	B2	Right
5033+82	B2	Right
5073+96	B2	Left
5074+10	B2	Right
5137+83	B2	Left
5183+04	B2	Right
5141+78	B2	Right
5142+41	B2	Left

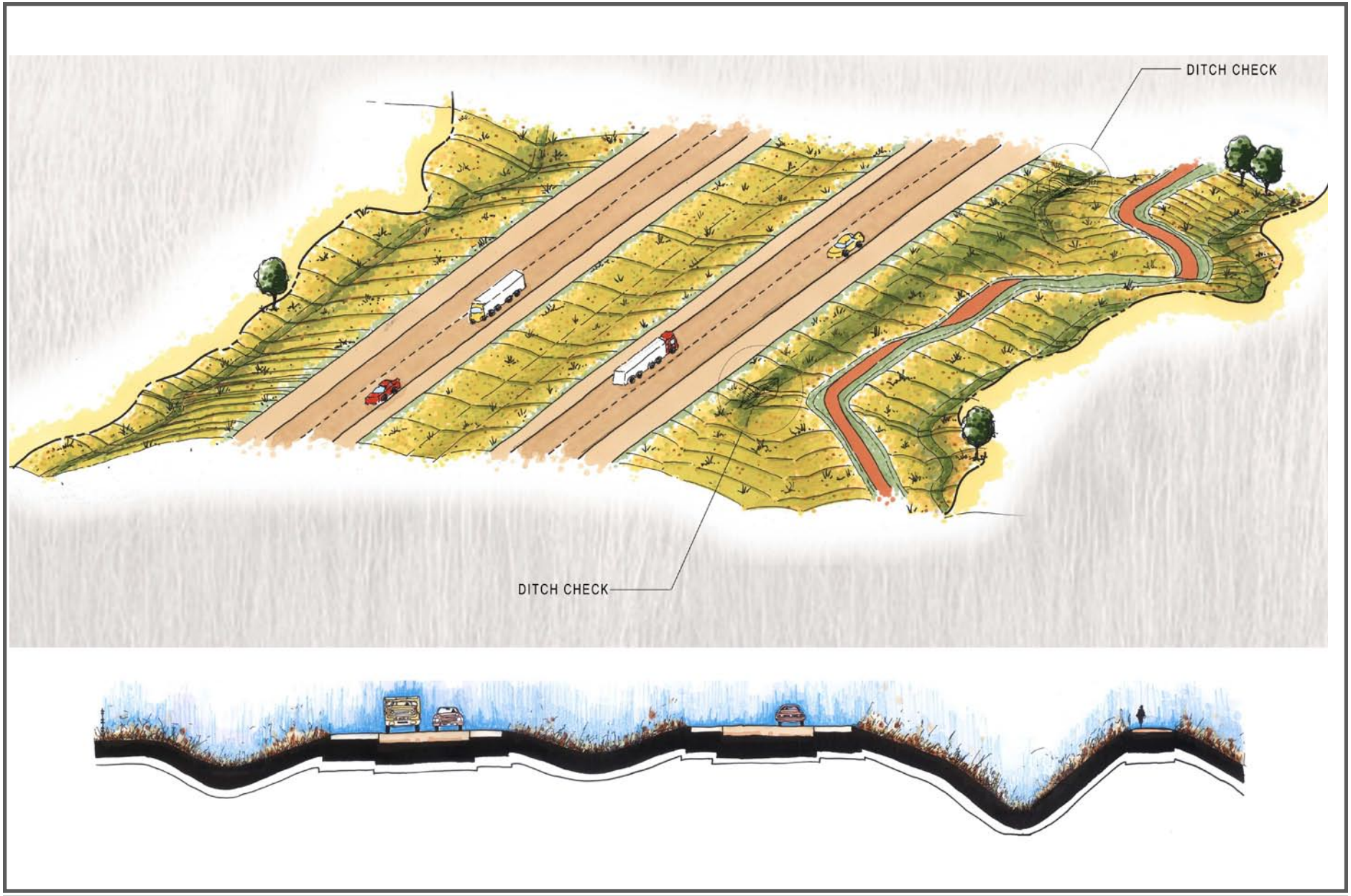
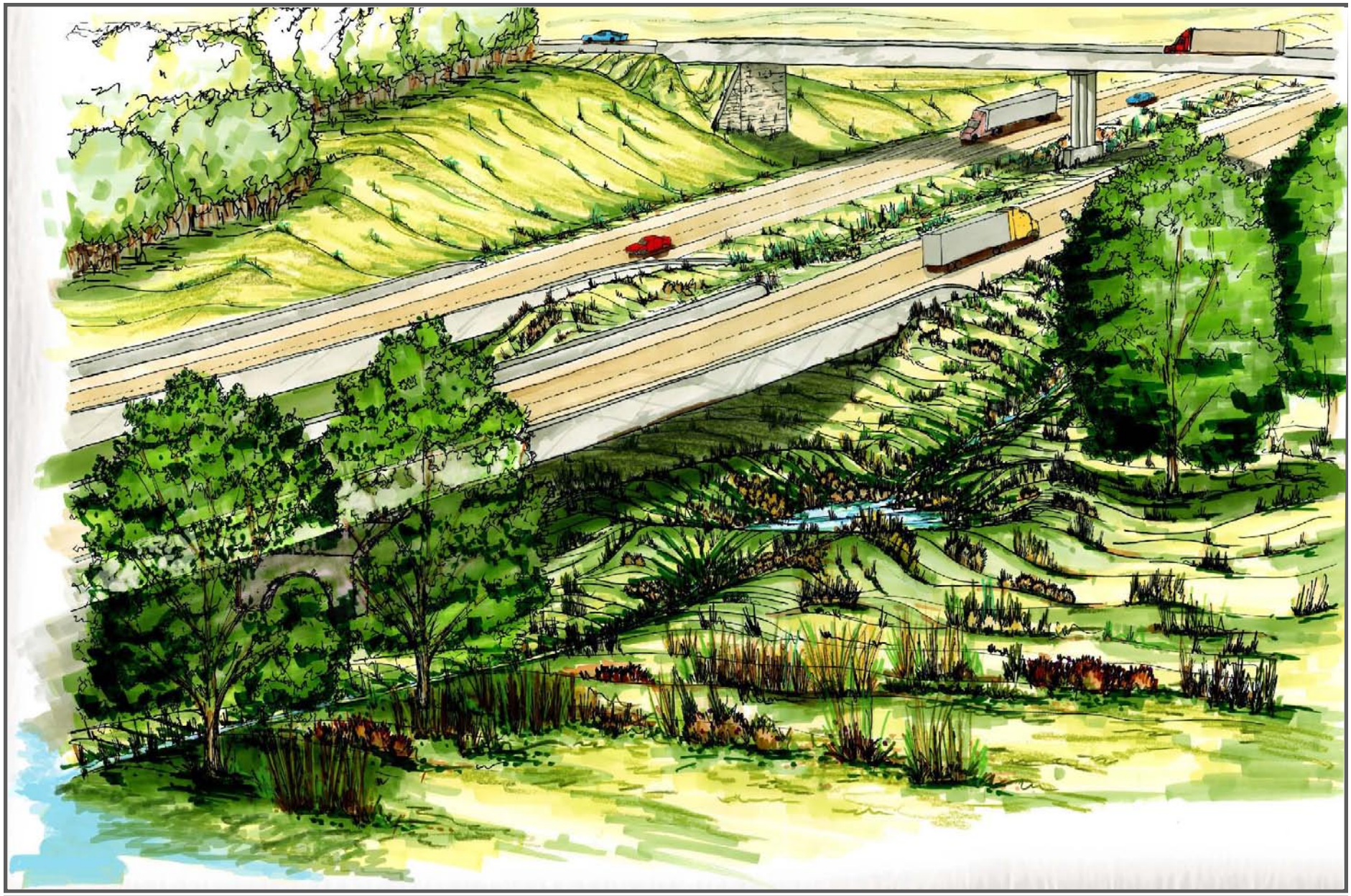


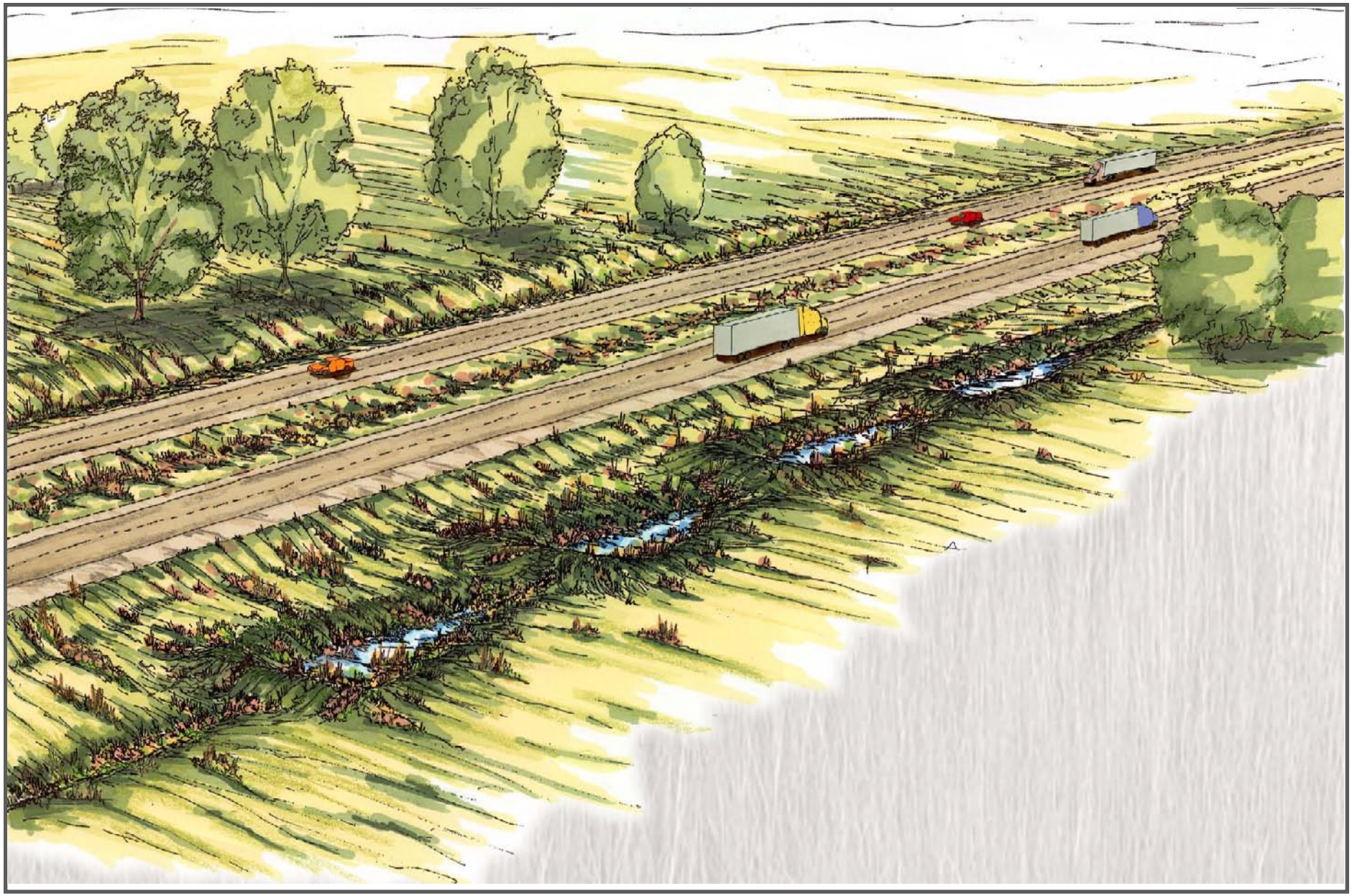
Figure D-1
Vegetated Swale/Ditch Check Rendering



Prairie Parkway
Draft Environmental Impact Statement

Figure D-2
Looking North - North of Fox River

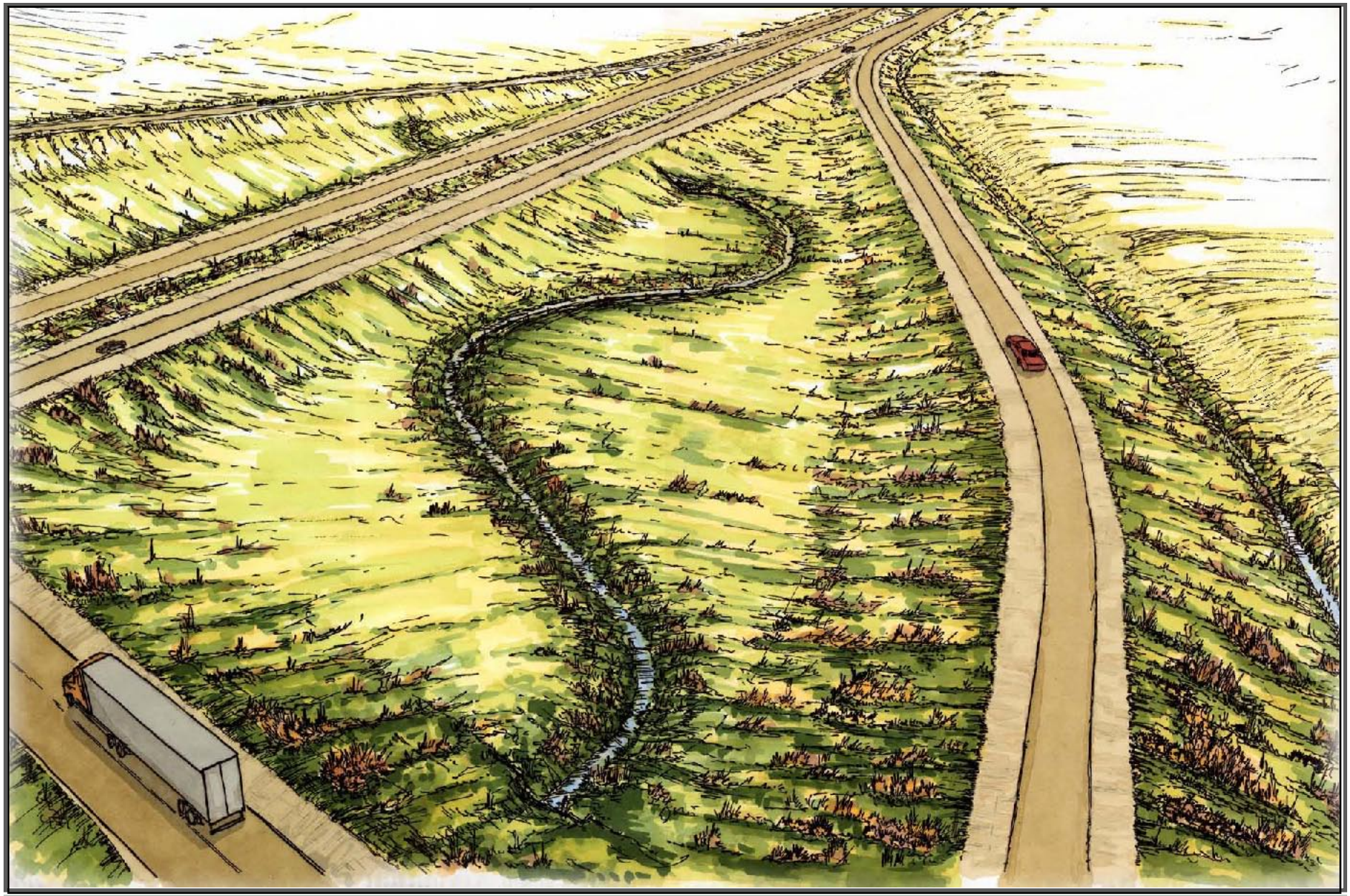
See Exhibit 3e for plan view
East side of Prairie Parkway, Station 3264+00



Prairie Parkway
Draft Environmental Impact Statement

See Exhibit 3L for plan view
East side of Prairie Parkway, Station 4256+00

Figure D-3
Looking North from Big Rock Creek



Prairie Parkway
Draft Environmental Impact Statement

See Exhibit 3N for plan view
East side of Prairie Parkway, Station 4365+00

Figure D-4
Looking North at US 30 Interchange