Attachment 5

Eola Main Line Improvements Aquatic/Stream Impact Analysis
Conceptual Mitigation Technical Memorandum

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Technical Memo

Chicago to Iowa City Intercity Passenger Rail Service - Eola Main Line Improvements Aquatic/Stream Impact Analysis and Conceptual Mitigation Plan

INTRODUCTION

The purpose of this technical memo is to characterize the affected environment for aquatic resources and anticipated impacts to these resources from the construction of the proposed Eola Main Line Improvements, located in Kane and Du Page County, Illinois. The Eola Main Line Improvements are a component of the set of required infrastructure improvements that would be required to reestablish intercity passenger rail service between Chicago and Iowa City (Figure 1).

In 2009, Illinois Department of Transportation (Illinois DOT) and Iowa Department of Transportation (Iowa DOT) prepared a Service Level (Tier 1) Environmental Assessment (2009 EA) describing the potential environmental impacts from reestablishing intercity passenger rail service between Chicago and Iowa City. The 2009 EA was submitted to Federal Railroad Administration (FRA) as part of Illinois DOT and Iowa DOT High-speed Intercity Passenger Rail Program grant application. The 2009 grant application was not successful. However, Illinois DOT and Iowa DOT are submitting a new Grant Application to FRA for consideration of funding the intercity passenger rail service between Chicago and Iowa City under the FRA's 2010 Notice of Funding Availability for Service Development Programs under the HSIPR Program. As part of the 2010 HSIPR Grant Application, Illinois DOT and Iowa DOT intend to resubmit the 2009 EA with supplemental information including this description of possible impacts to aquatic resources from the Eola Main Line Improvements and conceptual mitigation for those impacts. Detailed discussions of the purpose and need and description of the Eola Main Line Improvements is included in Chapters 1 and 2 of the Supplemental Information to the 2009 EA.

AFFECTED ENVIRONMENT

This technical memo describes the existing condition of the aquatic resources within the survey limits of the Eola Main Line Improvements section of the Project area (Figure 2). The assessment of existing conditions for the aquatic resources includes background information on aquatic habitat quality through a discussion of biological quality, water quality, and geomorphic condition. The assessment of existing conditions within the survey limits of Eola Main Line Improvements section of the Project area will focus on several linear drainage features or conveyances (wetlands are discussed and addressed in a separate memo). The linear drainage features within Eola yard convey large volumes of water generated both on-site and off-site to the southern branch of Indian Creek, a 2nd order perennial tributary of Fox River. Field

observations were made on July 6, 2010 at several representative channelized conveyances within the survey limits. A photo log of the site observations is included in Attachment A.

Background Information

The survey limits of the Eola Main Line Improvements section of the Project area resides within the within the Town of Aurora sub-basin HUC 12 (071200070107) of the Lower Fox River, HUC 8 (07120007). Aquatic resources within and surrounding the Eola Main Line Improvements section of the Project area include the perennial southern branch of Indian Creek to the south; several perennial to intermittent, channelized storm water conveyances within the survey limits; Eola Road Marsh Illinois Natural Area Inventory (INAI) site and Night Heron Marsh to the southeast; and several storm water detention ponds to the north (Figure 2). The linear conveyances within the survey limits of the Eola Main Line Improvements section of the Project area have a unique connection to both upstream and downstream resources. The drainages within Eola serve to connect the upstream Eola and Night Heron Marsh wetland complex and numerous storm water ponds to the southern branch of Indian Creek. The southern branch of Indian Creek flows west into the main branch of Indian Creek then into the Fox River, approximately two miles downstream from the location of the Eola main line improvements. Within the survey limits of the Eola Main Line Improvements section of the Project area there are approximately 16,700 linear feet of open channel, storm water conveyances, which includes approximately 2,200 linear feet of the southern branch of Indian Creek and two parallel wet bottom storm water conveyances that measure approximately 7,100 and 7,400 linear feet, respectively (Figure 2).

The southern branch of Indian Creek can be characterized as an urbanized stream that has been heavily influenced by regional industrial-commercial development. Within the survey limits of the Eola Main Line Improvements section of the Project area, aquatic habitat resources are highly channelized and form a complex drainage network, which conveys both natural base flow and storm water generated from on- and offsite locations to downstream aquatic resources. These linear features have a mixture of perennial, intermittent, and ephemeral flow regimes and contain associated palustrine forested (PFO), palustrine scrub-shrub (PSS), and palustrine emergent (PEM) wetlands. A detailed discussion and maps of the wetlands identified within and adjacent to the survey limits are provided in the Wetlands Determination Report conducted by HDR Engineering, Inc.

Biological Quality

Biological quality of a stream is best assessed through detailed field sampling of various groups of aquatic species (i.e., fish, macro invertebrates, mussels, crayfish, amphibians, etc.) conducted according to Illinois approved methodologies. When detailed sampling data is unavailable, consultation with the IDNR Stream Rating System does provide some insight into regional biological quality. According to the Illinois Biological Stream Rating System (IDNR 2008) the south branch of Indian Creek is not listed as a Biologically Significant Stream (BSS) and it is not rated as A or B for diversity or integrity. The main or northern branch Indian Creek (adjacent to the western terminus of the Project Area) is rated as Class D (Poor – Limited Aquatic Resource) for integrity. This stream rating indicates that the main branch of Indian Creek is impaired and not functional according to its biological communities.

A search of the Illinois Natural History (INHS) Fish Collection Database indicates there are no records of collections from Indian Creek; however, collection records from Fox River indicate over 60 species of fish have been collected from this large downstream tributary (Table 1) (http://ellipse.inhs.uiuc.edu:591/INHSCollections/fishsearch.html). Based on the proximity and downstream connection with Fox River, it is likely a small subset of these fish species is likely present within the southern branch of Indian Creek. Observations during the site visit conducted on July 6, 2010 confirmed the presence of fishes within the 2,220 linear feet of more natural stream habitat associated with the southern branch of Indian Creek.

Table 1: Illinois Natural History Fish Collection Database

#	Genus species	Common Name	Stream
1	*Ameiurus melas*	Black bullhead	Fox River
2	*Ameiurus natalis*	Yellow bullhead	Fox River
3	*Aplodinotus grunniens*	Freshwater drum	Fox River
4	*Campostoma anomalum*	Central stoneroller	Fox River
5	*Carpiodes cyprinus*	Quillback carpsucker	Fox River
6	*Catostomus commersoni*	White sucker	Fox River
7	*Cottus bairdi*	Mottled sculpin	Fox River
8	*Culaea inconstans*	Brook stickleback	Fox River
9	*Cyprinella spiloptera*	Spotfin shiner	Fox River
10	*Cyprinus carpio*	Common carp	Fox River
11	*Dorosoma cepedianum*	Gizzard shad	Fox River
12	*Esox americanus*	American pickerel	Fox River
13	*Etheostoma caeruleum*	Rainbow darter	Fox River
14	*Etheostoma exile**	Iowa darter*	Fox River
15	*Etheostoma nigrum*	Johnny darter	Fox River
16	*Etheostoma zonale*	Banded darter	Fox River
17	*Fundulus notatus*	Blackstripe topminnow	Fox River
18	*Hypentelium nigricans*	Northern hogsucker	Fox River
19	*Ictalurus punctatus*	Channel catfish	Fox River
20	*Ictiobus bubalus*	Smallmouth buffalo	Fox River
21	*Ictiobus cyprinellus*	Bigmouth buffalo	Fox River
22	*Labidesthes sicculus*	Brook silverside	Fox River
23	*Lepomis cyanellus*	Green sunfish	Fox River
24	*Lepomis cyanellus x L. gibbosus*	Green sunfish x pumpkin seed	Fox River
25	*Lepomis cyanellus x L. macrochirus*	Green sunfish x bluegill	Fox River
26	*Lepomis gibbosus*	Pumpkinseed sunfish	Fox River
27	*Lepomis gulosus*	Warmouth	Fox River
28	*Lepomis hybrid*	Hybrid sunfish	Fox River
29	*Lepomis macrochirus*	Bluegill	Fox River
30	*Micropterus dolomieu*	Smallmouth bass	Fox River
31	*Micropterus dolomieu x M. salmoides*	Smallmouth bass hydrid	Fox River
32	*Micropterus salmoides*	Largemouth bass	Fox River

#	Genus species	Common Name	Stream
33	*Morone chrysops*	White bass	Fox River
34	*Morone mississippiensis*	Yellow bass	Fox River
35	*Moxostoma anisurum*	Silver redhorse	Fox River
36	*Moxostoma carinatum**	River redhorse*	Fox River
37	*Moxostoma erythrurum*	Golden redhorse	Fox River
38	*Moxostoma macrolepidotum*	Shorthead redhorse	Fox River
39	*Moxostoma valenciennesi**	Greater redhorse*	Fox River
40	*Nocomis biguttatus*	Hornyhead chub	Fox River
41	*Notemigonus crysoleucas*	Golden shiner	Fox River
42	*Notropis atherinoides*	Emerald shiner	Fox River
43	*Notropis boops*	Bigeye shiner	Fox River
44	*Notropis hudsonius*	Spottail shiner	Fox River
45	*Notropis ludibundus*	Sand shiner	Fox River
46	*Noturus flavus*	Stonecat	Fox River
47	*Noturus gyrinus*	Tadpole madtom	Fox River
48	*Opsopoeodus emiliae*	Pugnose minnow	Fox River
49	*Perca flavescens*	Yellow perch	Fox River
50	*Percina caprodes*	Logperch	Fox River
51	*Percina maculata*	Blackside darter	Fox River
52	*Percina phoxocephala*	Slenderhead darter	Fox River
53	*Phenacobius mirabilis*	Suckermouth minnow	Fox River
54	*Pimephales notatus*	Bluntnose minnow	Fox River
55	*Pimephales promelas*	Fathead minnow	Fox River
56	*Pimephales vigilax*	Bullhead minnow	Fox River
57	*Pomoxis annularis*	White crappie	Fox River
58	*Pomoxis nigromaculatus*	Black crappie	Fox River
59	*Pylodictis olivaris*	Flathead catfish	Fox River
60	*Sander vitreus*	Walleye	Fox River
61	*Semotilus atromaculatus*	Creek chub	Fox River

**Three species are state threatened and endangered species Iowa darter (Etheostoma exile) (ST), river redhorse (Moxostoma carinatum) (ST), and greater redhorse (Moxostoma valenciennesi) (SE)*

Source: Illinois Natural History Fish Collection Database, http://ellipse.inhs.uiuc.edu:591/INHSCollections/fishsearch.html, retrieved on July 3, 2010.

Water Quality

Water Quality standards in Illinois are determined by the Watershed Management Section (WMS) of the Illinois Environmental Protection Agency (IEPA). In addition to setting state limits on water quality, IEPA administers the state 401 certification program. A typical 401 project certification process includes: 1) a detailed antidegradation review according to state standards, 2) a public notice, 3) posting of an antidegradation fact sheet, 4) IEPA review of the comments received, 5) IEPA decision to hold a public hearing, and 6) preparation of comment responses prior to the issuance of any certification. Typical 401 project level certification may take up to two or more years for IEPA to fully process.

Rivers and streams are rated based on the degree of support (attainment) of a designated use. Ratings are determined by an analysis of various types of information, including biological, physicochemical, physical habitat, and toxicity data. When sufficient data are available, each applicable designated use in each segment is assessed as Fully Supporting (good), Not Supporting (fair), or Not Supporting (poor). Waters in which at least one applicable use is not fully supported are considered "impaired." Water Quality of streams within Illinois can be assessed by consulting the Illinois Environmental Protection Agency (IEPA) Integrated Water Quality Report and Section 303(d) list of Impaired Waters (IEPA 2010).

According to the IEPA 303(d) list prepared in 2010, Indian Creek was not assessed; however the Fox River (HUC 072100701), in which Indian Creek discharges into, was assessed for use attainment in 2010 (Table 2) and was not supporting aquatic life (582), fish consumption (583), public and food processing water supplies (584), and primary contact (585). The identified causes include the following aldrin (79), alteration in stream-side or littoral vegetative covers (84), chloride (138), hexachlorobenzene (246), mercury (274), methoxychlor (277), other flow regime alterations (319), dissolved oxygen (322), polychlorinated biphenyls (348), sedimentation/siltation (371), fecal coliform (400), total suspended solids (403), pH (443), total phosphorus (462), and aquatic algae (479). Identified sources of the non attainment causes include the following atmospheric deposition – toxics (10), combined sewer overflows (23), contaminated sediments (28), impacts from hydrostructure flow regulation/modification (58), municipal point discharges (85), streambank modification/destabilization (125), source unknown (140), dam or impoundment (142), agriculture (156), and urban runoff/storm sewers (177)

Table 2: 2010 IEPA 303(d) List - Specific Assessment Information for the Fox River

Name	Assessment Unit ID	10-Digit HUC	IEPA Basin	Cat.	Size (miles)	Use Attainment*
Fox R.	IL_DT-03	0712000701	4	5	7.39	N582, N583, N585, X586, X590
Fox R.	IL_DT-09	0712000701	4	5	8.11	N582, N583, N585, X586, X590
Fox R.	IL_DT-38	0712000701	4	5	10.83	N582, N583, N584, N585, X586, X590
Fox R.	IL_DT-58	0712000701	4	5	3.74	N582, N583, X585, X586, X590

* X = not assessed; F = fully supporting; N = not supporting; 582 = primary contact; 583 = fish consumption'585 = aquatic life; 586 =secondary contact; 590 = aesthetic quality

Geomorphic Condition

As described in the introduction the aquatic resources within the survey limits have been subject to significant disturbance and alteration from their original condition. Historical mapping of the region indicates modifications to the presettlement landscape occurred during the early to mid 19th century. Since this time, the aquatic features within the yard have regained some natural features such as meanders, riffles and pools; however, ongoing "improvements" and routine maintenance activities continue to degrade the existing aquatic habitat. Assessment of the existing geomorphic condition was performed for the aquatic resources within the survey limits of the Project area through observation of the channel conditions and hydrological conditions. In addition, the IEPA Qualitative Stream Habitat Assessment Procedure (SHAP) was also performed.

Channel and Hydrological Condition

The wetted width of the channelized conveyances measured approximately 5 to 10 feet wide within the survey area of the Project Area, and maintained a depth of flow of approximately 1 to 2 feet. Substrate within the channel was composed of course sands, gravel, and cobble, with a fair amount of fine grained sand and silt deposition as well. As mentioned above the stream channel has been straightened and is generally confined by railroad tracks. Some portions contain a small riparian bench approximately 5-10 feet wide adjacent to the channel. The banks slopes were approximately 2:1 (H:V) along most of the channel and were mostly vegetated with a mixture of emergent, shrub-scrub, and woody riparian vegetation. Outside of the riparian bench railroad ballast composed the remainder of the riparian area. The stream is constricted by various culverts within the survey limits, which connect the various linear conveyances to Indian Creek. Indian Creek becomes much more natural (i.e., more meandering with some riffle-pool structure) downstream and outside the survey limits.

Qualitative Stream Habitat Assessment Procedure (SHAP)

The IEPA's Qualitative Stream Habitat Assessment Procedure (SHAP) (IEPA 1994) was used to provide a standard assessment of the habitat within the linear aquatic resources on July 6, 2010. These linear conveyances have been channelized and disturbed; however, the lower 2,200 of stream within the survey limits does maintain natural channel characteristics including riffle-pool sequencing, undercut banks, while also maintain a small riparian bench around the channel. Overall the stream habitat is generally poor; however, it is suitable enough to support a limited community of aquatic organisms. Generally the function of this stream is to convey storm water from offsite (upstream) and onsite locations downstream to the southern branch of Indian Creek. Attachment B includes a completed SHAP form for the evaluated aquatic resources.

ENVIRONMENTAL CONSEQUENCES

The construction of the Eola main line improvements would impact approximately 4,920 linear feet of open channel storm water conveyances. In general the open channel would be replaced with an enclosed conduit and a new rail line constructed immediately adjacent to the enclosed conduit. Analysis of these impacts includes a discussion on the direct effects from the proposed action as well as the potential indirect effects.

Direct Effects

Construction of the proposed connection would relocated 4,920 linear feet of open storm water channel to an enclosed conduit. This direct effect would result in alternation to the current hydrology and would result in loss of open channel habitat. This direct effect would alter the current channel and would result in the permanent loss of this channelized stream habitat for numerous aquatic and terrestrial organisms, including fish, amphibians, invertebrates, and mammals. During construction, the open channel tributaries of the south branch of Indian Creek would be affected physically, chemically, and biologically. The biological functions of these systems would be affected by the loss of habitat, refugia, food production, reproduction, and dispersal. The chemical integrity of south branch tributaries can be defined as the natural composition and properties of various substances within the aquatic system. Impacts on the chemical functions would include alteration of nutrient cycling, particulate retention, organic carbon export, removal and sequestration of elements and compounds, and diminished water quality. The physical functions can be characterized as the hydrological attributes of a particular stream. Impacts on the physical functions would include alteration of the natural flow regime, flood attenuation ability, storm water reduction, groundwater exchange, and maintenance of natural thermal regimes.

Indirect Effects

Indirect effects would include impacts both upstream and downstream of the channel relocation. Indirect effects upstream of the Eola main line improvements of the Project area would include impacts on aquatic organism movement and disruption of the current hydrological regime. Downstream impacts on biota and habitat may also result from construction the improvements. During construction, changes in the hydrological flow may have indirect effects on downstream habitat. Furthermore, after construction, the new encased channel and its relation to downstream flows would require time to adjust. During the channel adjustment period, downstream habitat areas may indirectly change through scour and/or accretion; however, these impacts are likely to be short term and localized to areas immediately downstream of this section of the Project area.

POTENTIAL MITIGATION MEASURES

As stated above, approximately 4,920 linear feet of stream and storm water conveyances and their associated fringe wetlands (discussed in separate wetlands determination report) could be impacted by the proposed action. In order to offset the loss of aquatic habitat (stream and storm water conveyances and wetlands), mitigation for these aquatic resources will be required.

In March of 2010, the USACE produced a regulatory guidance document that provides detailed guidance for stream mitigation in Illinois (USACE, 2010). This guidance document was

designed in order to facilitate Clean Water Act Section 404 permit applications, and provide a standard way to assess adverse impacts and to determine the amount of mitigation required.

Based on this guidance document, mitigation for the potential stream impacts to upper headwaters of the southern branch of Indian Creek could be accomplished through a combination of on- and off-site restoration alternatives. Preliminary analysis of mitigation alternatives and onsite observations indicated available onsite mitigation was limited due to numerous anthropogenic constraints within the railway yard. Ecologically successful mitigation would be very difficult to achieve onsite; however, numerous onsite Best Management Practices (BMPs) could be included as part of the mitigation. On-site mitigation is limited to and could include the implementation of numerous Best Management Practices (BMPs) that would minimize potential future impacts to aquatic resources. Furthermore, by implementing additional BMPs such as the use of interpretive signage, ecological training for rail employees and exotic species management potential future impacts may be avoided.

In order to fully compensate for the functions and values, offsite mitigation appears to be a much more viable alternative for the impacts. Off-site mitigation could include:

1. Aquatic habitat restoration and enhancement through the management of exotic species within Eola Road Marsh and Night Heron Marsh
2. Restore stream and wetland habitat within Night Heron Marsh to south of Liberty Street
3. Restore and enhance aquatic habitat features downstream within Indian Creek
4. Purchase wetland and stream mitigation credits from an approved mitigation bank within the service area.

Aquatic habitat within Eola Road Marsh and Night Heron Marsh can be enhanced by instituting an aggressive exotic species management plan. Removing exotics (i.e., buckthorn, reed canary grass, *Phragmites* etc.) and planting wetland herbaceous, shrubs and tree species would enhance these natural areas and improve overall aquatic habitat. Additional off-site mitigation in the form of habitat enhancement and/or creation could be accomplished through a partnership with the DuPage County Forest Preserve District (DCFPD) to restore wetlands and stream features within the Night Heron Marsh parcel to the south across Liberty Street. In recent years, the Forest Preserve acquired a parcel south of the road, which remains relatively undeveloped. Detailed off-site surveys to identify restoration options will be conducted during the Tier 2 project level NEPA environmental assessment process.

Approximately 6,500 linear feet of aquatic habitat along Indian Creek (Figure 3) could be enhanced through a combination of exotic species removal, wetland plantings, bank stabilization, and/or installation of the appropriate in-stream treatments such as: cross veins, j-hooks, porous weirs, newberry riffles, or root wads (Attachment C). Exact locations for the downstream mitigation measures have not been selected at this point of the project; however, detailed surveys to identify specific mitigation sites will be conducted during the Tier 2 project level NEPA environmental assessment process. These structures will be strategically located throughout Indian Creek to optimize their effect on scour and deposition along the creek. Installation of channel treatments will enhance stream substrate and aid in the development of riffle–pool sequencing to restore a more natural width to depth ratio.

Additional off-site mitigation for wetlands and stream impacted by the Eola Main Line Improvements could be accomplished through the purchase of stream/wetland mitigation credits

from an approved mitigation bank(s) located within the service area. Preliminary analysis indicates numerous permitted mitigation banks within northern Illinois include:

1. Ferson Creek Wetland Mitigation Bank, USACOE Permit 199600027
2. Otter Creek Wetland Mitigation Bank, USACOE Permit 199300675
3. Butterfield Road Wetland Mitigation Bank, USACOE Permit 19980192
4. Cedar Creek Wetland Mitigation Bank, USACOE Permit 200500804
5. Andalusia Slough Wetland Mitigation Bank, USACOE Permit CEMVR-OD-P-2005-205
6. Jelkes Creek Wetland Mitigation Bank, USACOE Permit 200300216
7. Kilbuck Creek Wetland Mitigation Bank, USACOE Permit CEMVR-RD 342590
8. Mink Creek Wetland Mitigation Bank, USACOE Permit 200200409
9. Red Wing Slough Wetland Mitigation Bank, USACOE Permit 200300490

By employing the appropriate combination of on- and off-site mitigation measures detailed above, impacts to the aquatic resource features within the Eola yard can be mitigated to minimize impacts.

Should FRA approve Illinois DOT's HSIPR grant application, preliminary engineering including detailed evaluation of possible alternatives to avoid or minimize aquatic impacts will be evaluated. In addition, detailed, site-specific mitigation plans to compensate for unavoidable impacts will be developed during the Tier 2 project level environmental assessment and Section 404 permit evaluation.

FUTURE PHASES OF THE PROJECT

If the FRA approves the Illinois DOT FY2010 HSIPR Grant Application, Service Development Plan and Tier I EA, the next step in the development process will be to conduct a detailed Project Level NEPA review of the various project elements. During the Project Level NEPA review process numerous environmental surveys will be conducted at a more defined scale. The Project Level NEPA review will also include the full range of alternatives evaluation, impact assessment and mitigation development, including permit applications. It is also important to note that the detailed engineering and alternative analysis will be concurrent with the Project Level NEPA review. Illinois DOT will coordinate the future Project Level NEPA reviews with all of the appropriate federal and state agencies including the Illinois Department of Natural Resources (IDNR) and will work with these agencies to identify the best alternatives to avoid and minimize impacts to aquatic resource features.

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FIGURES

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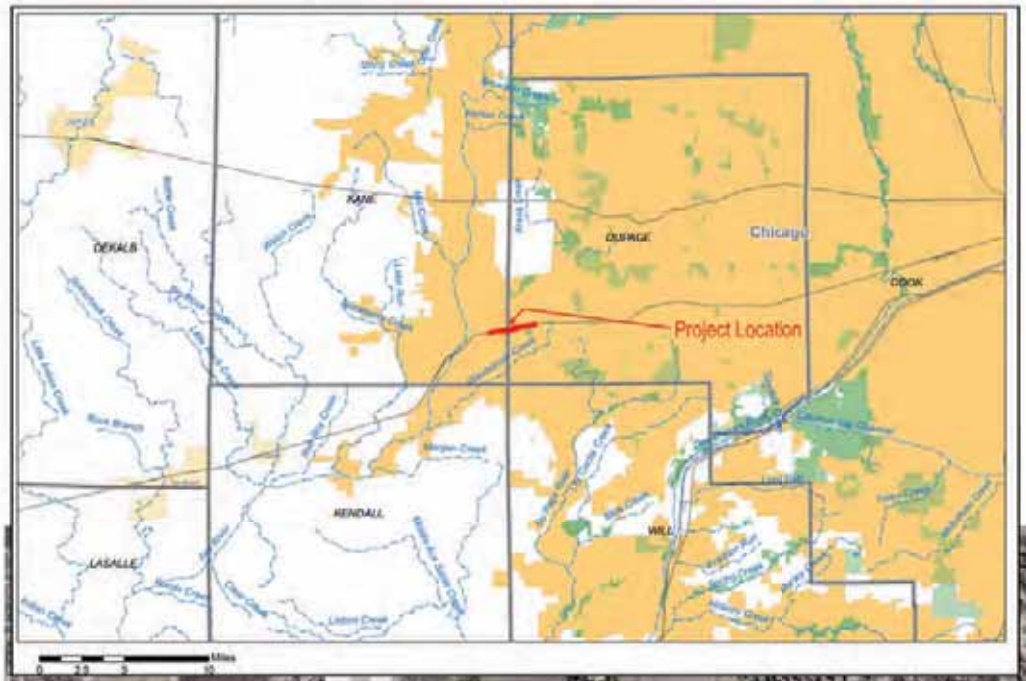

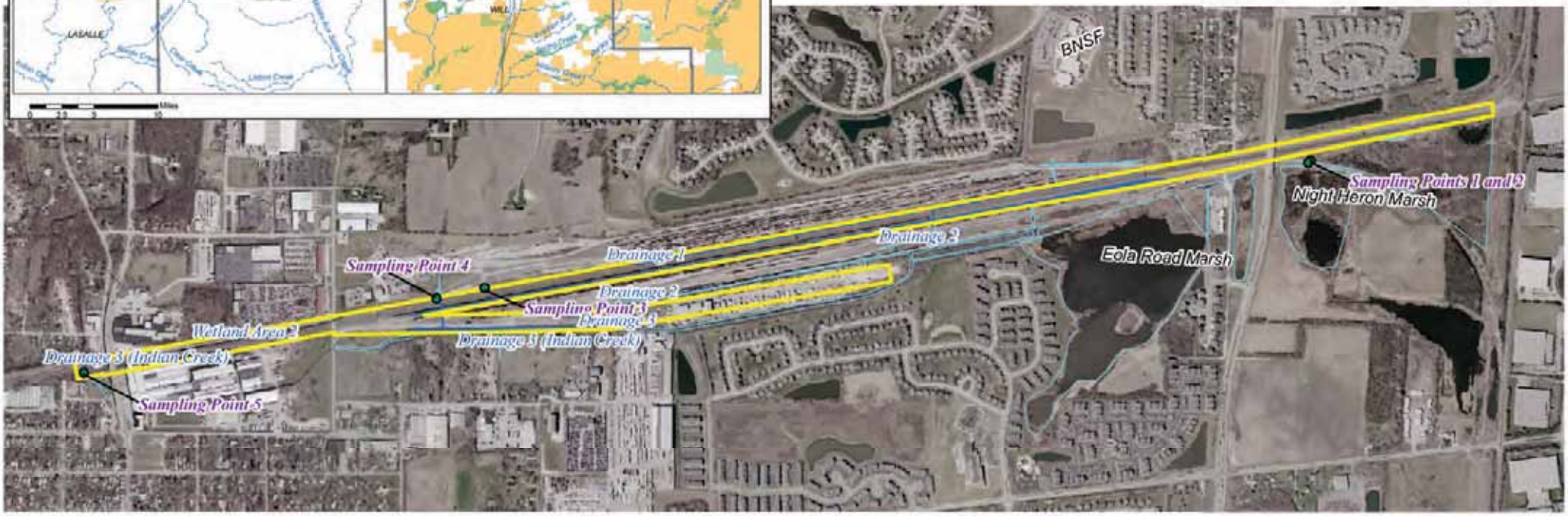

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Location Map

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- Wetland Areas within Survey Limits
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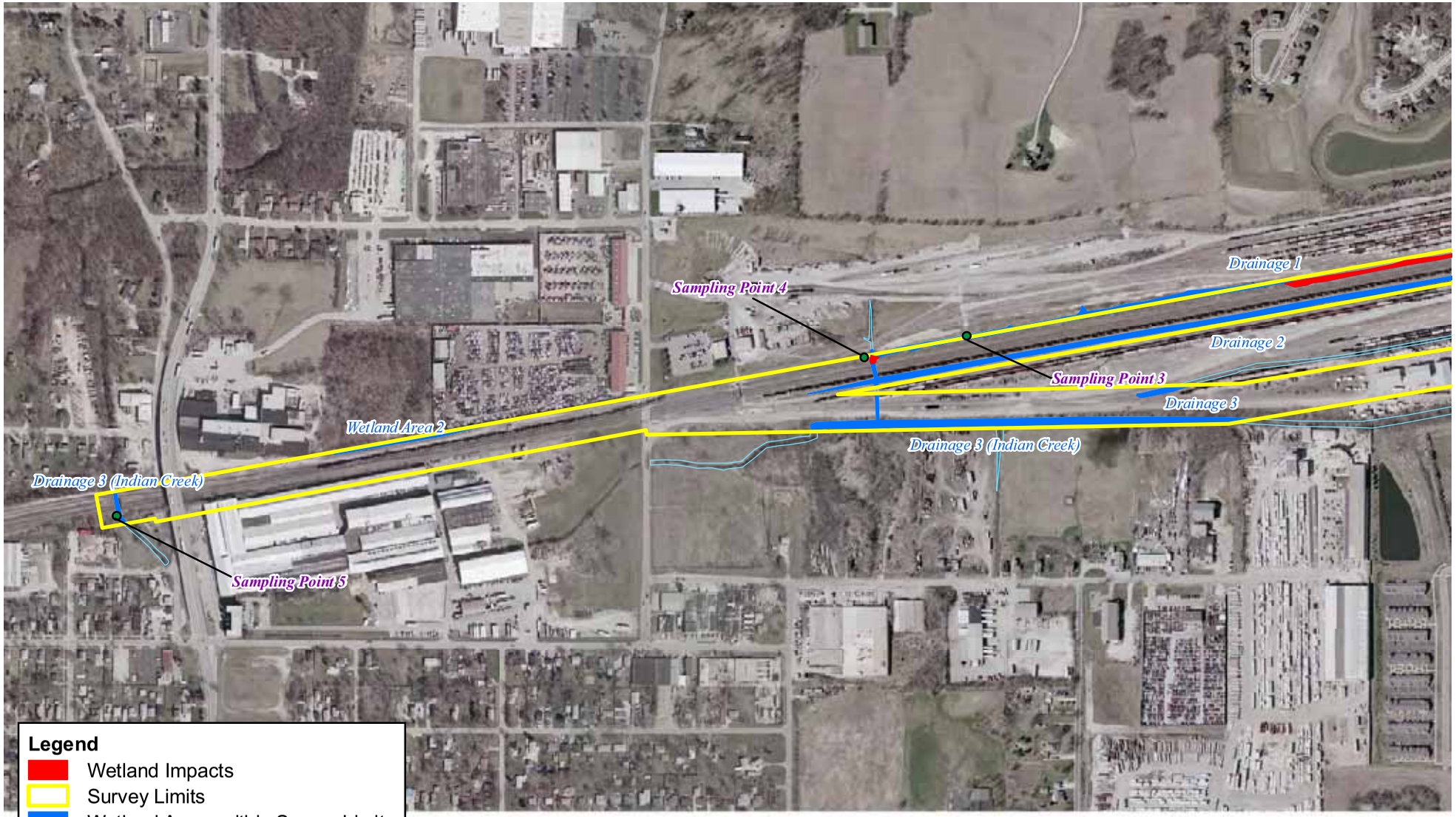

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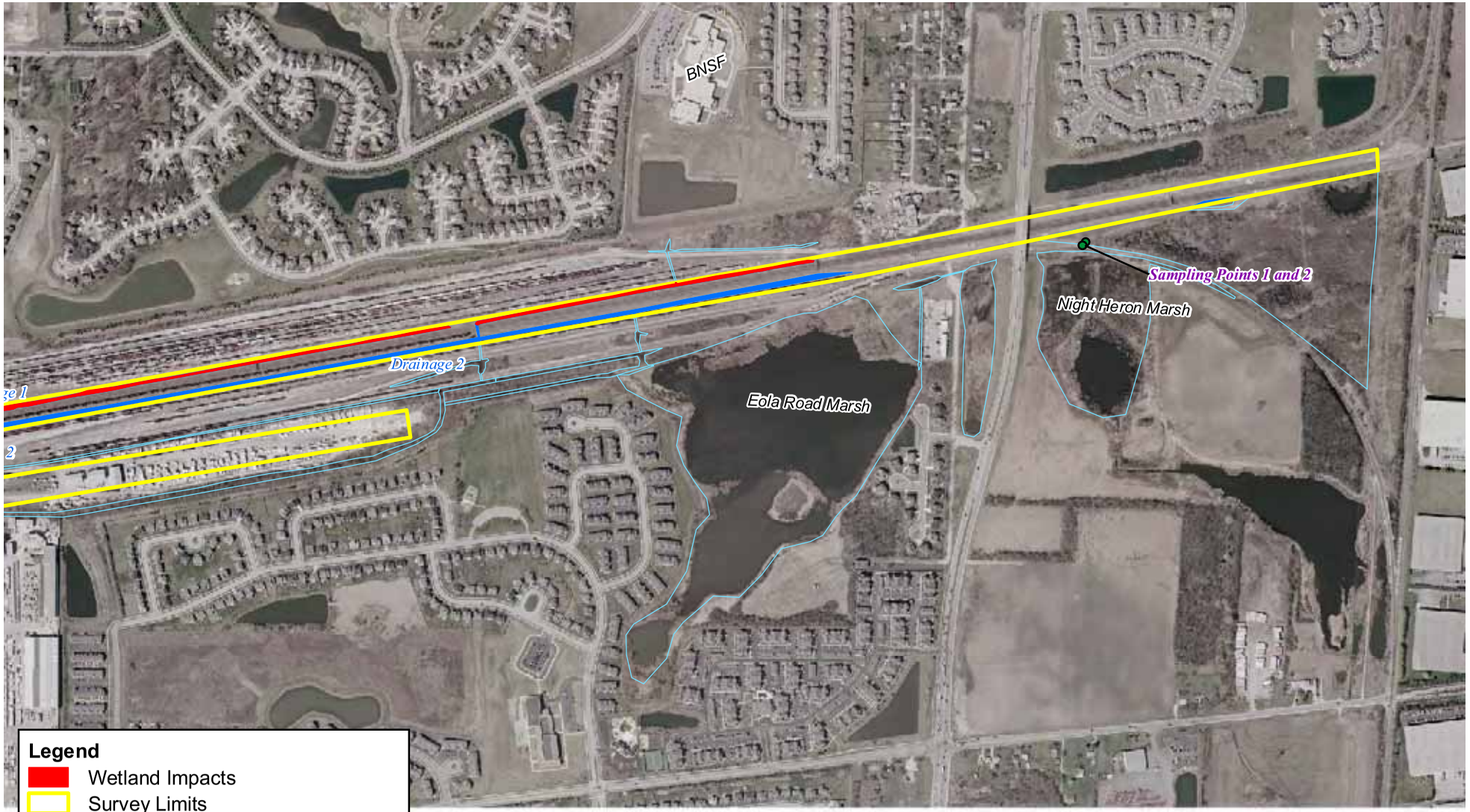

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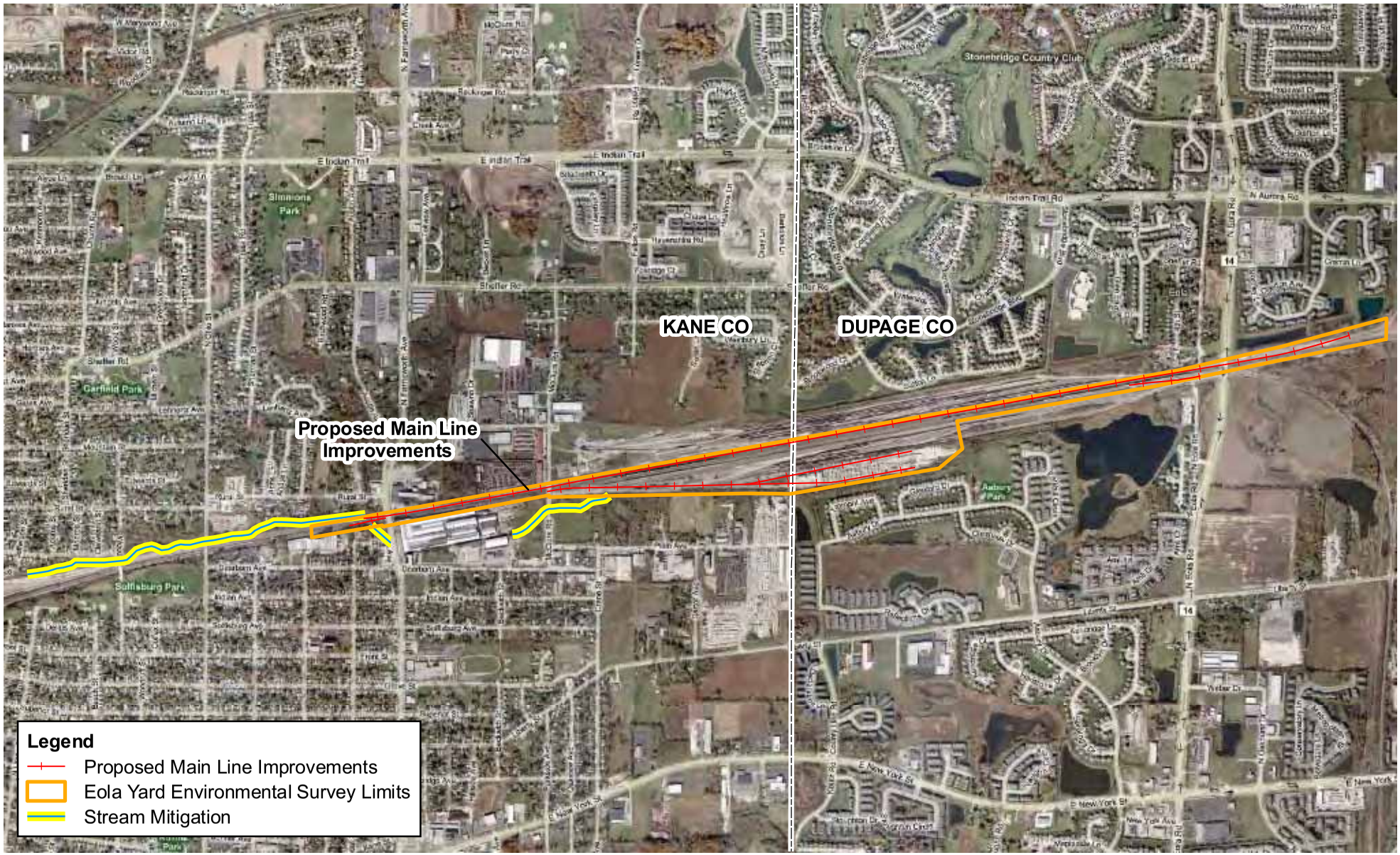

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Off-Site Stream Mitigation

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ATTACHMENTS

A – Site Observation Photo Log
B – IEPA SHAP Data Sheet
C – Typical Section of Instream Mitigation Features

Attachment A – Site Observation Photo Log

Looking at double box culvert that contains flow of Indian Creek, at the west end of the Eola yard, west of Farnsworth Ave.

Looking south at Indian Creek channel flowing north within the west end of the Eola Yard, west of Farnsworth Avenue

Looking southeast at the Dupage County Forest Preserve Night Heron Marsh from Eola Road, adjacent to the Project area

Looking east at the section of natural stream channel within the Eola yard that would be impacted by the new tracks

Looking west from the top of the embankment at the natural stream channel and adjacent riparian vegetation

Looking east at the linear drainage feature as it loses its riparian vegetation and becomes more of a wet bottom storm water conveyance

Looking east at the drainage feature as it loses flow, notice the large patches of filamentous algae

Looking east at the stream channel of Indian Creek along the southern boundary of the Project area

Attachment B – IEPA SHAP Data Sheet

APPENDIX E-9: IEPA QUALITATIVE STREAM HABITAT ASSESSMENT PROCEDURE (SHAP)

Stream: Upper headwaters of the southern branch of Indian Creek (HUC 07120007010?) Station Code: N/A

Reach Length: _____ Date: July 06, 2010 Assessed by: JLB / DRK

Reach Description: Channelized stormwater conveyance

		EXCELLENT	GOOD	FAIR	POOR
1	Bottom Substrate	Greater than 50% gravel, cobble or boulders	30-50% consolidated gravel, cobble or boulders	10-30% gravel (largely unconsolidated) cobble, boulders	Less than 10% gravel, cobble or boulders; predom. Sand or silt
Score:	11	16-20	11-15	6-10	1-5
2	Deposition	Less than 5% affected; minor accumulation of coarse particles at channel bars, point bars snags or submerged vegetation	5-30% affected; moderate accumulation of sand/gravel at channel point bars, snags or submerged vegetation	5-30% affected; major deposition of sand at channel point bars, snags or submerged vegetation; pools shallow from heavy deposition	Mud, silt, or sand in braided or nonbraided channels; pools almost absent due to deposition
Score:	4	10-12	7-9	4-6	1-3
3	Substrate Stability	Abundance of boulders or cobble; periphyton/aquatic vegetation often abundant	Presence of some boulders or cobble with some periphyton	Few boulders and cobble; small shifting particles common; periphyton rare; or predom. Claypan or bedrock	Stable substrate types absent; small gravel, sand and silt abundant; periphyton usually absent or present only during low flow
Score:	6	13-16	9-12	5-8	1-4
4	Instream Cover (for pan fish juveniles or adults)	Abundant submerged logs, undercut banks or other stable habitat (>12% of stream)	Adequate habitat (6-12% of stream)	Habitat availability less than desirable (2-6% of stream)	Lack of habitat obvious (<2 of stream)
Score:	6	10-12	7-9	4-6	1-3
5	Pool Substrate Characterization	Mixture of coarse substrate materials with gravel and firm sand prevalent; root mats and submerged vegetation common	Mixture of soft sand, mud or clay; mud may be dominant; some root mats and submerged vegetation present	All mud/clay or sandy bottom; little or no root mat, no submerged vegetation; older channelization	Hardpan clay or bedrock; no root mats or vegetation OR maintained channel with shifting sand substrates; OR pools absent
Score:	7	16-20	11-15	6-10	1-5
6	Pool Quality	(see flow chart)			
Score:	5				
7	Pool Variability	Approx equal mix of deep/shallow/large/ small pools present	Majority of pools large and deep; very few shallow	Shallow pools much more prevalent than deep pools	Majority of pools small and shallow or pools absent
Score:	5	13-16	9-12	5-8	1-4
8	Canopy Cover (Shading	Mixture of conditions some areas fully exposed to sun while others receive various degrees of filtered light	Covered by sparse canopy; entire water surface receiving filtered light	Water surface completely shaded OR nearly full sun reaching water surface (10-20%)	Lack of canopy, full sunlight reaching water surface (0-10%)
Score:	1	10-12	7-9	4-6	1-3

APPENDIX E-9: IEPA QUALITATIVE STREAM HABITAT ASSESSMENT PROCEDURE (SHAP)

		EXCELLENT	GOOD	FAIR	POOR
9	Bank Vegetative Protection/ stability (waters edge to top of bank)	Over 90% of the streambank surfaces covered by vegetation or bare rock	70-90% of the stream bank surface covered by vegetation or bare rock	50-70% of the stream bank surface covered by vegetation or bare rock OR older channelization	<50% of the stream bank surface covered by vegetation or bare rock OR new or regularly maintained channelization
Score:	3	13-16	9-12	5-8	1-4
10	Top of bank land use (top of bank to 30 yards inland)	Well vegetated or =>90% in undisturbed land use	Generally undisturbed (79-90%)	Moderately disturbed (40-70%)	Little of immediate watershed undisturbed (<40%)
Score:	1	7-8	5-6	3-4	1-2
11	Flow-related refugia	Readily available refugia at all flow regimes	Abundant stable cover for fish present between water's edge and top of bank; moderate pool depth at low flows	Sparse cover for fish present between the waters edge and top of bank OR pools nearly absent at low flow	Lack of refugia at most stream stages
Score:	2	10-12	7-9	4-6	1-3
12	Channel Alteration	Little or no enlargement of islands or point bars or no channelization	Some natural channel modification or recovered old channelization	Older channelization in various degrees of recovery	Extensive recent or regularly maintained channelization
Score:	1	7-8	5-6	3-4	1-2
13 **	Channel Sinuosity	Instream channel length 3 to 4 times straight distance	Instream channel length 2 to 3 times straight line distance	Instream channel length 1 to 2 times straight line distance	Channel straight, channelized waterway
Score:	1	10-12	7-9	4-6	1-3
14 **	Width /Depth ratio	Stream very deep and narrow; width/depth <=7	Stream moderately deep and narrow; Width/depth 8-15	Stream moderately shallow with some deep areas; width/depth 15-25	Stream relatively wide and shallow; width/depth >25
Score:	3	13-16	9-12	5-8	1-4
15	Hydrologic diversity	Variety of habitats: deep riffles and pools; diverse velocities readily apparent	Adequate depth in pools and riffles; bends provide habitat; good velocity diversity	Occasional riffle or bend; bottom contours provide some habitat; fair velocity diversity	Essentially a straight stream with poor habitat; uniform velocity
Score:	2	10-12	7-9	4-6	1-3

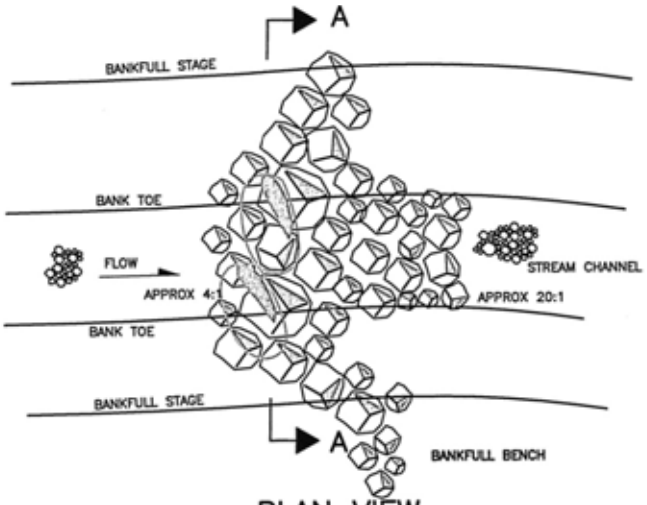
Total Score: 58

Representativeness of sampled reach to entire stream reach: Excellent, Good, Fair, (Poor) (circle one)

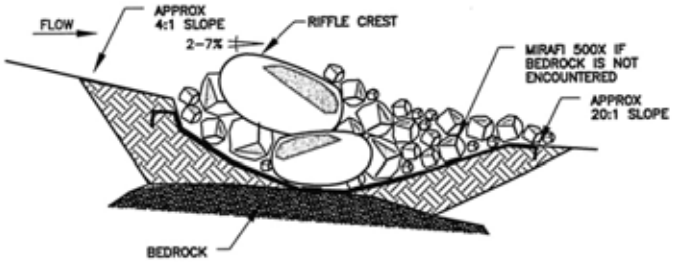
Comments: Linear stormwater conveyances within the Project Area (a rail yard) are highly channelized and disturbed. Overall function is to shunt stormwater from upstream offsite and onsite to the downstream Southern branch of Indian Creek. Qualitative habitat is generally poor.

** Office: Indicates that assessment based on measured habitat information is recommended.

Attachment C – Typical Section of Instream Mitigation Features



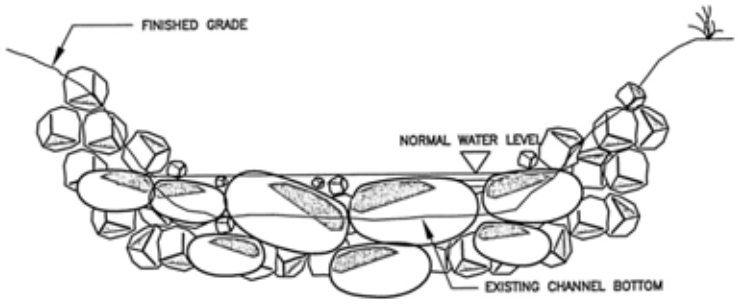
PLAN VIEW



PROFILE

CONSTRUCTION NOTES:

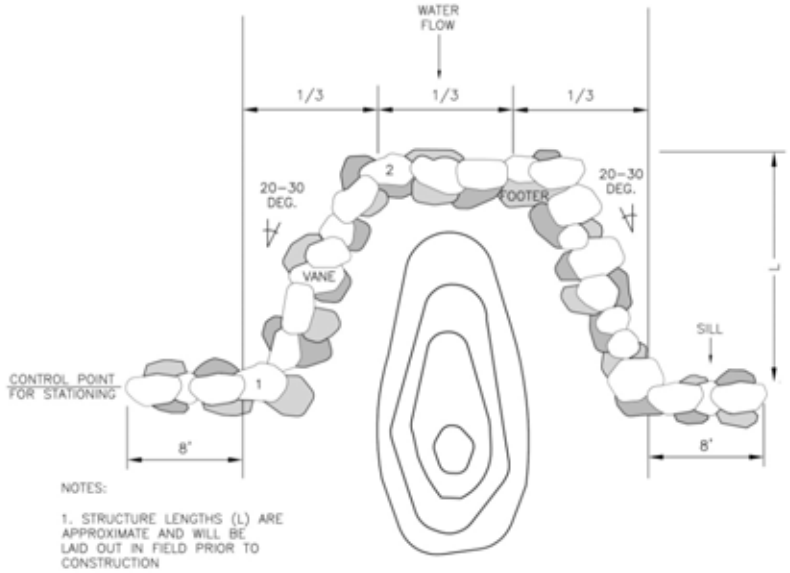
1. PLAN: BUILD RIFFLE TO EXTEND ACROSS BASE OF STREAM WITH LARGEST DIAMETER BOULDERS AT CREST LINE AND REDUCE SIZES PROGRESSIVELY DOWNSTREAM. CREST BOULDERS SIZED 1.5 TO 2 TIMES MAXIMUM SIZE TRANSPORTABLE WITH TOP-OF-BANK EVENT. RIFFLE CREST HAS SIMILAR SIZED FOOTERS TO COHESIVE SAPROLITE OR BEDROCK.
2. PROFILE: CONSTRUCT DOWNSTREAM FACE OF RIFFLE AT APPROXIMATELY 20:1 AND UPSTREAM FACE AT APPROXIMATELY 4:1 SLOPE. SLOPE SHOULD BE ADJUSTED TO MEET DESIGN RIFFLE:POOL RATIO, AND RIFFLE SLOPES.
3. CROSS SECTION: V-SHAPED CREST CUT DOWN TOWARDS CENTER OF CHANNEL.
4. SURFACE: SPACE LARGE SURFACE ROCKS 20 TO 30 CM APART ON THE DOWNSTREAM FACE OF THE RIFFLE TO FORM LOW FISH PASSAGE CHANNELS.
5. BANKS: EXTEND RIFFLE SIDE SLOPE UP BANK TO LEVELS EQUAL TO HEIGHT OF COIR FIBER LOGS, AND THEN EXTEND CREST BACK WITH ROCK PLACED WITHIN BANDS AT 20 TO 30° ANGLE FROM BANK, AND WITH RISE ANGLE OF 2-7° (AS SEEN IN THE CROSS VANE STRUCTURE).



SECTION A-A

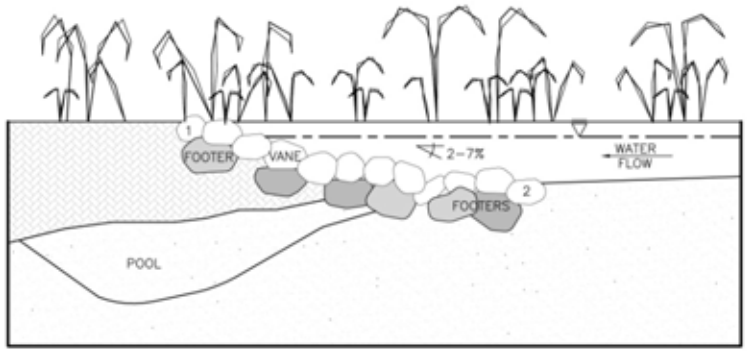
CONSTRUCTED BEDROCK RIFFLE

NO SCALE



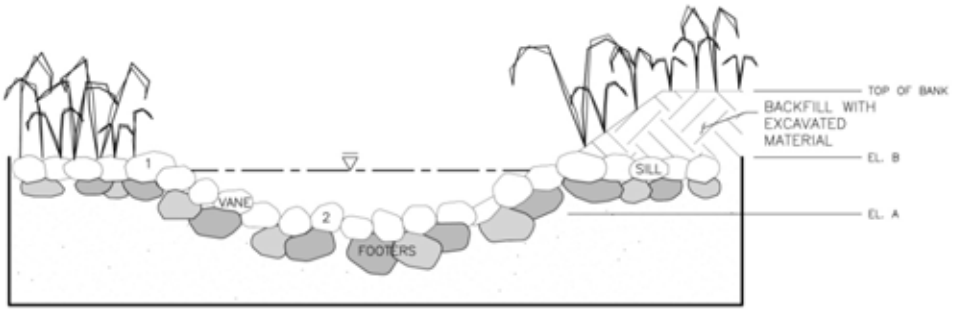
PLAN VIEW

NTS



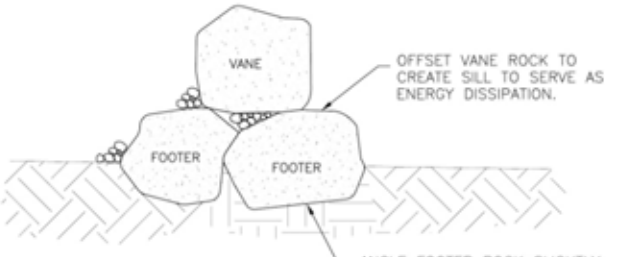
PROFILE VIEW

NTS



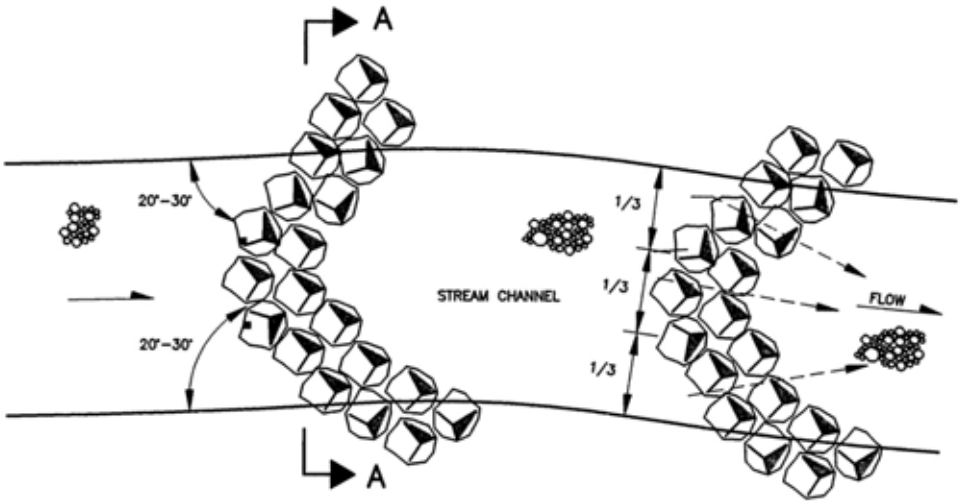
CROSS SECTION VIEW

NTS

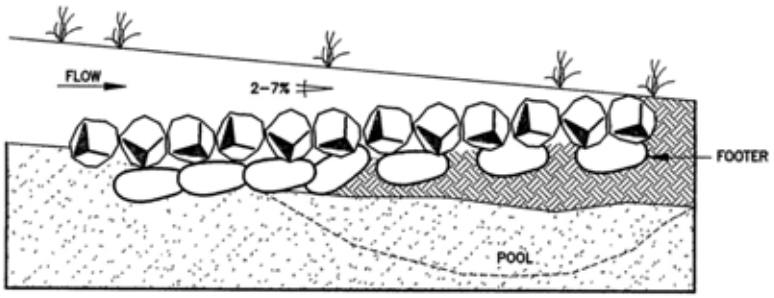


ROCK DETAIL

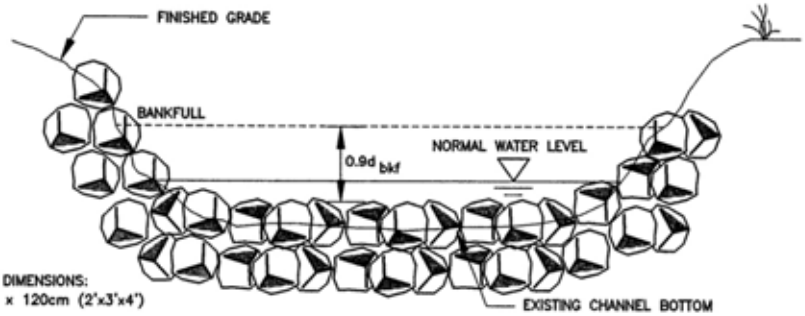
NTS



PLAN VIEW
NOT TO SCALE



PROFILE
NOT TO SCALE



MIN. BOULDER DIMENSIONS:
60cm x 90cm x 120cm (2'x3'x4')

BOULDER SPACING:
TO BE DETERMINED IN FIELD

SECTION A–A

ROCK CROSS VANES

NO SCALE