US Army Corps of Engineers ®
Chicago District

BUBBLY CREEK, SOUTH BRANCH OF THE CHICAGO RIVER, ILLINOIS INTEGRATED ECOSYSTEM RESTORATION FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX C
CIVIL DESIGN

MARCH 2020

BUBBLY CREEK, SOUTH BRANCH OF THE CHICAGO RIVER, ILLINOIS ECOSYSTEM RESTORATION FEASIBILITY STUDY

APPENDIX C – CIVIL DESIGN

March 2020

List of Attachments

Attachment 1: Civil Design Appendix
Attachment 2: VE Study Civil Quantities
Attachment 3: VE Study Drawings

Attachment 1:

Civil Design Appendix

BUBBLY CREEK ECOSYSTEM RESTORATION – SECTION 206
CHICAGO, IL

APPENDIX C – CIVIL DESIGN

GENERAL

Purpose and Scope

The purpose of this Appendix is to: 1) discuss existing survey, utility and topographic information; 2) describe design criteria, engineering methods and procedures that were used to layout the project features shown on the civil drawings; 3) present the requirement for the needed real estate; and 4) present the methods used and calculations developed for construction quantities.

DESIGN ANALYSIS

General

The main report discusses the alternatives considered for this report. This design analysis will only cover the recommended plan which involves the placement two substrate restoration sections on the riverbed. The first is a round river rock substrate restoration section (6 inches of rock on 6 inches of sand) between stations 0+00 to 41+00, and station 71+50 to the end of the turning basin. The second is placement of a quarried stone substrate restoration section (6 inches of stone on 6 inches of sand) between stations 41+00 to 71+50. Loose surface foreign debris would be removed from the side slopes of the riverbanks and disposed. The side slopes of the riverbank (generally ranging from 1:1 to 3:1) will be planted with riparian and emergent seeds and plugs. Other restoration features include woody debris piles, pebble/cobble placement around the nine combined sewer overflow outfalls, and submergent plant habitats. Organic leaf litter compost would be worked into the rounded river rock or quarried stone layer in the areas to be planted to further provide an adequate planting medium.

Survey and Mapping

Although not shown on the civil drawings, the existing topographic contours were created from a LIDAR survey of Cook County. The 1-foot contours of the survey represent the general slopes of the terrain. A bathymetric survey was performed on the river bottom and was also taken from the Cook County GIS database. Also not shown is the mapping for the parcels and easements which are ESRI Shape File format in Illinois State Plane Projection, and NAD83 Datum provided by Cook County. This information will be used in the design phase for general GIS applications and should not to be used in place of a field survey to determine precise location of features and boundaries for any engineering design, legal, or regulatory purposes.

Access/Staging/Storage

The majority of access to and staging for the project area will be made by a barge on the South Branch Chicago River. Vehicle access to the east bank can be made from public roads and alleys identified on the civil drawings. Measures need to be taken for removing and replacing fence when accessing the riverbanks from land. Coordination with MRWD is required to access the site by land through the Racine Avenue Pumping Station, if necessary. There are 4 bridges along Bubbly Creek—CTA and METRA railroad bridge, I-55, Archer Avenue, and W. 35th Street. No as-built information on clearance height is provided. The main report identifies general heights and lengths for these bridges. Any damaged areas or structures will be restored to previous condition.

Utilities

Combined sewer and watermain utility CADD files obtain from the City of Chicago GIS database were available in the vicinity. However, no pipe size or invert elevation information was given. Based on the scope of the project which includes minimal ground disturbance (three inches into channel banks for riparian plantings; placement of new substrate in the channel; emergent and submergent plantings within the new substrate; and placement of woody debris within the channel), it is anticipated that there will be no impacts to utilities. During preconstruction engineering and design, additional investigation would continue to confirm initial findings.

Quantity Calculations

Substrate restoration areas were calculated using Microstation. ArcGIS shapefiles, developed by PM-PL, were imported into Microstation and measured. Substrate restoration volume was computed by applying the section thicknesses to the area. ArcGIS shapefiles for woody debris and riprap were also provided by PM-PL and imported into the drawings.

Attachment 2:

VE Study Civil Quantities

US Army Corps of Engineers® Chicago District	PROJECT TITLE: **BUBBLY CREEK RESTORATION SECTION 206**	COMPUTED BY: **DGA**	DATE: **08/12/13 Rev 08/27/14**	SHEET: of
	COMPUTATION TITLE: **VE STUDY CIVIL QUANTITIES**	CHECKED BY: **A**	DATE: **09/09/13**	

Quantities were calculated from *pw:\\LRC-AP02CHI.lrc.ds.usace.army.mil:lrc-ap02chi.lrc.ds.usace.army.mil\Documents\Projects\South Fork South Branch Chicago River\Bubbly Creek Sect 206\Civil Design\Drawings-Solicitation\Working Files\NER-Quantity-Calc.dgn*

Restoration areas and NER measures were imported into MicroStation from shapefiles found in -
J:\LRC_Projects\PRJ_Bubbly_Creek\Shapefiles\BC_LWD_Measure_2013_05.shp
J:\LRC_Projects\PRJ_Bubbly_Creek\PRJ_BubblyCreek.gdb\BC_Eco_Measures_NER
J:\LRC_Projects\PRJ_Bubbly_Creek\PRJ_BubblyCreek.gdb\Bubbly_Area_SHK

SUBSTRATE RESTORATION QUANTITIES

Total Substrate Area = 1338173.3 sf = **30.7 acres** (Round River Rock 21.04 acres + Quarried Stone 9.68 acres)

Round River Rock Vol = 277441.1 sf + 639142.2 sf = 916583.3 sf × 6" = 458291.7 cf ÷ 27 = 16973.8 cy – 30% voids = 11881.7 cy × 1.5 = 17822.5 tons + 25% contingency = 22278.1 tons **Use 22280 tons**

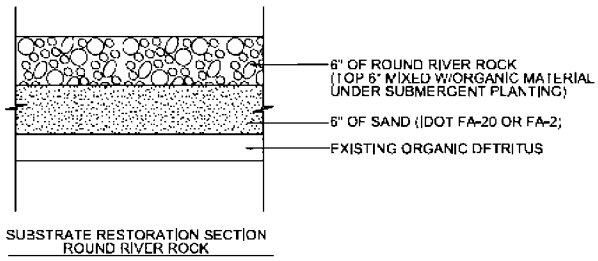
Quarried Stone Vol = 421590 sf × 6" = 210795 cf ÷ 27 = 7807.2 cy – 30% voids = 5465.1 cy × 1.5 = 8197.6 tons + 25% contingency = 10247 tons **Use 10250 tons**

(Geotech has confirmed 30% voids is appropriate)

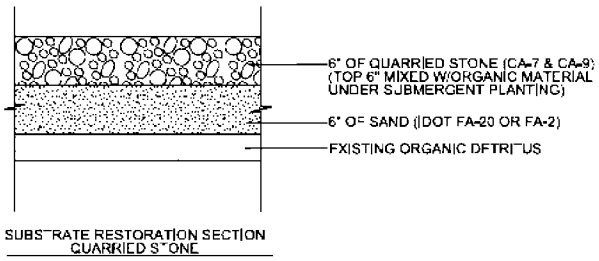
Sand Vol = 1338173.3 sf × 6" = 669086.7 cf ÷ 27 = 24781 cy + 25% contingency = 30976 cy **Use 30980 cy**

Pebble/Cobble Vol = 10890 sf × 18" = 16335 cf ÷ 27 = 605 cy – 30% voids = 423.5 cy × 1.5 = 635.3 tons + 25% contingency = 794.1 tons **Use 795 tons**

(Pebble/Cobble added into the substrate section in certain areas along the river)



SUBSTRATE RESTORATION SECTION
ROUND RIVER ROCK



SUBSTRATE RESTORATION SECTION
QUARRIED STONE

Assumptions: substrate area does not consistently match the NWL of 577.3 shown on the civil drawings.

~~Pebble Bed Vol = 10890 sf × 18" = 16335 cf ÷ 27 = 605 cy – 30% voids = 423.5 cy × 1.5 = 635.3 tons + 25% contingency = 794.1 tons **Use 795 tons**~~

PLANTING HABITAT QUANTITIES

Invasive Species Removal Area = 44213.2 + 125889.9 + 73964.8 + 102583.8 + 36078.9 + 20136 = 402866.6 sf = **9.25 acres**

Riparian Area = 44213.2 + 125889.9 + 73964.8 + 102583.8 + 36078.9 + 20136 = 402866.6 sf = **9.25 acres**

Emergent Area = 7101.8 + 18224.7 + 4968.8 + 12285.8 + 2870.6 = 45451.7 sf = **1.04 acres**

Submergent Area = 24074.1 + 81651.9 + 10155.1 + 16413.4 + 9551 + 2597.5 = 144443 sf = **3.32 acres**

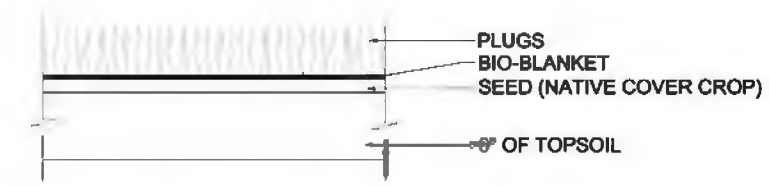
Large Woody Debris (from PM-PL) = **10 piles**

- Size of piles undetermined at this time

Topsoil for Emergent/Riparian Areas

Area = 65587.8 sf (emergent) + 382712.4 sf (riparian) = 448300.2 sf = 10.29 acres

Vol = 448300.2 sf × 6" = 224150.1 cf ÷ 27 = 8301.9 cy + 25% contingency = 10377.4 cy **Use 10380 cy**



EMERGENT/RIPARIAN PLANTING SECTION

RIPRAP REMOVAL QUANTITY

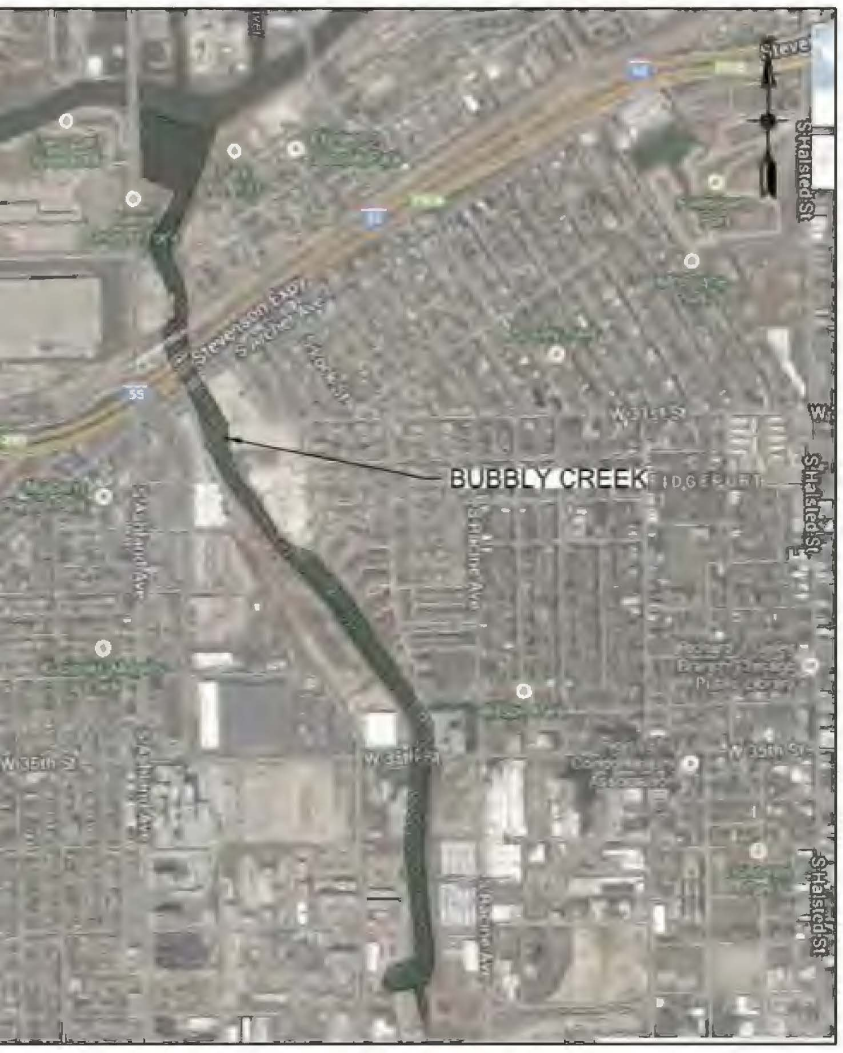
Assume 18" of riprap 5' wide at 755' length

Vol = 1.5' × 5' × 755' = 5662.5 cf ÷ 27 = 209.7 cy × 1.5 = **315 tons**

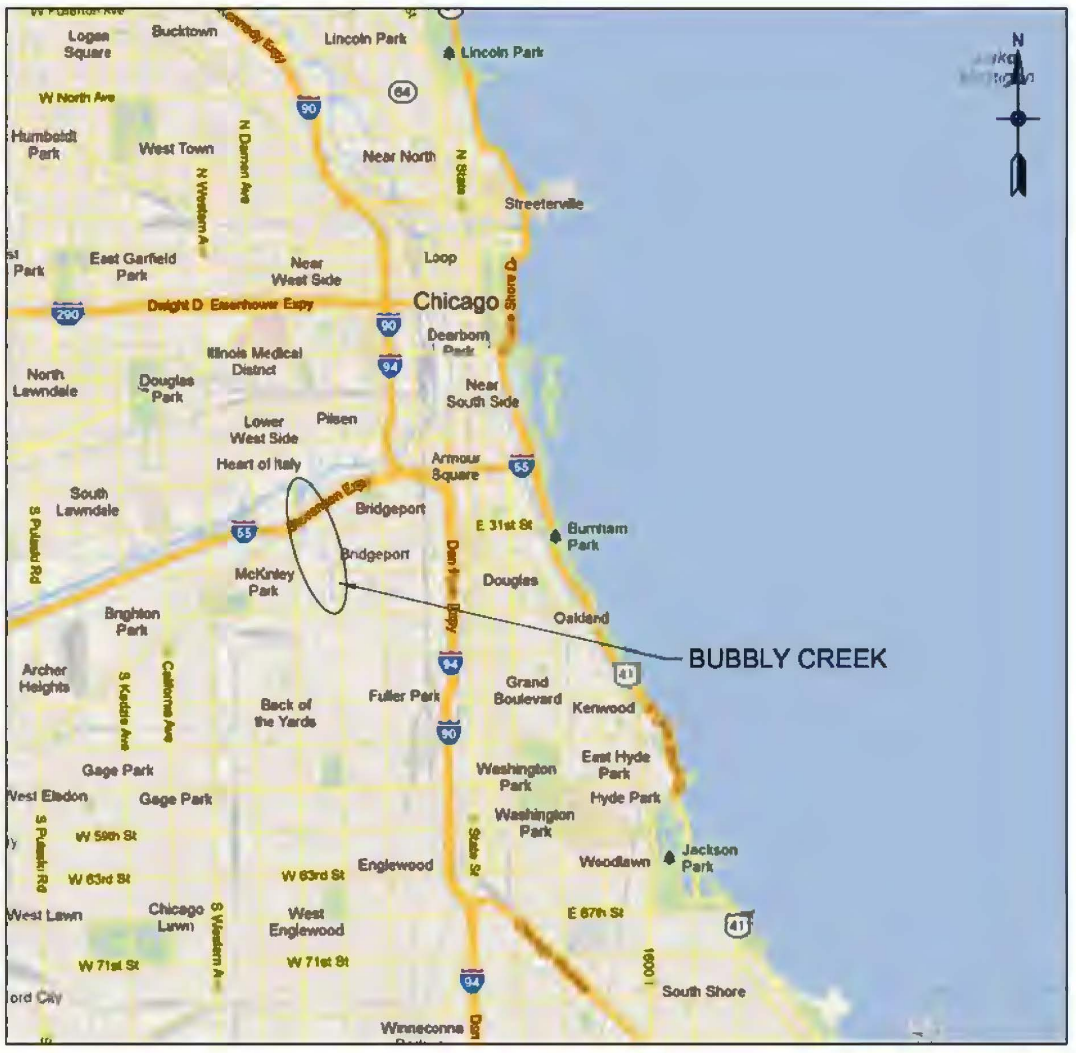
Attachment 3:

VE Study Drawings

SOUTH FORK SOUTH BRANCH CHICAGO RI
BUBBLY CREEK - SECTION 206
ECOSYSTEM RESTORATION
CHICAGO, ILLINOIS



LOCATION MAP
(N.T.S.)



VICINITY MAP
(N.T.S.)

Submittal
2014

SHEET INDEX

SHEET NO.	SHEET I.D.	SHEET TITLE
1	G-001	TITLE SHEET, LOCATION, AND VICINITY MAPS
2	G-002	SHEET INDEX, GENERAL NOTES, AND ABBREVIATIONS
3	C-100	KEY MAP
4	C-101	RESTORATION PLAN - BUBBLY CREEK STA. 0+00 TO STA. 10+00
5	C-102	RESTORATION PLAN - BUBBLY CREEK STA. 10+00 TO STA. 18+00
6	C-103	RESTORATION PLAN - BUBBLY CREEK STA. 18+00 TO STA. 26+00
7	C-104	RESTORATION PLAN - BUBBLY CREEK STA. 26+00 TO STA. 34+00
8	C-105	RESTORATION PLAN - BUBBLY CREEK STA. 34+00 TO STA. 42+00
9	C-106	RESTORATION PLAN - BUBBLY CREEK STA. 42+00 TO STA. 50+00
10	C-107	RESTORATION PLAN - BUBBLY CREEK STA. 50+00 TO STA. 58+00
11	C-108	RESTORATION PLAN - BUBBLY CREEK STA. 58+00 TO STA. 66+00
12	C-109	RESTORATION PLAN - BUBBLY CREEK STA. 66+00 TO STA. 72+00
13	C-110	RESTORATION PLAN - BUBBLY CREEK STA. 72+00 TO STA. 76+23
14	C-111	RESTORATION PLAN - BUBBLY CREEK TURNING BASIN
15	C-301	RESTORATION CROSS-SECTIONS

GENERAL NOTES

1. ALL COORDINATES SHOWN ARE REFERENCED TO THE ILLINOIS STATE PLANE COORDINATE SYSTEM, EAST ZONE, NORTH AMERICAN DATUM (NAD) 1983 (U.S. FEET).
2. ALL ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 (U.S. FEET).
3. CONSTRUCTION AND RESTORATION ACTIVITIES SHALL BE PERFORMED BY WAY OF ACCESS FROM BUBBLY CREEK.
4. PLACEMENT OF THE SUBSTRATE RESTORATION SHALL BE DONE IN LIFTS AND NOT DUMPED FROM A SCOW OR DROPPED FROM A BUCKET.
5. CONTRACTOR SHALL INSTALL, INSPECT, AND MAINTAIN ALL ENVIRONMENTAL PROTECTION MEASURES INCLUDING BUT NOT LIMITED TO TURBIDITY CONTROL DEVICES.

ABBREVIATIONS

AC-FT	ACRE FEET
APPROX.	APPROXIMATELY
B/P	BOTTOM OF PIPE
BM	BENCH MARK
CB	CATCH BASIN
℄	CENTERLINE
COR	CONTRACTING OFFICER'S REPRESENTATIVE
COE	CORPS OF ENGINEERS
CMP	CORRUGATED METAL PIPE
DIA.	DIAMETER
D.I.P.	DUCTILE IRON PIPE
DWG.	DRAWING
E	EAST
ELEV	ELEVATION
EXIST.	EXISTING
FES	FLARED END SECTION
F&G	FRAME AND GRATE
FH	FIRE HYDRANT
H	HORIZONTAL
HWL	HIGH WATER ELEVATION
IE	INVERT ELEVATION
IN	INLET
LF	LINEAR FEET
MH	MANHOLE
MIN.	MINIMUM
N	NORTH
NAVD	NORTH AMERICAN VERTICAL DATUM
N.T.S.	NOT TO SCALE
NWL	NORMAL WATER ELEVATION
PROP.	PROPOSED
RCP	REINFORCED CONCRETE PIPE
S	SOUTH
SAN	SANITARY
SQ-FT	SQUARE FEET
ST	STORM
T/P	TOP OF PIPE
TYP	TYPICAL
VIF	VERIFY IN FIELD
W	WEST
W/	WITH
W/O	WITHOUT

HABITAT MEASURES

INVASIVE SPECIES REMOVAL	8.79 ACRES
RIPARIAN PLANTING	9.25 ACRES
EMERGENT PLANTING	1.0 ACRES
SUBMERGENT PLANTING	3.3 ACRES
WOODY DEBRIS	10 PILES
SUBSTRATE RESTORATION ROUND RIVER ROCK	21.0ACRES
SUBSTRATE RESTORATION QUARRIED STONE	9.7 ACRES
PEBBLE/COBBLE RESTORATION	0.25 ACRES

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MARK	DESCRIPTION	TRACKING NO.	ACTION	DATE

MARK	DESCRIPTION	TRACKING NO.	ACTION	DATE

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CHICAGO, ILLINOIS

DESIGNED BY: DGA
DWN BY: D.B.
CKD BY: CKB
SUBMITTED BY: JOHN A. GROBOSKI, P.E.
PLOT SCALE: AS SHOWN
PLOT DATE: 8/27/2014
SIZE: ANSI D
FILE NAME: BC00FPY12PS_G-002.dgn
DATE: AUGUST 2014
SOLICITATION NO.: SOL-08-B-NUMB
CONTRACT NO.: CON-08-B-NUMB
FILE NUMBER: BC00FPY12PS

SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

SHEET INDEX, GENERAL NOTES, AND ABBREVIATIONS

SHEET IDENTIFICATION
G-002
SHEET 02 OF 15

2 3 4

W. 35TH ST.
RACINE AVE.
LOOMIS ST.
W. 32ND PL.
W. 33RD ST.
THROOP ST.
W. 31TH ST.
LOCK ST.
BENSON ST.
S. PITNEY CT.
CHICAGO TRANSIT AUTHORITY & METRA RAIL LINES
I-55
ASHLAND AVE.
ARCHER AVE.
CHICAGO SUN-TIMES
RACINE AVENUE PUMPING STATION
C-101
C-102
C-103
C-104
C-105
C-106
C-107
C-108
C-109
10

ROUTE

LEGEND

- RIPARIAN PLANTING
- SUBSTRATE RESTORATION ROUND RIVER ROCK
- EMERGENT PLANTING
- SUBMERGENT PLANTING
- INVASIVE SPECIES REMOVAL
- WOODY DEBRIS
- EXISTING RIPRAP TO BE REMOVED

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.
2. DISPOSE OF RIPRAP TO AN APPROVED DISPOSAL SITE.

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SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK STA. 0+00 TO STA. 10+00

SHEET IDENTIFICATION
C-101

LEGEND

- RIPARIAN PLANTING
- EMERGENT PLANTING
- SUBMERGENT PLANTING
- INVASIVE SPECIES REMOVAL
- WOODY DEBRIS
- SUBSTRATE RESTORATION ROUND RIVER ROCK

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.

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SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK STA. 10+00 TO STA. 18+00

SHEET IDENTIFICATION
C-102
SHEET 05 OF 15

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.
2. DISPOSE OF RIPRAP TO AN APPROVED DISPOSAL SITE.

LEGEND

- RIPARIAN PLANTING
- SUBMERGENT PLANTING
- INVASIVE SPECIES REMOVAL
- SUBSTRATE RESTORATION ROUND RIVER ROCK
- EXISTING RIPRAP TO BE REMOVED

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SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK STA. 18+00 TO STA. 26+00

SHEET IDENTIFICATION
C-103
SHEET 06 OF 15

NOTES

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.

LEGEND

- RIPARIAN PLANTING
- EMERGENT PLANTING
- SUBMERGENT PLANTING
- INVASIVE SPECIES REMOVAL
- WOODY DEBRIS
- SUBSTRATE RESTORATION ROUND RIVER ROCK

SCALE: 1" = 30'

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SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK STA. 26+00 TO STA. 34+00

SHEET IDENTIFICATION
C-104
SHEET 07 OF 15

LEGEND

- RIPARIAN PLANTING
- EMERGENT PLANTING
- SUBMERGENT PLANTING
- INVASIVE SPECIES REMOVAL
- WOODY DEBRIS
- SUBSTRATE RESTORATION ROUND RIVER ROCK
- SUBSTRATE RESTORATION QUARRIED STONE

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.

SCALE: 1" = 30'

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SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK STA. 34+00 TO STA. 42+00

SHEET IDENTIFICATION
C-105
SHEET 08 OF 15

01 FOR RESTORATION CROSS-SECTIONS.

LEGEND

RIPARIAN PLANTING

INVASIVE SPECIES REMOVAL

WOODY DEBRIS

SUBSTRATE RESTORATION
QUARRIED STONE

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.

LEGEND

- RIPARIAN PLANTING
- INVASIVE SPECIES REMOVAL
- SUBSTRATE RESTORATION QUARRIED STONE

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SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK STA. 50+00 TO STA. 58+00

SHEET IDENTIFICATION
C-107
SHEET 10 OF 15

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.
2. DISPOSE OF RIPRAP TO AN APPROVED DISPOSAL SITE.

LEGEND

- RIPARIAN PLANTING
- INVASIVE SPECIES REMOVAL
- WOODY DEBRIS
- SUBSTRATE RESTORATION QUARRIED STONE
- EXISTING RIPRAP TO BE REMOVED

SCALE: 1" = 30'

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DESIGNED BY
DRAWN BY
CHKD BY
SUBMITTED BY
PLOT SCALE
PLOT DATE
FILE NUMBER
SIZE
D

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CHICAGO DISTRICT
CHICAGO, ILLINOIS

SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK STA. 58+00 TO STA. 66+00

SHEET IDENTIFICATION
C-108
SHEET 11 OF 15

MATCHLINE SHEET C-110 @ STA. 72+00

MATCHLINE SHEET C-108 @ STA. 66+00

LEGEND

- RIPARIAN PLANTING
- SUBMERGENT PLANTING
- INVASIVE SPECIES REMOVAL
- SUBSTRATE RESTORATION ROUND RIVER ROCK
- EXISTING RIPRAP TO BE REMOVED
- SUBSTRATE RESTORATION QUARRIED STONE

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.
2. DISPOSE OF RIPRAP TO AN APPROVED DISPOSAL SITE.

SCALE: 1" = 30'

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SOUTH FORK SOUTH BRANCH CHICAGO RIVER BUBBLY CREEK - SECTION 206 CHICAGO, ILLINOIS

RESTORATION PLAN BUBBLY CREEK STA. 66+00 TO 72+00

SHEET IDENTIFICATION C-109

SHEET 12

MATCHLINE SHEET C-109 @ STA. 72+00

LEGEND

- RIPARIAN PLANTING
- SUBMERGENT PLANTING
- INVASIVE SPECIES REMOVAL
- SUBSTRATE RESTORATION ROUND RIVER ROCK
- SUBSTRATE RESTORATION QUARRIED STONE

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.

SCALE: 1" = 30'

US Army Corps of Engineers Chicago District

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SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK STA. 72+00 TO 76+23

SHEET IDENTIFICATION
C-110
SHEET 13 OF 15

NOTES:

1. SEE SHEET C-301 FOR RESTORATION CROSS-SECTIONS.

LEGEND

- RIPARIAN PLANTING
- SUBMERGENT PLANTING
- INVASIVE SPECIES REMOVAL
- SUBSTRATE RESTORATION ROUND RIVER ROCK
- SUBSTRATE RESTORATION QUARRIED STONE

SCALE 1" = 30'

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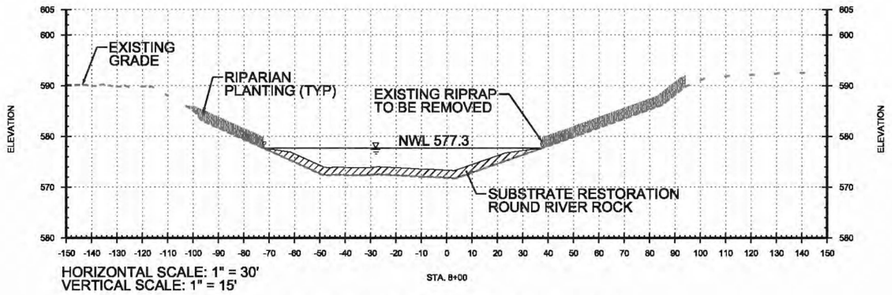
CHICAGO DISTRICT
CHICAGO, ILLINOIS

DESIGNED BY DGA		DATE AUGUST 2014
DWN BY DB	CKD BY CKB	SOLICITATION NO
SUBMITTED BY JOHN A. GROBOSKI, P.E.		CONTRACT NO
PLOT SCALE	PLOT DATE	FILE NUMBER
SIZE	FILE NAME	

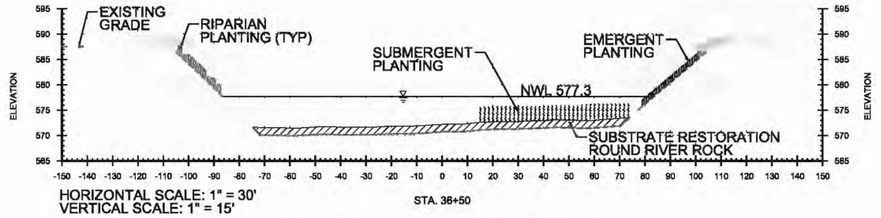
SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION PLAN
BUBBLY CREEK TURNING BASIN

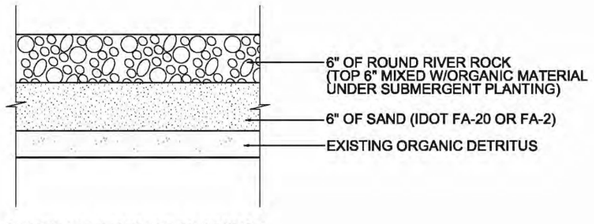
SHEET IDENTIFICATION
C-111
SHEET 14 OF 15



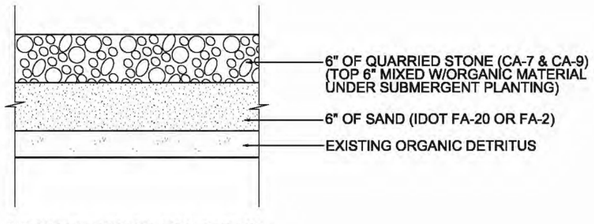
RESTORATION CROSS-SECTION AT STATION 8+00



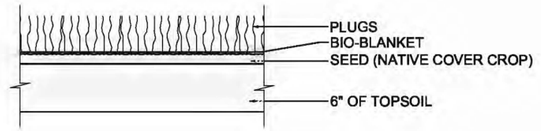
RESTORATION CROSS-SECTION AT STATION 36+50



SUBSTRATE RESTORATION SECTION
ROUND RIVER ROCK



SUBSTRATE RESTORATION SECTION
QUARRIED STONE



RIPARIAN HABITAT PLANTING SECTION

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Chicago District

MARK	DESCRIPTION	TRACKING NO	ACTION	DATE

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U.S. ARMY CORPS OF ENGINEERS
CHICAGO DISTRICT
CHICAGO, ILLINOIS

DESIGNED BY: DMA		DATE: AUGUST 2014	
DRAWN BY: DB	CKD BY: CKB	SOLICITATION NO.: SOL-08-B-NUMB	
SUBMITTED BY: JOHN A. GROSCOSKI, P.E.		CONTRACT NO.: CON-08-B-NUMB	
PLOT SCALE: AS SHOWN	PLOT DATE: 8/27/2014	FILE NUMBER: BC08PPY12PS	
SIZE: ANSI D	FILE NAME: BC08PPY12PS_C-301XS.dgn		

SOUTH FORK SOUTH BRANCH CHICAGO RIVER
BUBBLY CREEK - SECTION 206
CHICAGO, ILLINOIS

RESTORATION CROSS-SECTIONS

SHEET IDENTIFICATION
C-301
SHEET 15 OF 15