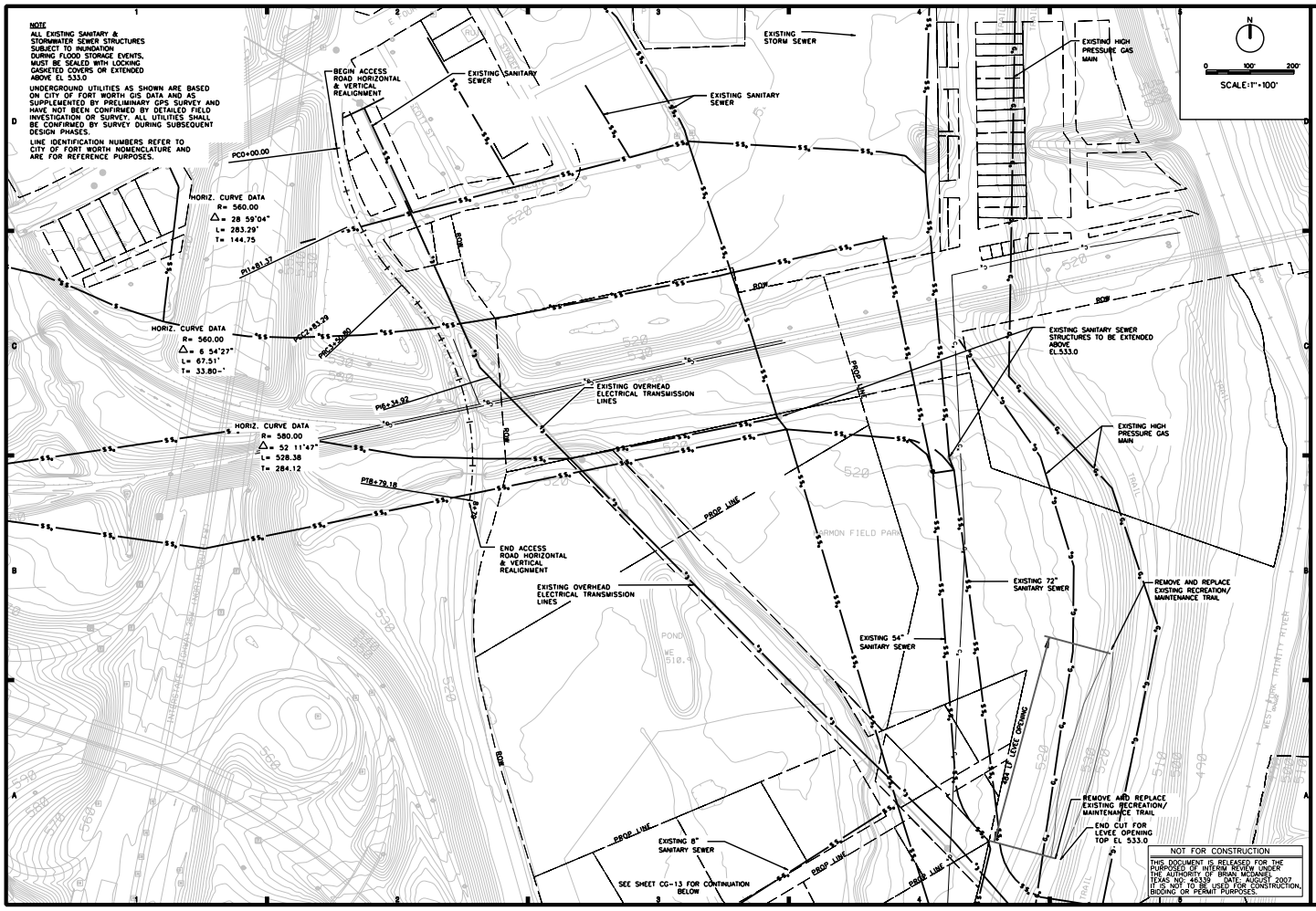

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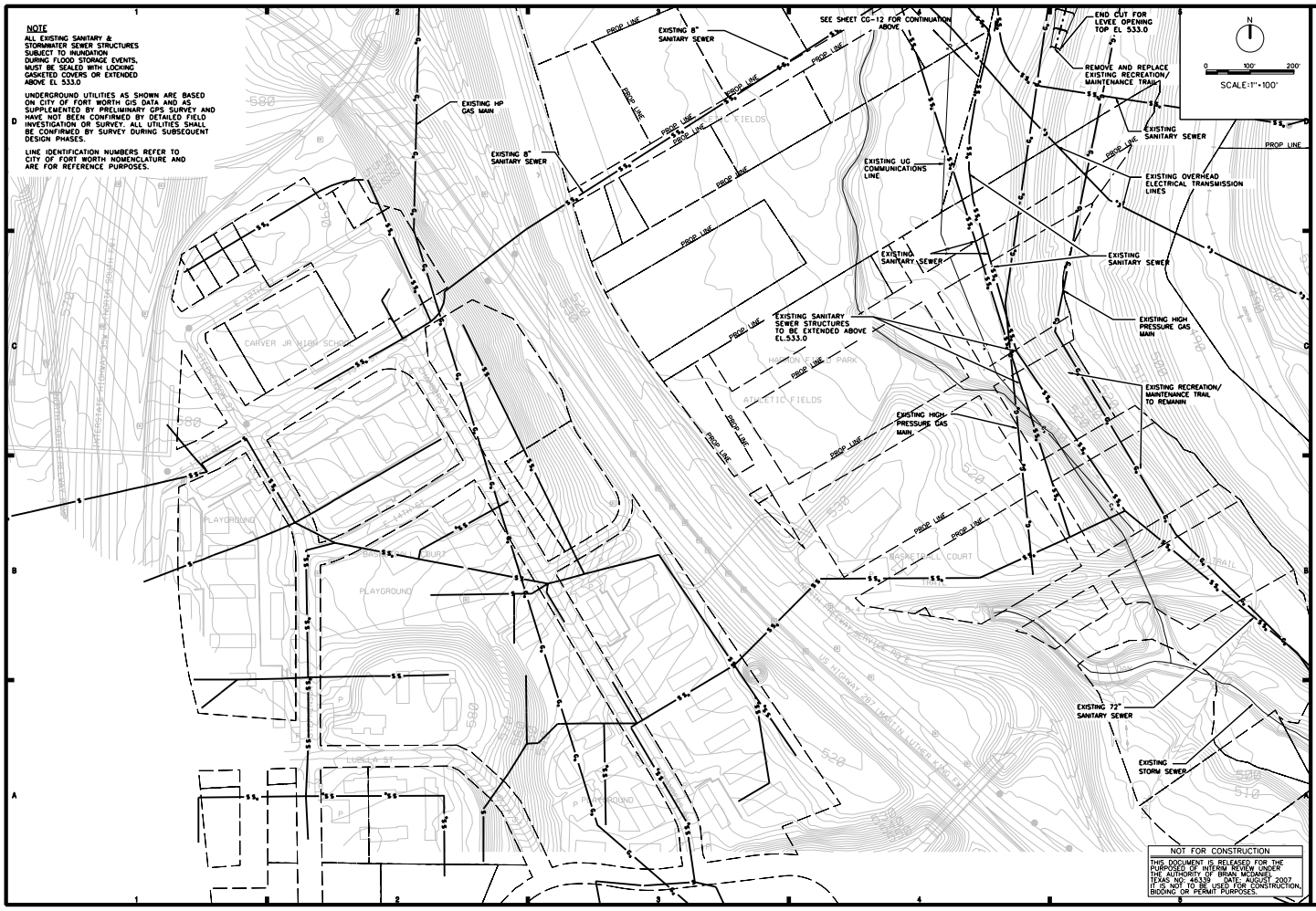

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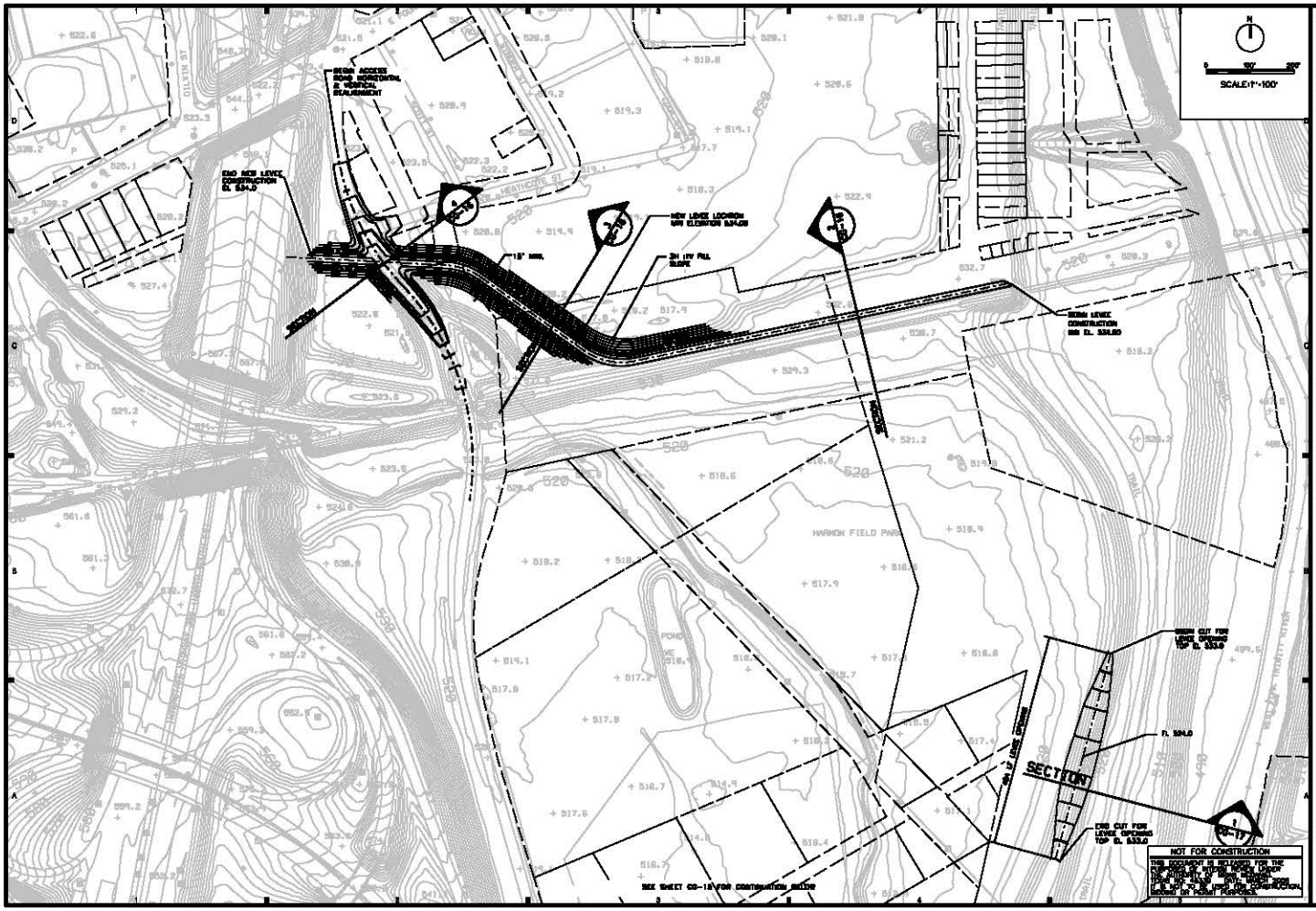
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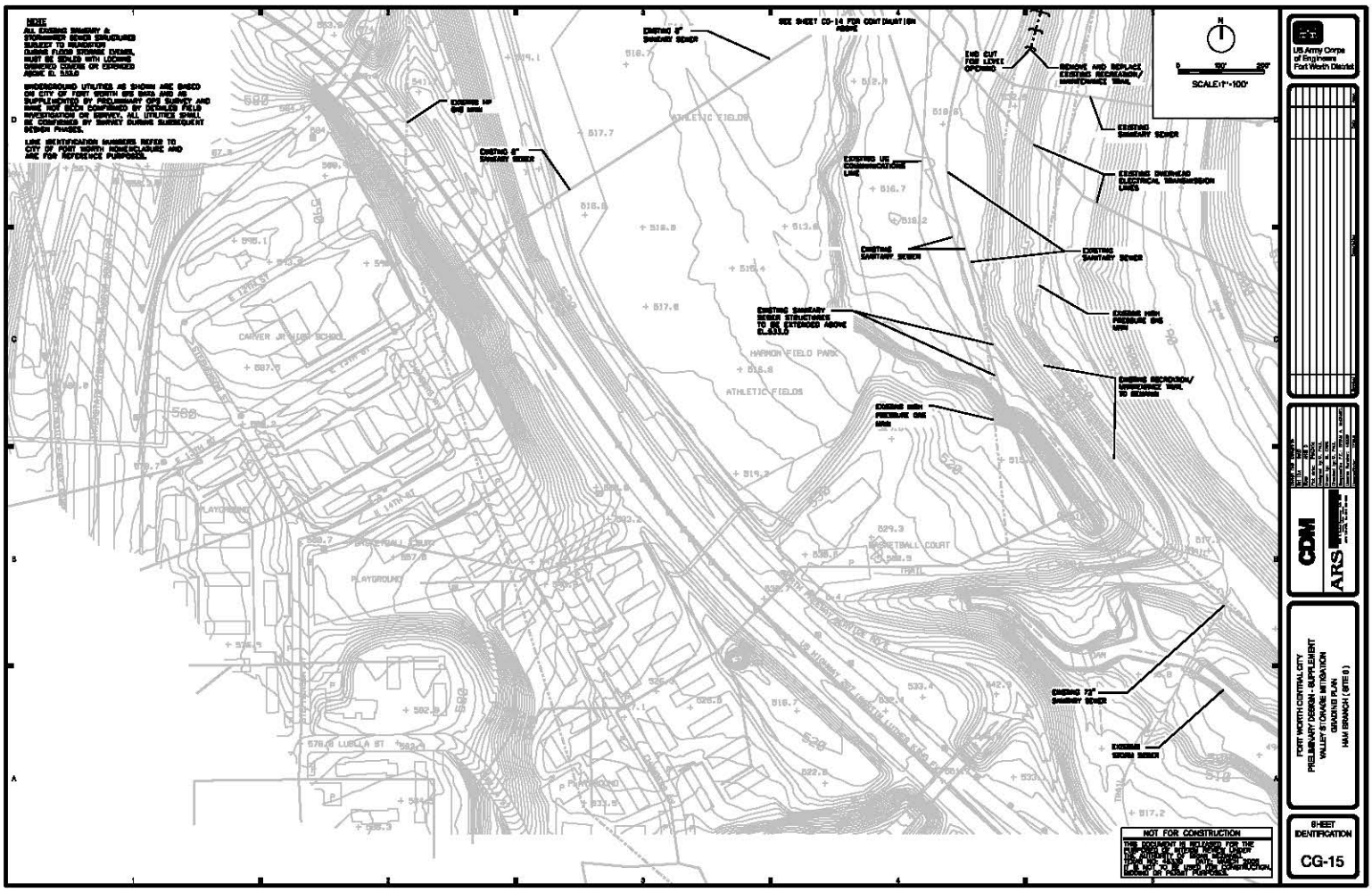
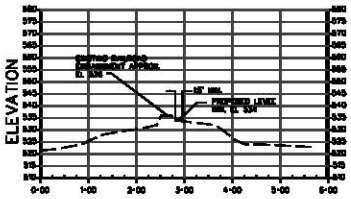
US Army Corps of Engineers Fort Worth District
CDM
ARS
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
GRADING PLAN
HAM BRANCH
SHEET IDENTIFICATION
CG-14
NOT FOR CONSTRUCTION
SECTION
HARMON FIELD PARK
SEE SHEET CG-15 FOR CONTINUATION BELOW


NOTE
ALL EXISTING SANITARY & STORMWATER SEWER STRUCTURES SUBJECT TO REMOVAL DURING FUTURE STORMWATER EVENTS, MUST BE SEALED WITH LOCKING DIRECTED COVERS OR CENTERED ABOVE EL 533.0
UNDERGROUND UTILITIES AS SHOWN ARE BASED ON CITY OF FORT WORTH GIS DATA AND AS SUPPLEMENTED BY PRELIMINARY GPS SURVEY, AND HAVE NOT BEEN CONFIRMED BY DETAILED FIELD INVESTIGATION OR SURVEY. ALL UTILITIES SHALL BE CONFIRMED BY SURVEY DURING SUBSEQUENT DESIGN PHASES.
LINE INVENTORIES MARKERS REFER TO CITY OF FORT WORTH NOMENCLATURE AND ARE FOR REFERENCE PURPOSES.
SEE SHEET CG-14 FOR CONTINUATION HERE
EXISTING 8" SANITARY SEWER
EXISTING 54" GAS MAIN
EXISTING 8" SANITARY SEWER
ATHLETIC FIELDS
EXISTING UTILITY COMMUNICATIONS LINE
EXISTING SANITARY SEWER
EXISTING SANITARY SEWER STRUCTURES TO BE EXTENDED ABOVE EL.533.0
HARMON FIELD PARK
ATHLETIC FIELDS
EXISTING HIGH PRESSURE GAS MAIN
CARVER JR HIGH SCHOOL
PLAYGROUND
BASKETBALL COURT
PLAYGROUND
BASKETBALL COURT
TRAIL
LUBBOCK ST
TRAIL
TWO CUT FOR LEVEE OPENING
REMOVE AND REPLACE EXISTING RECREATION/ MAINTENANCE TRAIL
EXISTING SANITARY SEWER
EXISTING OVERHEAD ELECTRICAL TRANSMISSION LINES
EXISTING SANITARY SEWER
EXISTING HIGH PRESSURE GAS MAIN
EXISTING RECREATION/ MAINTENANCE TRAIL TO REMAIN
EXISTING 72" SANITARY SEWER
EXISTING STORM SEWER
N
0 50' 200'
SCALE:1"=100'
NOT FOR CONSTRUCTION
THIS DOCUMENT IS RELEASED FOR THE PURPOSES OF REVIEW, MEETING, BIDDING OR ESTIMATING. IT WAS RELEASED ON [illegible] BY [illegible] UNDER THE AUTHORITY OF [illegible]. IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.
US Army Corps of Engineers Fort Worth District
CDM
ARS
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
GRADING PLAN
HAM BRANCH (SITE 6)
SHEET IDENTIFICATION
CG-15



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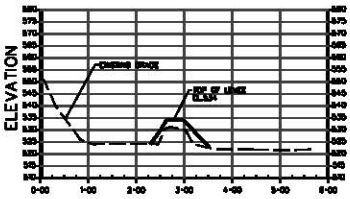

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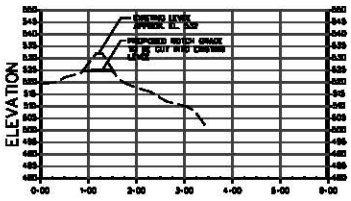
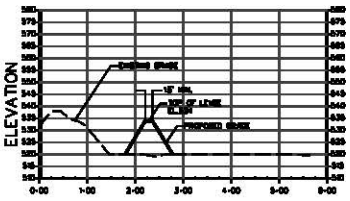


SECTION 1



SECTION 3

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US Army Corps of Engineers Fort Worth District

CDM

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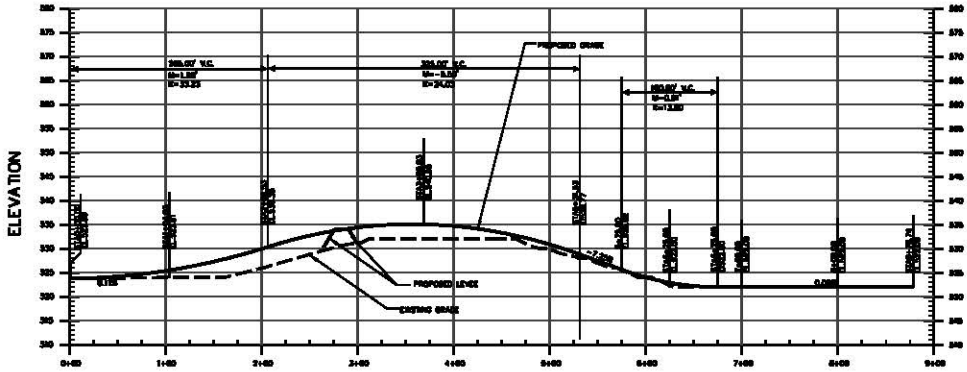
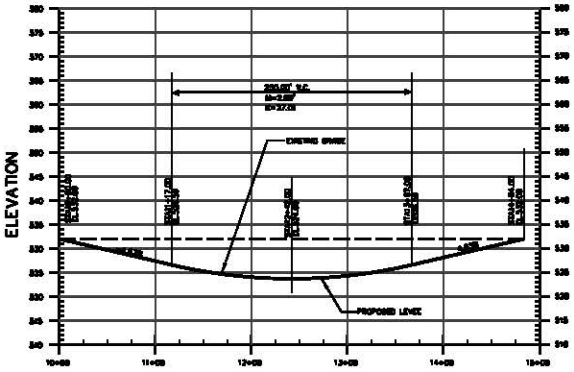
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
CROSS SECTIONS
HAM BRANCH (SITE 6)

SHEET IDENTIFICATION

CG-16



PROFILE NORTH FREEWAY SERVICE ROAD



PROFILE LEVEE OPENING

NOT FOR CONSTRUCTION

US Army Corps of Engineers Fort Worth District

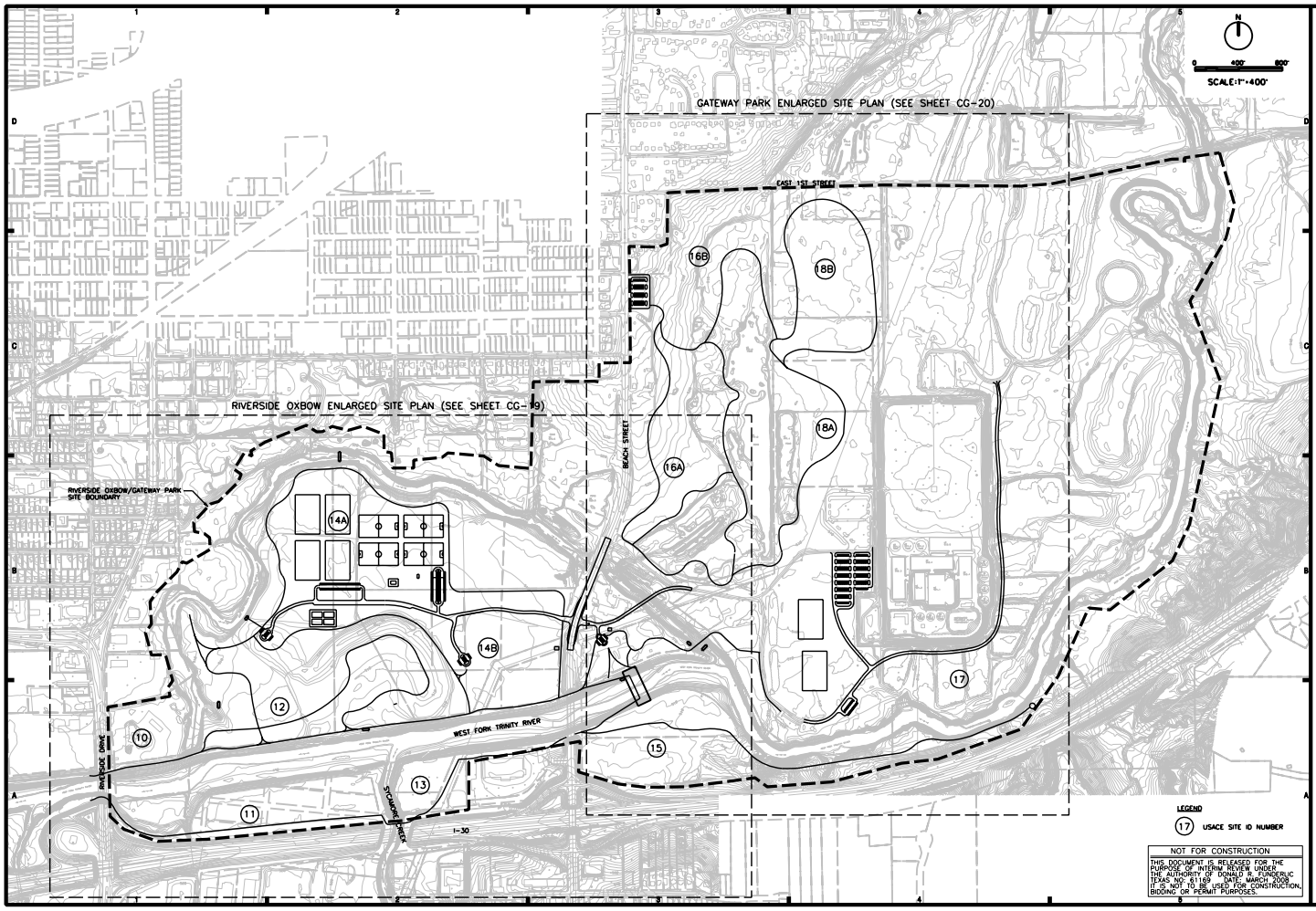
CDM

ARS

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
PROFILE
HAM BRANCH (SITE 6)

SHEET IDENTIFICATION

CG-17



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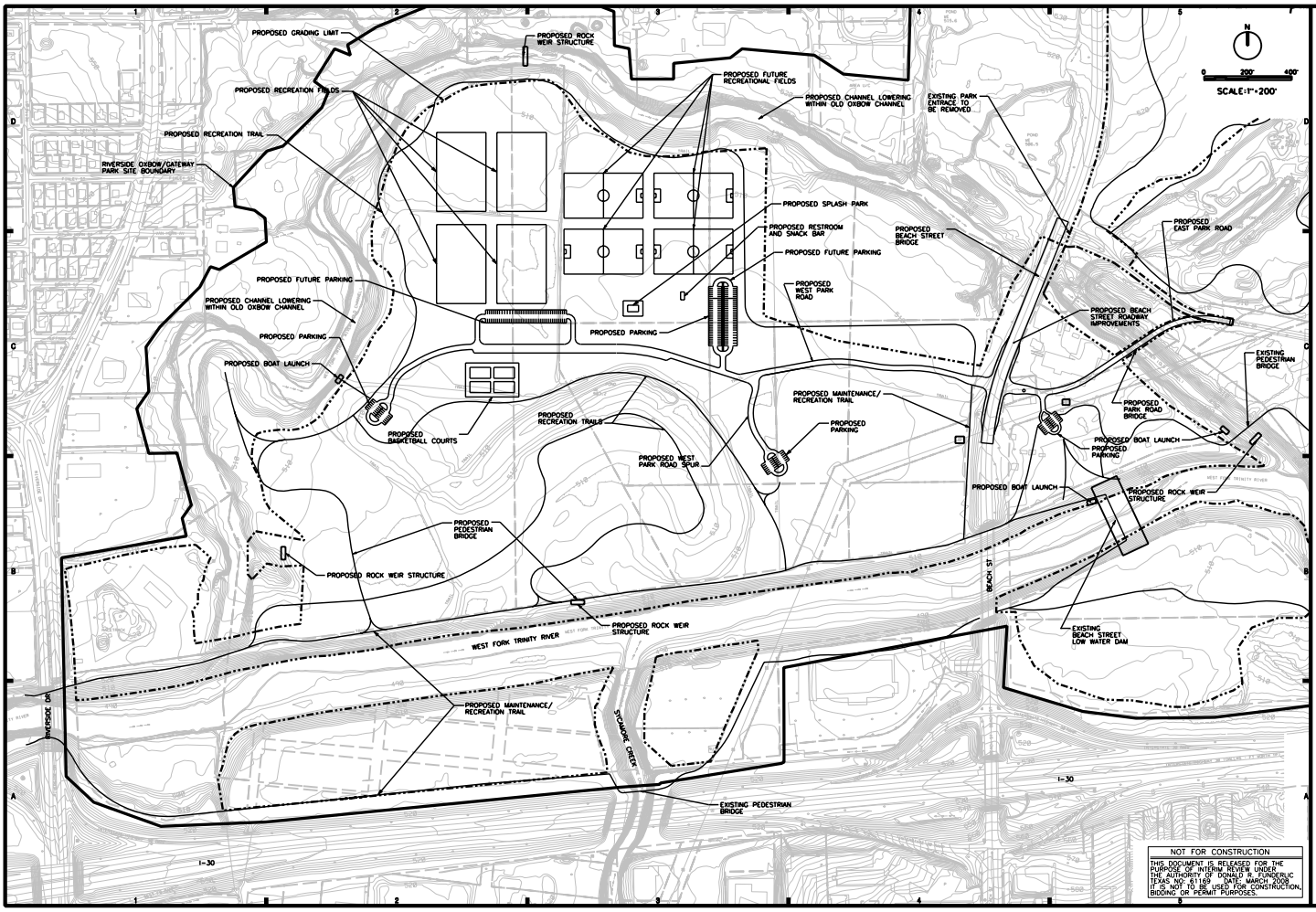

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US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
RIVERSIDE OXBOW ENLARGED PLAN
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION

CG-19

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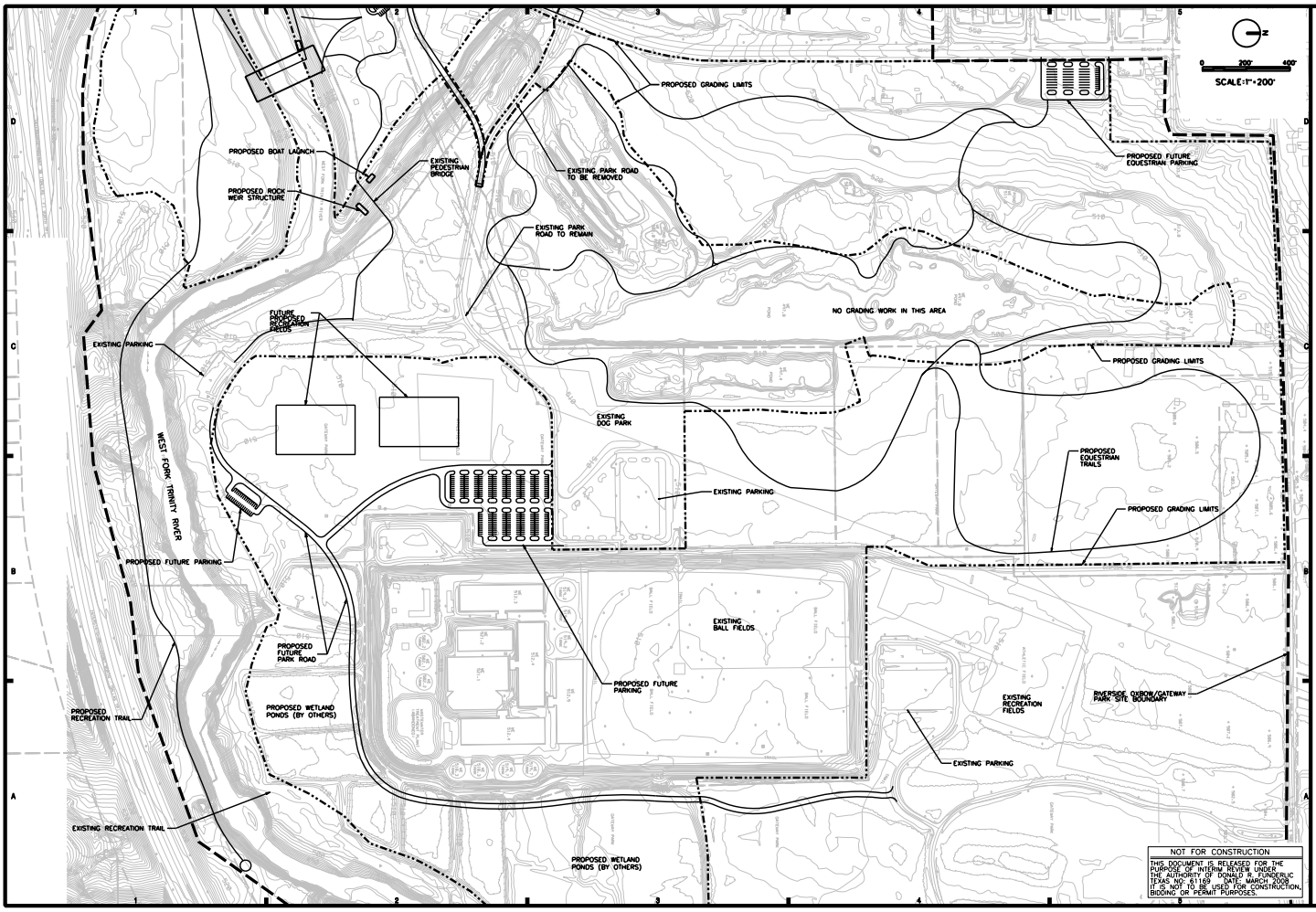

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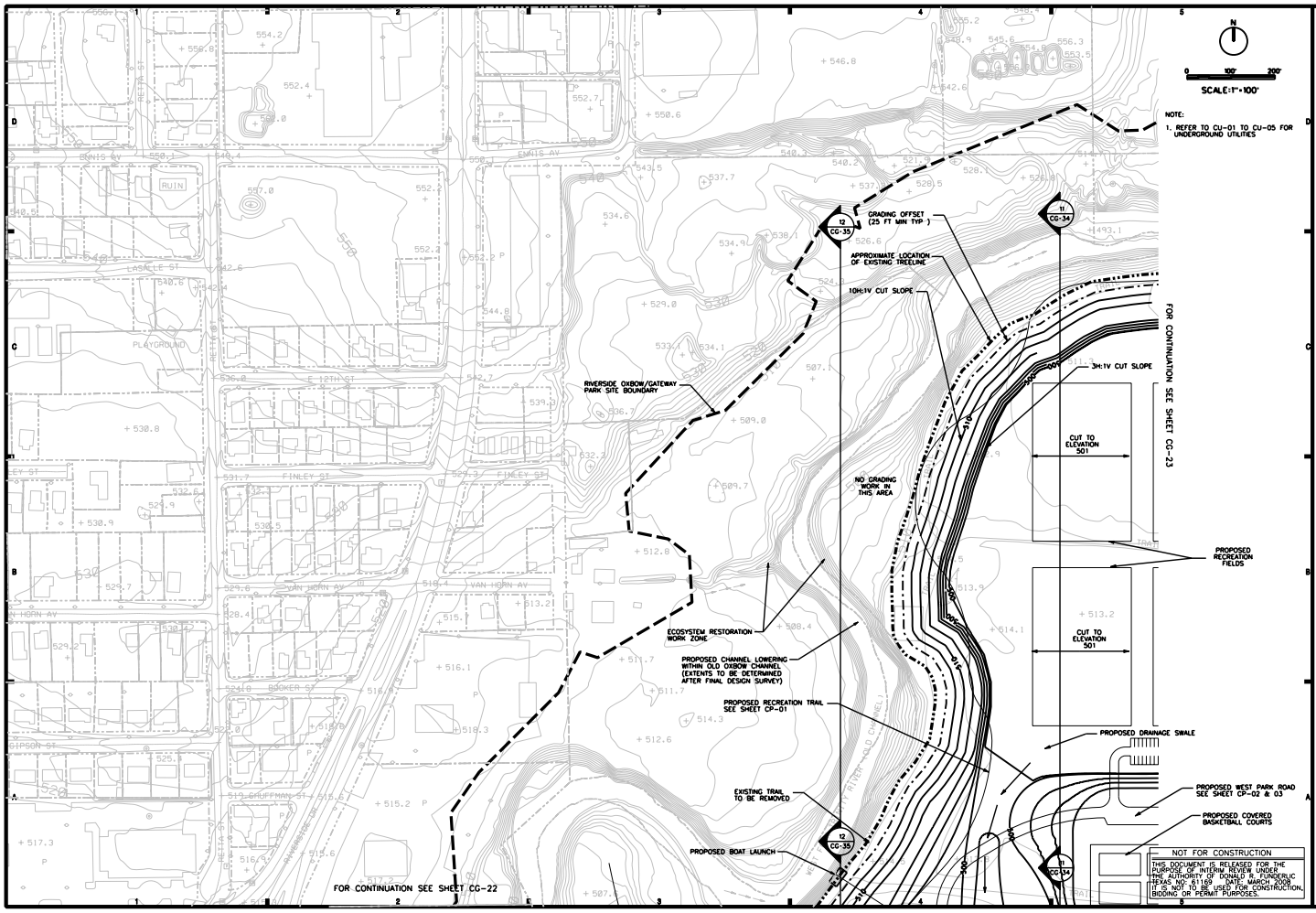

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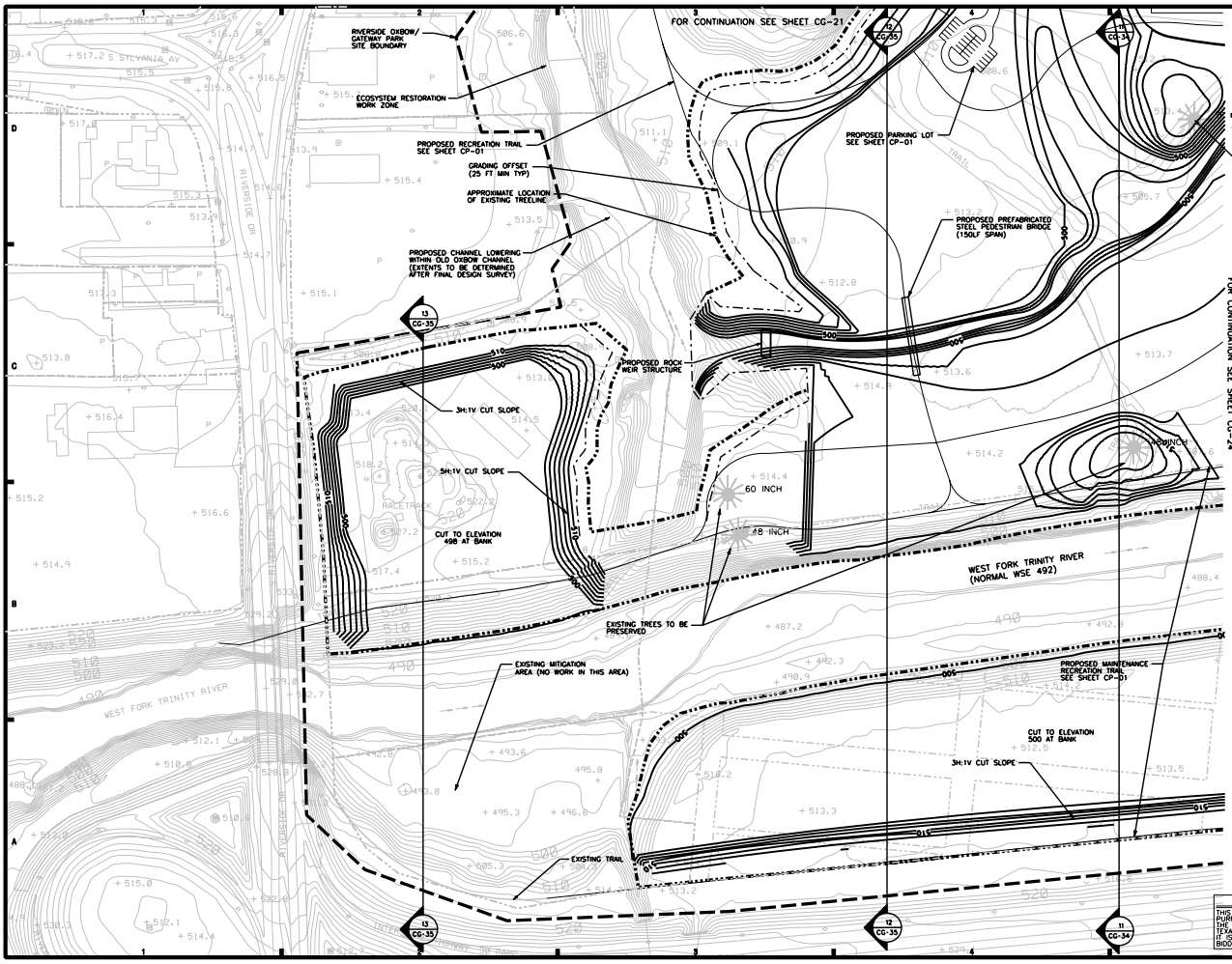

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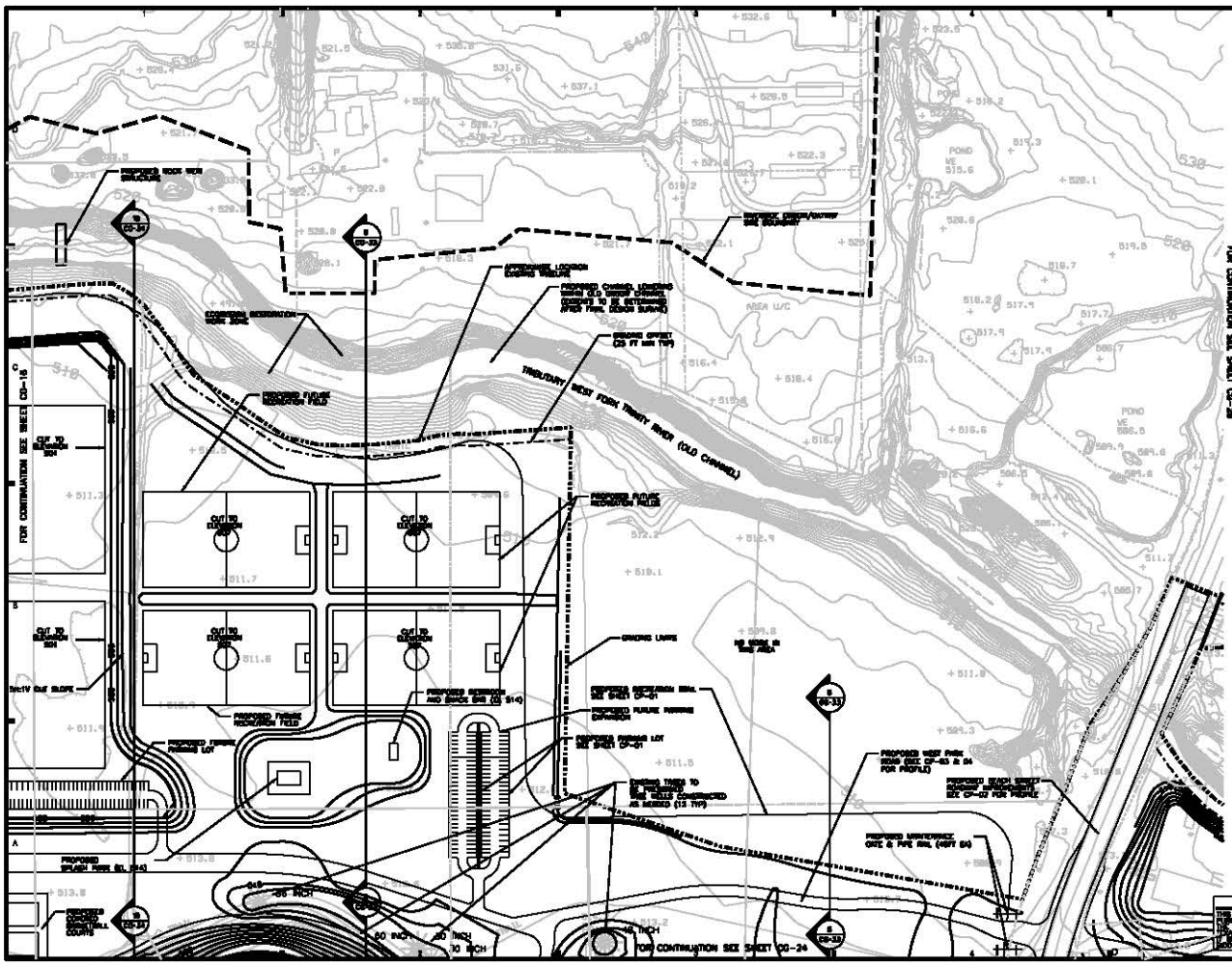
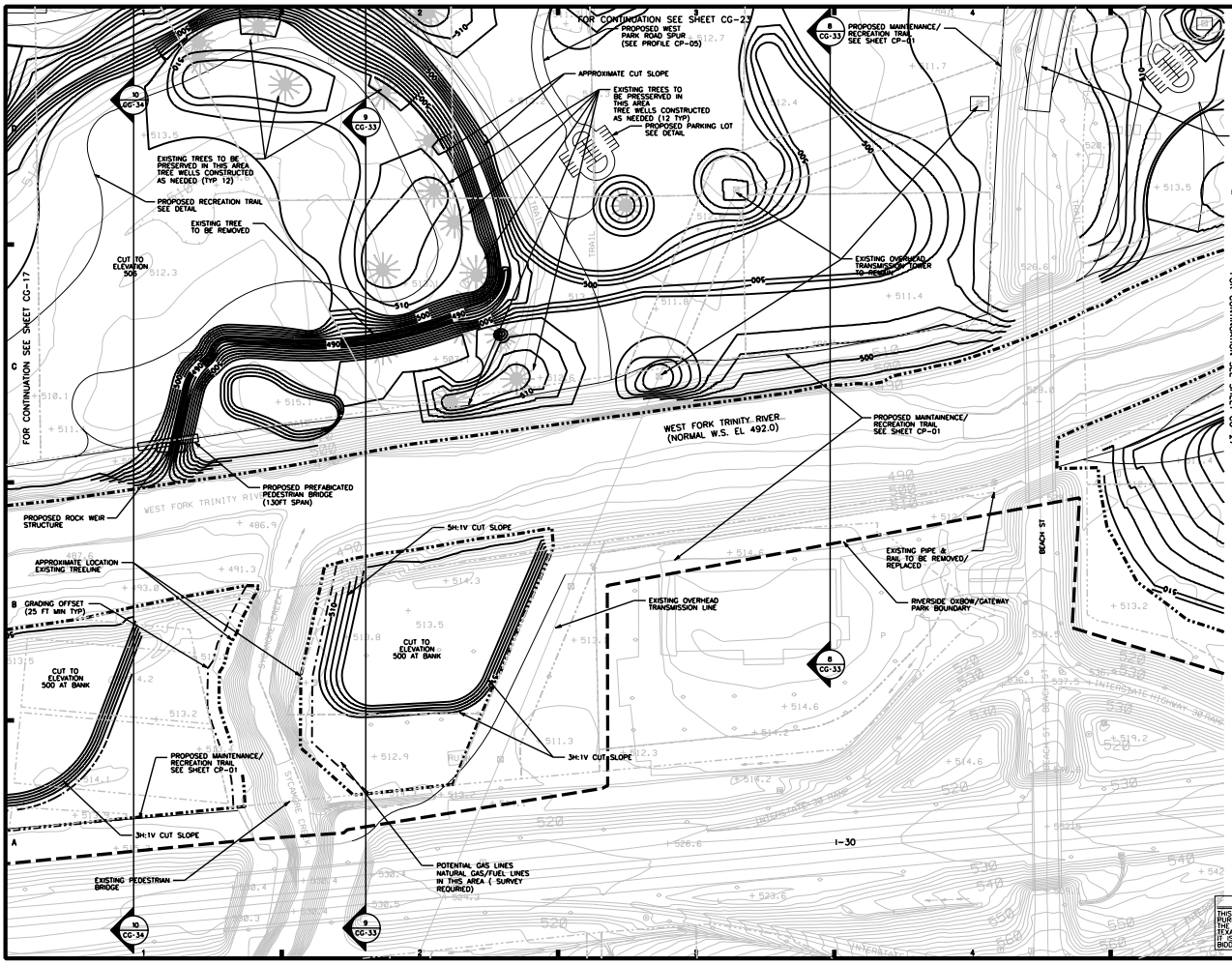

TRIBUTARY WEST FORK TRINITY RIVER (OLD CHANNEL)
FOR CONTINUATION SEE SHEET CG-16
FOR CONTINUATION SEE SHEET CG-24
FOR CONTINUATION SEE SHEET CG-26
POND VE 515.6
POND VE 586.5
AREA U/C
CUT TO ELEVATION 504
CUT TO ELEVATION 506
CUT TO ELEVATION 508
CUT TO ELEVATION 510
PROPOSED FUTURE RECREATION FIELD
PROPOSED FUTURE PARKING EXPANSION
PROPOSED PARKING AND BARCK BAR (CG 514)
PROPOSED SPLASH PARK (CG 514)
PROPOSED CONCRETE SOFTBALL COURTS
PROPOSED WEST PARK BRIDGE (SEE CP-43 & 54 FOR PROFILE)
PROPOSED MINIATURE GATE & PIPE RAIL (VERY BA)
CG-30
CG-31
CG-32
CG-33
CG-34
CG-35
NOT FOR CONSTRUCTION
US Army Corps of Engineers Fort Worth District
CDM
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
GRADING PLAN
(GATEWAY-CRESCIM SITE
SHEET IDENTIFICATION
CG-23



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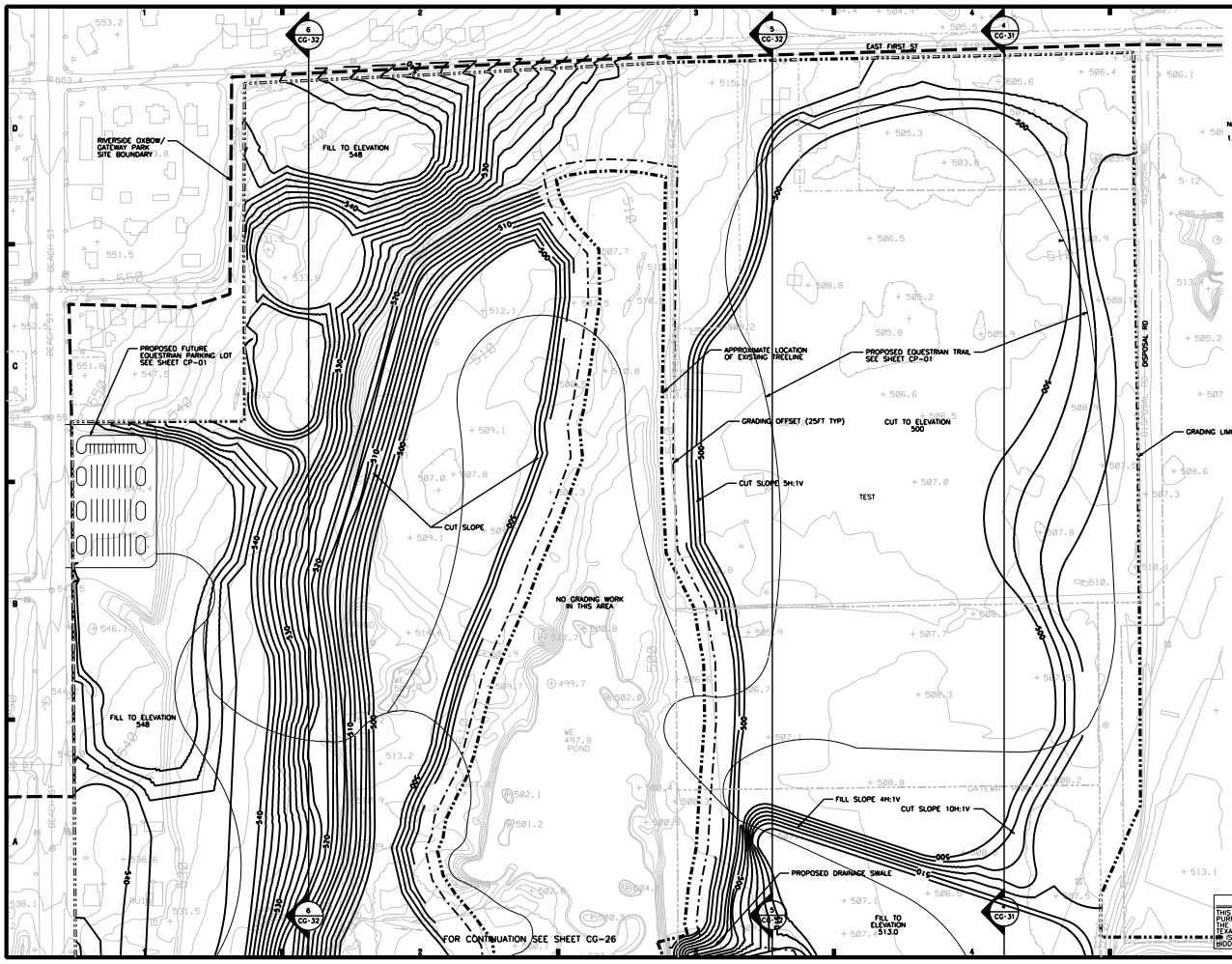

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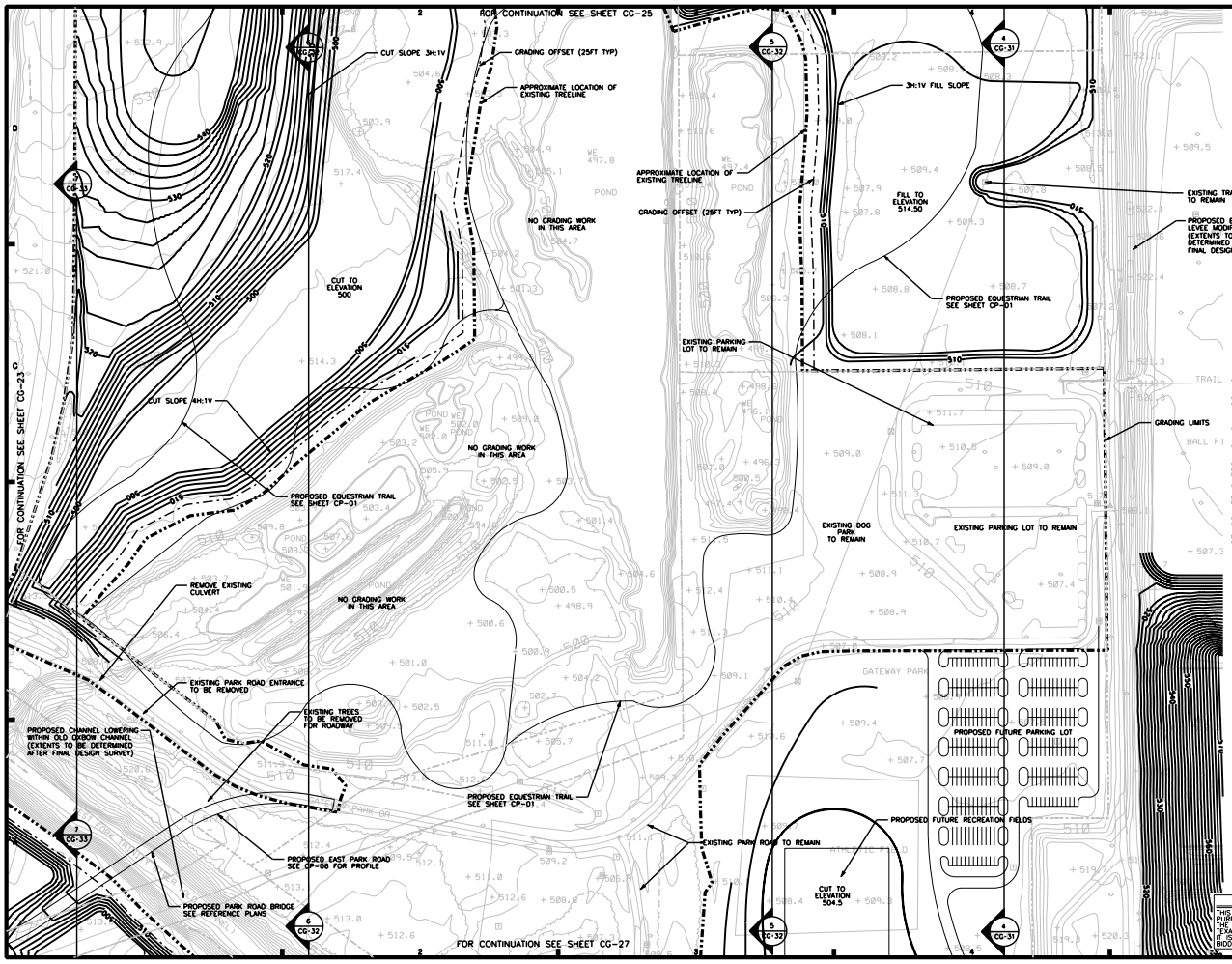

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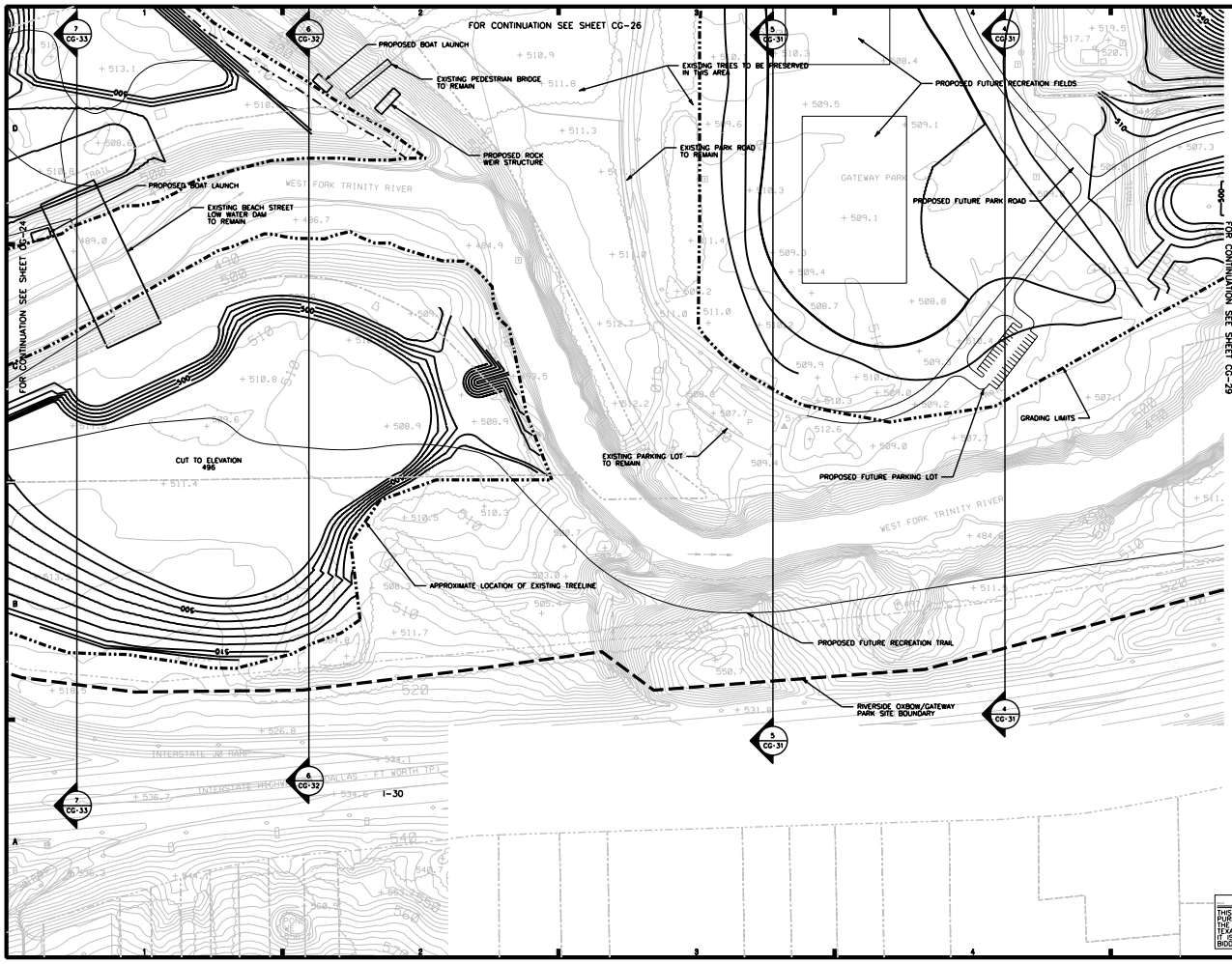

NOTE:

1. REFER TO CU-01 TO CU-05 FOR UNDERGROUND UTILITIES

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US Army Corps of Engineers Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
GRADING PLAN
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION

CG-27

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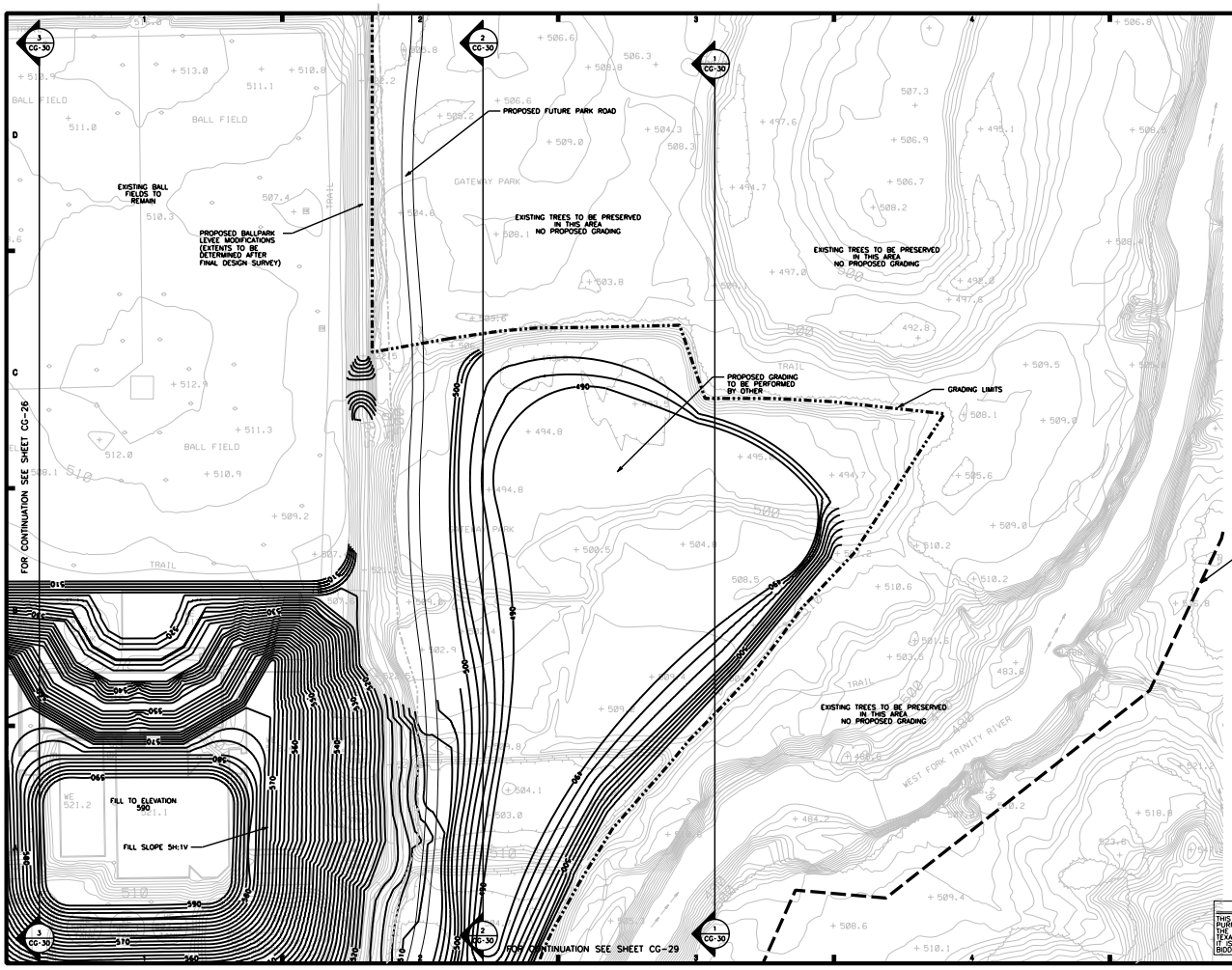

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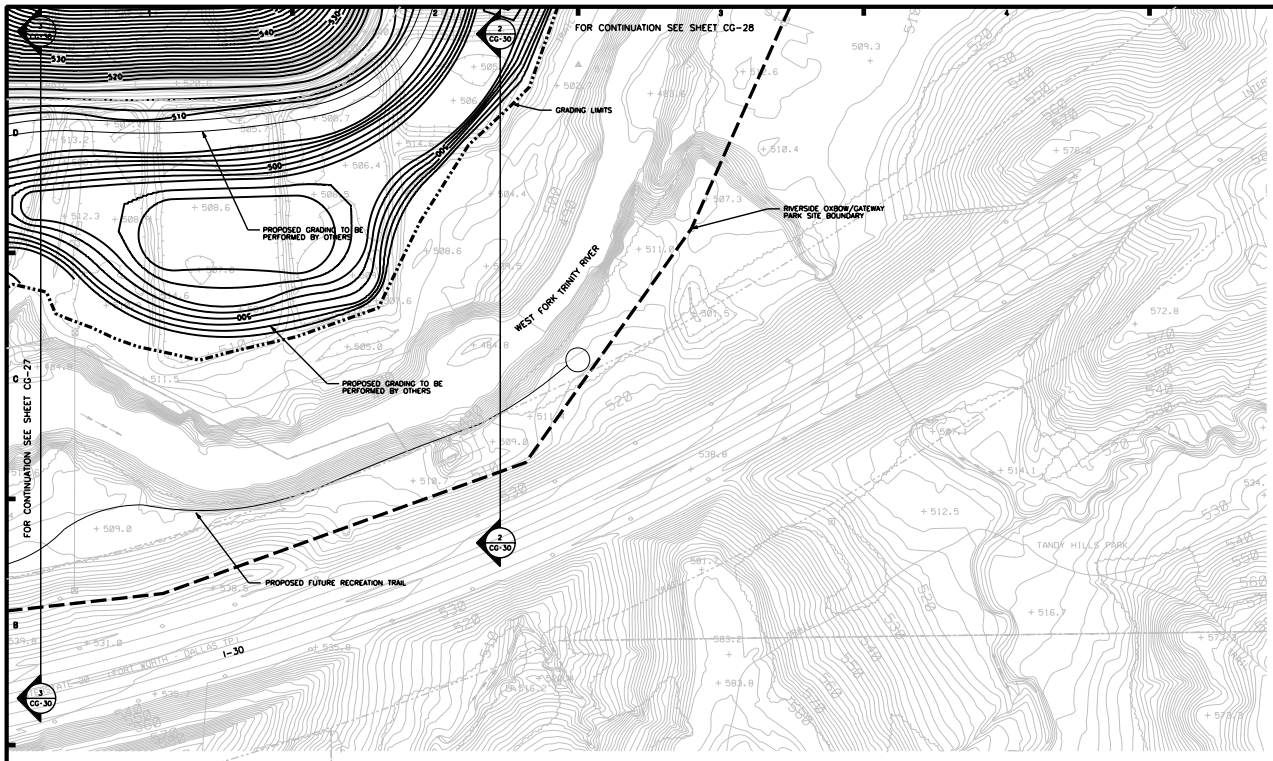

N

0 100' 200'

SCALE: 1" = 100'

NOTE:

1. REFER TO CU-01 TO CU-05 FOR UNDERGROUND UTILITIES

US Army Corps of Engineers
Fort Worth District

No.	Date	Revision

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
GRADING PLAN
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION

CG-29

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SCALE:
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VERT: 1" = 20'

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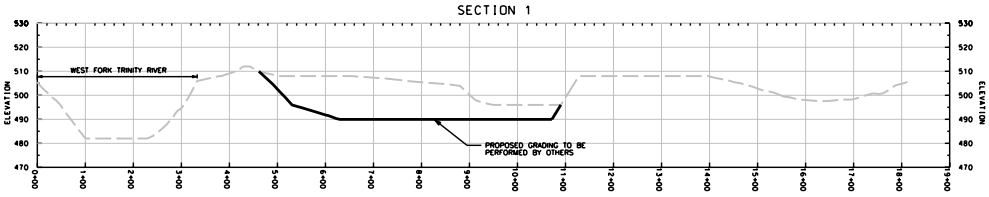

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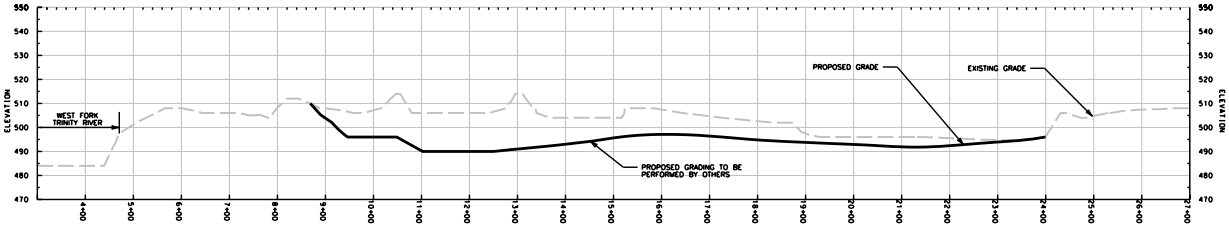

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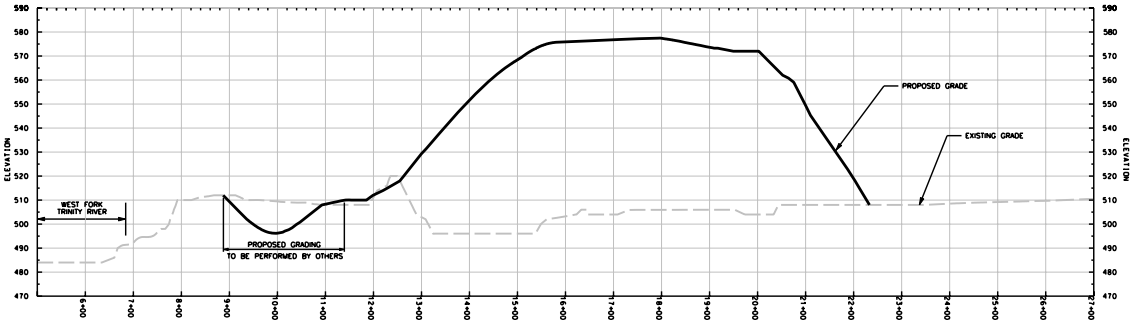

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US Army Corps of Engineers
Fort Worth District

No.	Date	Revision	By

CDM

Date: 03-06-2008
Sca. D.: Scale
Dwg. No.: 330xx34
Rev. date: mar.8 2007
Drawn by: M. Gallegos
Reviewed by: M. Gallegos
Checked by: D. Funderlic
Approved by: D. Funderlic
Contract No.: W912EP-07-D-0004
Design Agency: CDM
Construction Agency: Fort Worth District

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
CROSS-SECTIONS
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION
CG-30

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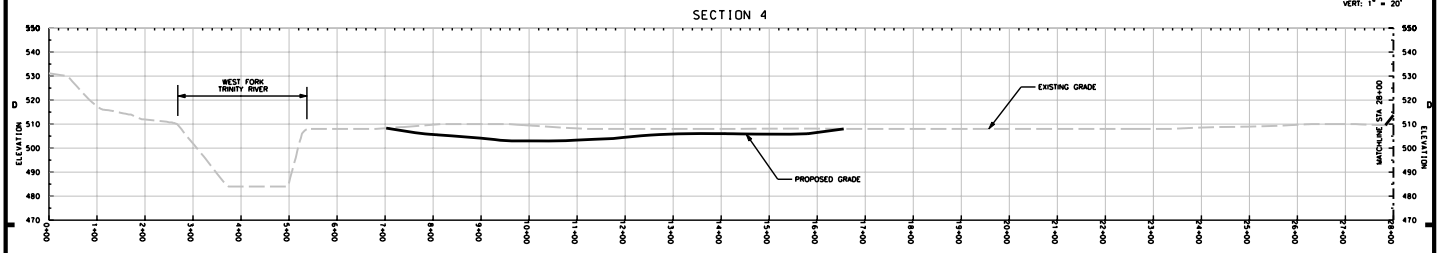
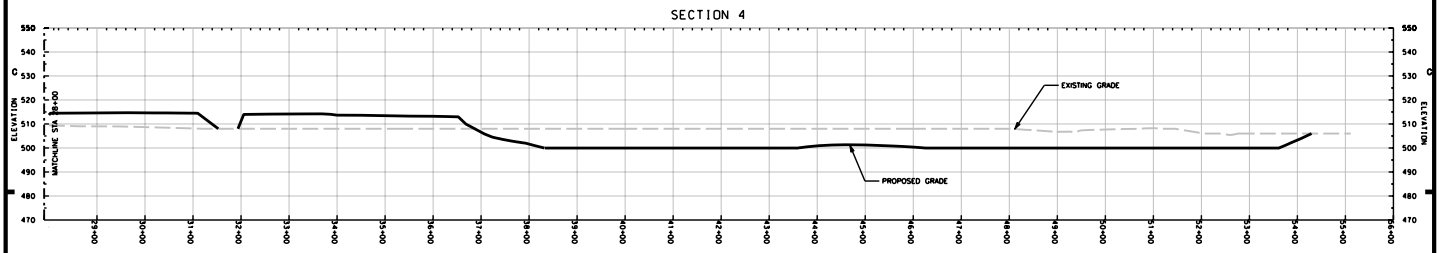
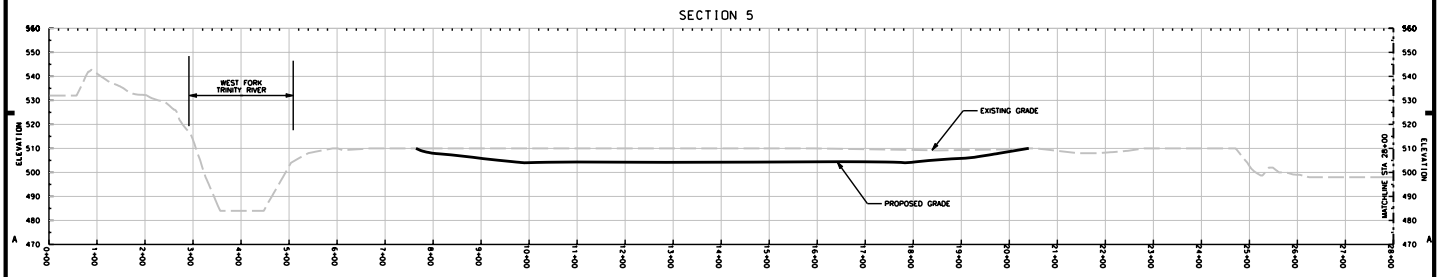
VERT: 1" = 20'







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US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
CROSS SECTIONS
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION

CG-31

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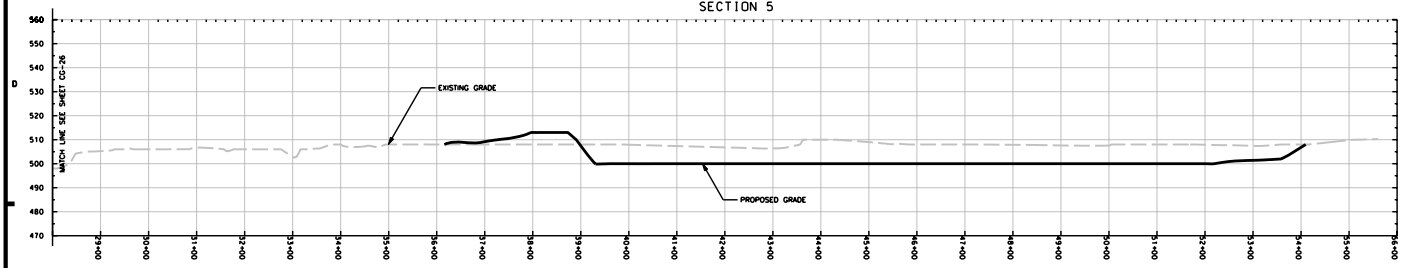

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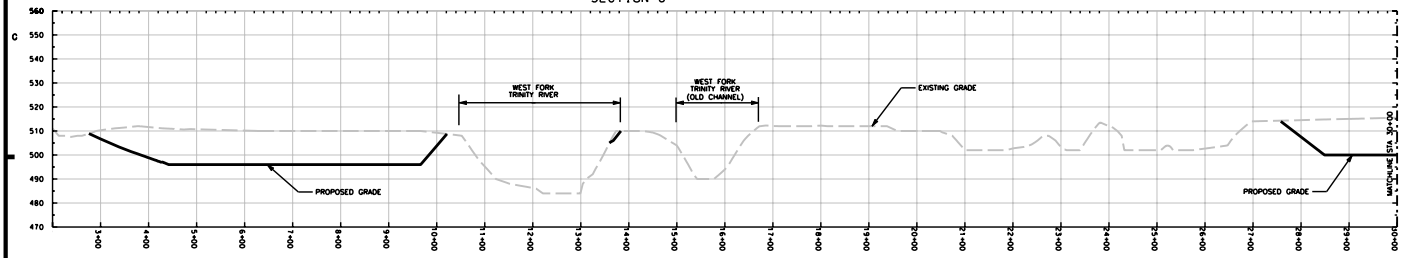

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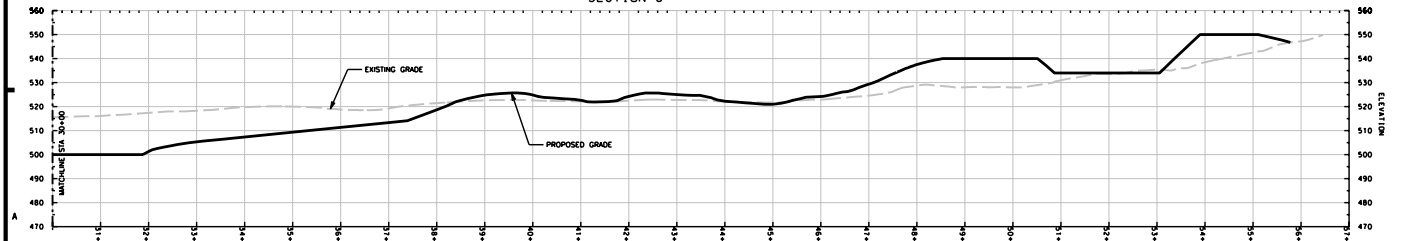

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US Army Corps of Engineers
Fort Worth District

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FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
CROSS SECTIONS
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION

CG-32

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SCALE:
HORIZ: 1" = 100'
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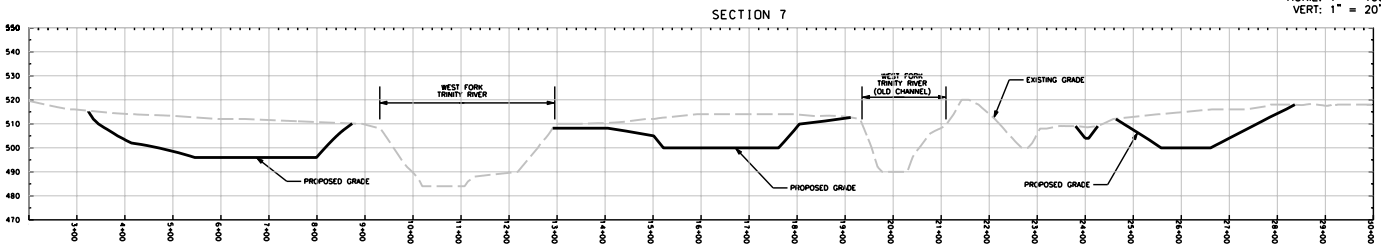
SECTION 7



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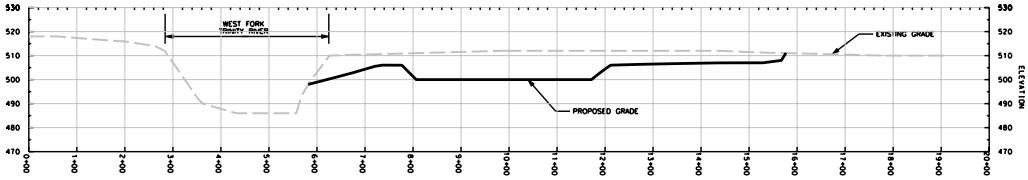

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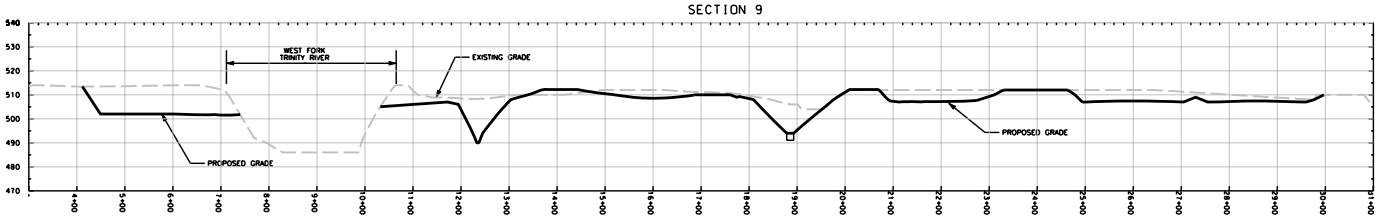

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US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
CROSS SECTIONS
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION
CG-33

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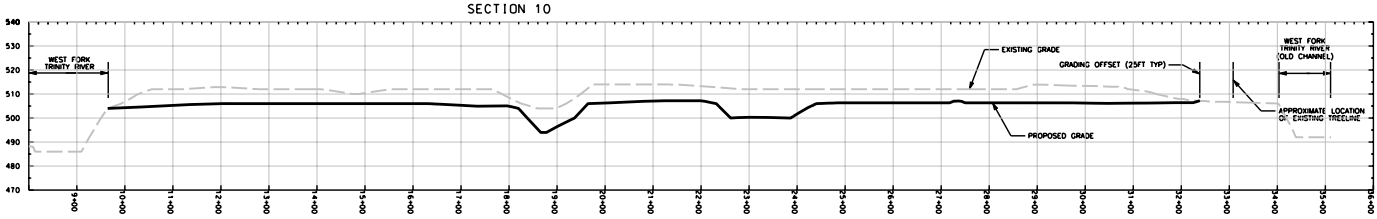
SCALE:
HORIZ: 1" = 100'
VERT: 1" = 20'

SECTION 10



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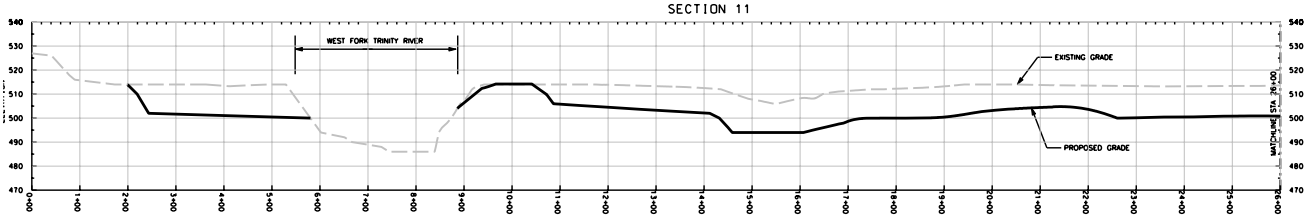
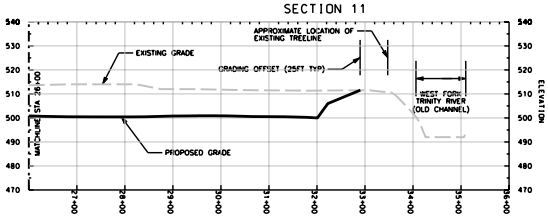


SECTION 11



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US Army Corps of Engineers
Fort Worth District

No.	Date	Revision

CDM

Sq. ft.	10,000.0
Sq. in.	1000.0
Scale	
No.	
Rev. date	Feb 8 2007
Plotted	
Revised by H. Gibbs	
Checked by	
Checked by J. Funderlic	
Drawn by	J. Thompson
Checked by	J. Thompson
Drawing Name	Xsections
Drawing Date	3/7/08

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
CROSS SECTIONS
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION

CG-34

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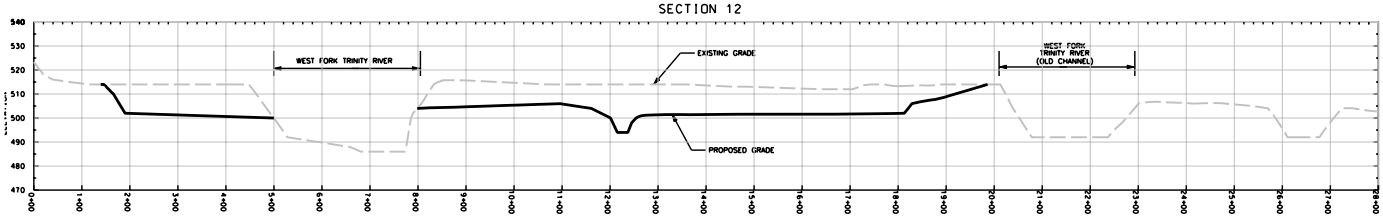
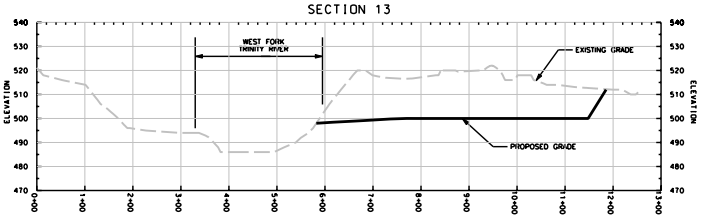
SCALE:
HORIZ: 1" = 100'
VERT: 1" = 20'

SECTION 12



SECTION 13



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US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
CROSS SECTIONS
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION
CG-35

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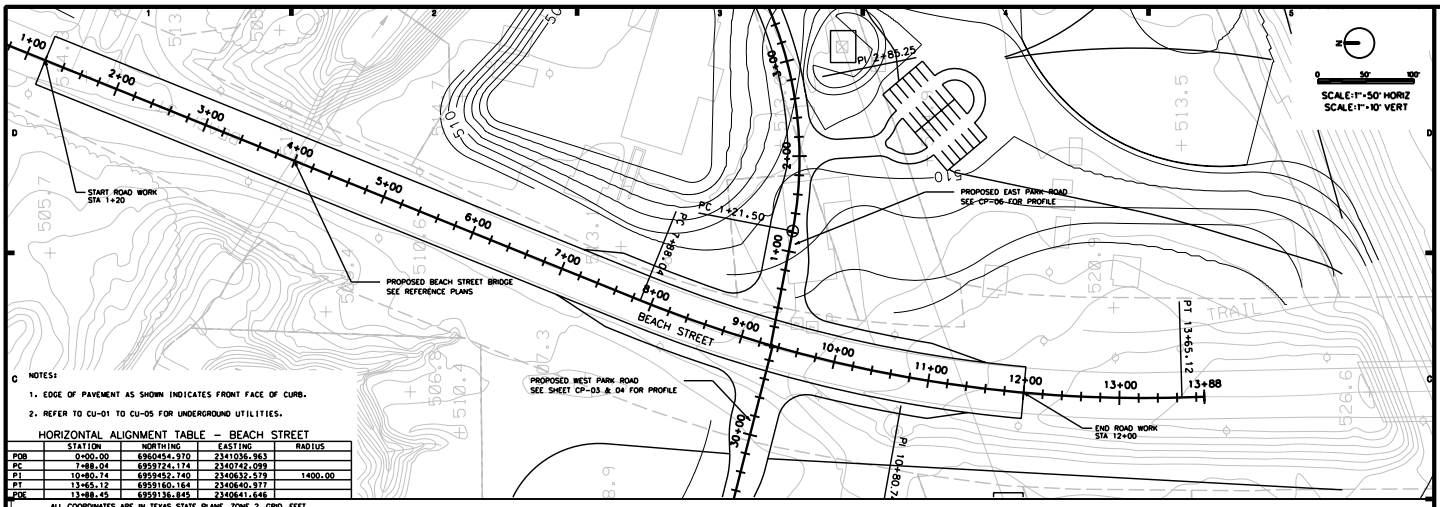


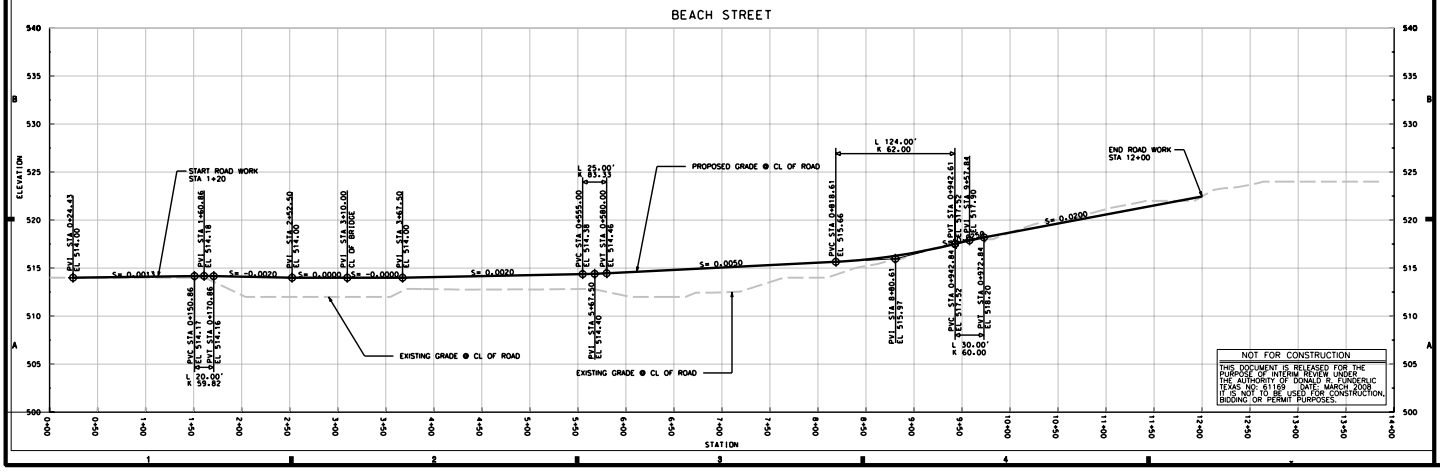
NOTES:

1. EDGE OF PAVEMENT AS SHOWN INDICATES FRONT FACE OF CURB.
2. REFER TO CU-01 TO CU-05 FOR UNDERGROUND UTILITIES.

HORIZONTAL ALIGNMENT TABLE – BEACH STREET

	STATION	NORTHING	EASTING	RADIUS
POB	0+00.00	6960454.970	2341036.963	
PC	1+88.04	6959724.174	2340742.099	
PI	10+80.14	6959452.740	2340632.579	1400.00
PT	13+65.12	6959160.164	2340640.977	
POE	13+88.45	6959136.845	2340641.646	

ALL COORDINATES ARE IN TEXAS STATE PLANE, ZONE 2, GRID, FEET



US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
PLAN AND PROFILE
WEST PARKWAY

SHEET IDENTIFICATION
CP-01

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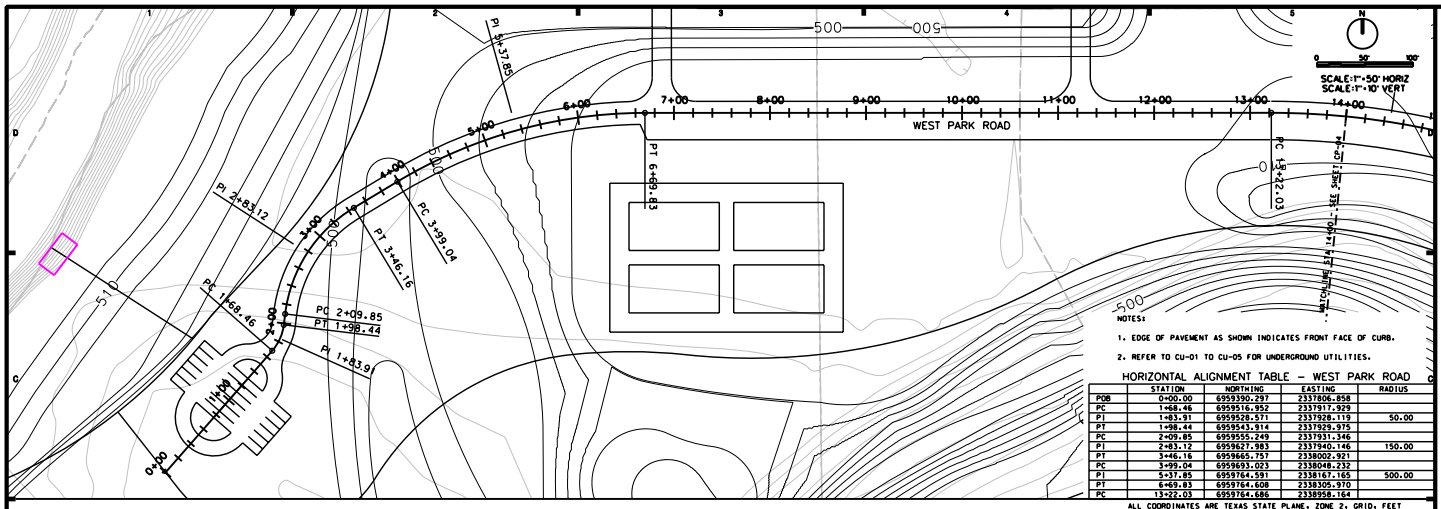


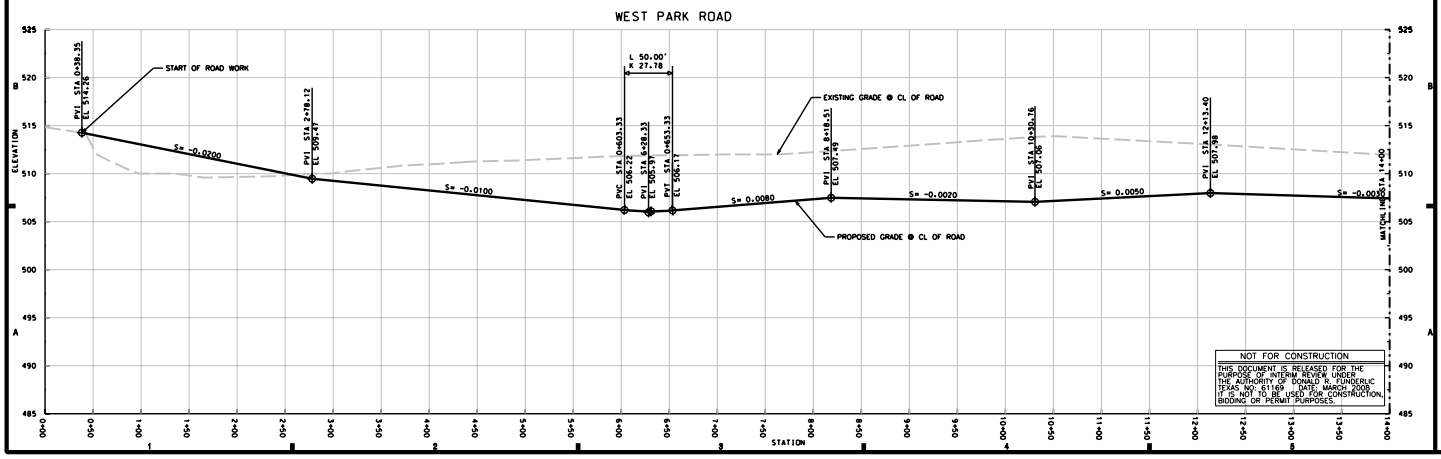
NOTES:

1. EDGE OF PAVEMENT AS SHOWN INDICATES FRONT FACE OF CURB.
2. REFER TO CU-01 TO CU-05 FOR UNDERGROUND UTILITIES.

HORIZONTAL ALIGNMENT TABLE – WEST PARK ROAD

	STATION	NORTHING	EASTING	RADIUS
POB	0+00.00	6959390.297	2337806.858	
PC	1+68.46	6959516.952	2337917.929	
PI	1+83.91	6959528.571	2337928.119	50.00
PT	1+98.44	6959543.914	2337929.975	
PC	2+09.85	6959555.249	2337931.346	
PI	2+83.12	6959627.983	2337940.146	150.00
PT	3+46.16	6959665.757	2338002.921	
PC	3+99.04	6959693.023	2338048.232	
PI	5+37.85	6959764.591	2338167.165	500.00
PT	6+69.83	6959764.608	2338305.970	
PC	13+22.03	6959764.686	2338958.164	

ALL COORDINATES ARE TEXAS STATE PLANE, ZONE 2, GRID, FEET



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US Army Corps of Engineers
Fort Worth District

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FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
PLAN AND PROFILE
WEST PARK ROAD

SHEET IDENTIFICATION
CP-02

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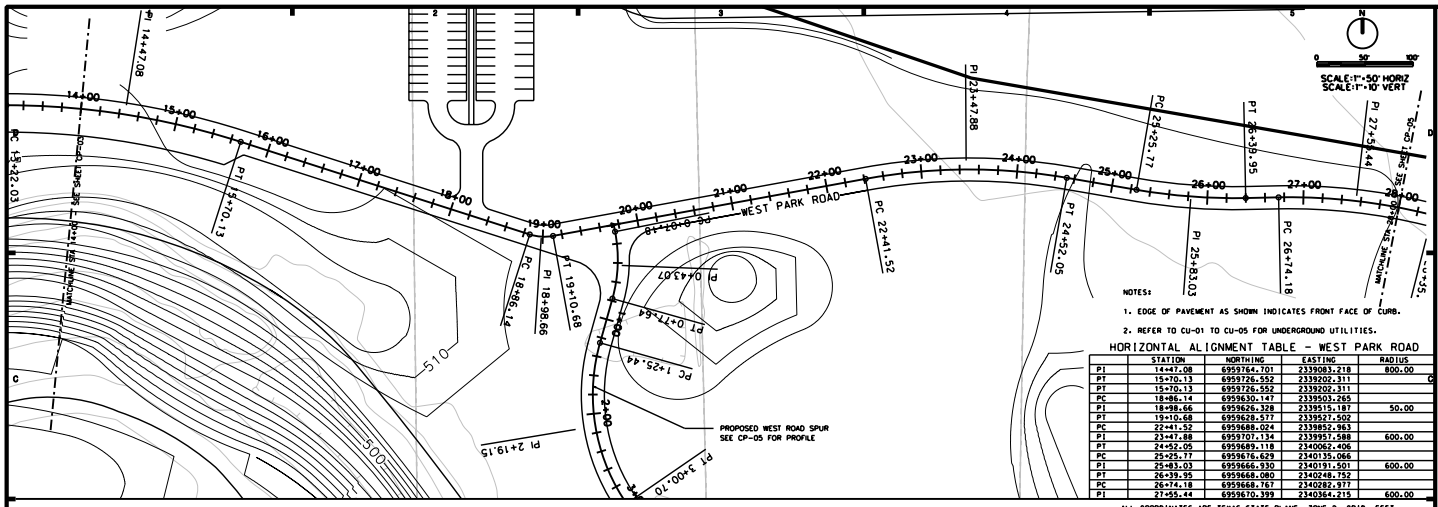


NOTES:

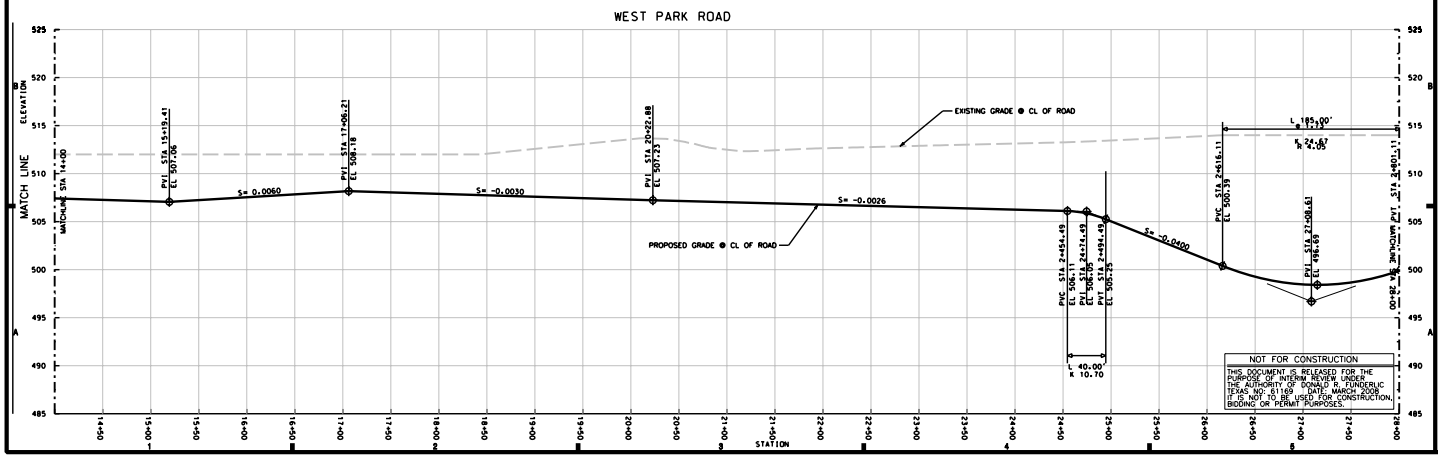
1. EDGE OF PAVEMENT AS SHOWN INDICATES FRONT FACE OF CURB.

2. REFER TO CU-01 TO CU-05 FOR UNDERGROUND UTILITIES.

HORIZONTAL ALIGNMENT TABLE - WEST PARK ROAD

	STATION	NORTHING	EASTING	RADIUS
PI	14+47.08	6959764.701	2339083.218	800.00
PT	15+70.13	6959726.552	2339202.311	
PT	15+70.13	6959726.552	2339202.311	
PC	18+86.14	6959630.147	2339503.265	
PI	18+98.66	6959626.328	2339515.187	50.00
PT	19+10.68	6959628.577	2339527.502	
PC	22+41.52	6959688.024	2339852.963	
PI	23+47.88	6959707.134	2339957.588	600.00
PT	24+52.05	6959689.118	2340062.406	
PC	25+25.77	6959676.629	2340135.066	
PI	25+83.03	6959666.930	2340191.501	600.00
PT	26+39.95	6959666.080	2340248.752	
PC	26+74.18	6959668.767	2340282.977	
PI	27+55.44	6959670.399	2340364.215	600.00

ALL COORDINATES ARE TEXAS STATE PLANE, ZONE 2, GRID, FEET



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US Army Corps of Engineers
Fort Worth District

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FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
PLAN AND PROFILE
WEST PARK ROAD

SHEET IDENTIFICATION
CP-03

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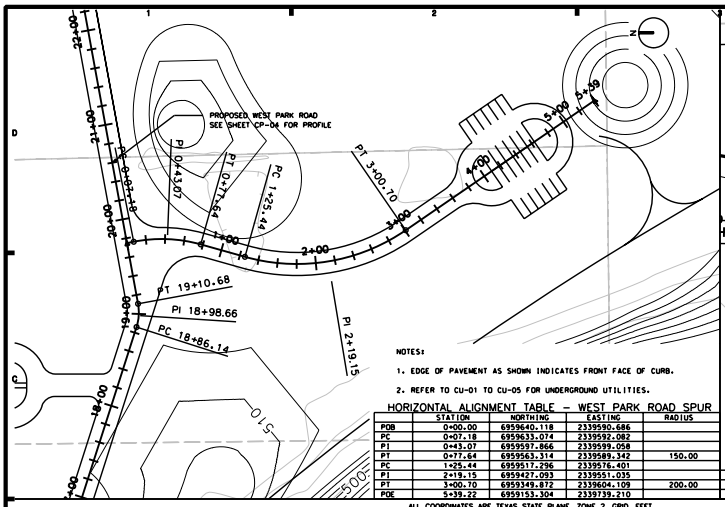


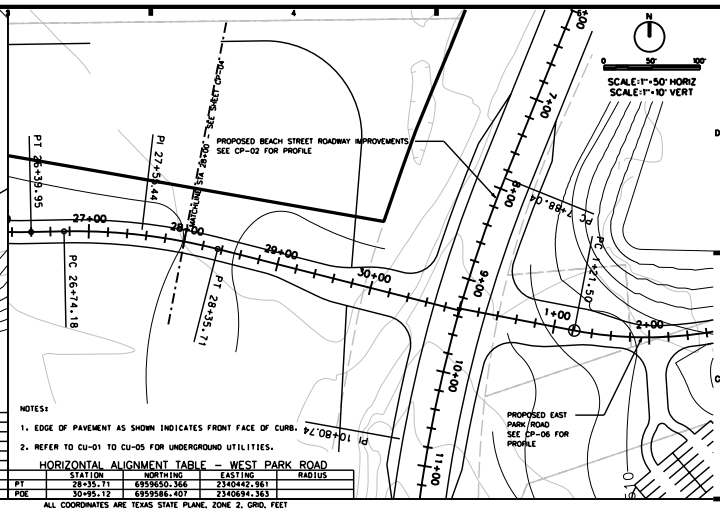
NOTES:

1. EDGE OF PAVEMENT AS SHOWN INDICATES FRONT FACE OF CURB.
2. REFER TO CU-01 TO CU-05 FOR UNDERGROUND UTILITIES.

HORIZONTAL ALIGNMENT TABLE – WEST PARK ROAD SPUR

	STATION	NORTHING	EASTING	RADIUS
POB	0+00.00	6959640.118	2339590.686	
PC	0+07.18	6959633.074	2339592.082	
PI	0+43.07	6959597.866	2339599.058	
PT	0+77.64	6959563.314	2339589.342	150.00
PC	1+25.44	6959517.296	2339576.401	
PI	2+19.15	6959427.093	2339551.035	
PT	3+00.70	6959349.872	2339604.109	200.00
POE	5+39.22	6959153.304	2339739.210	

ALL COORDINATES ARE TEXAS STATE PLANE, ZONE 2, GRID, FEET



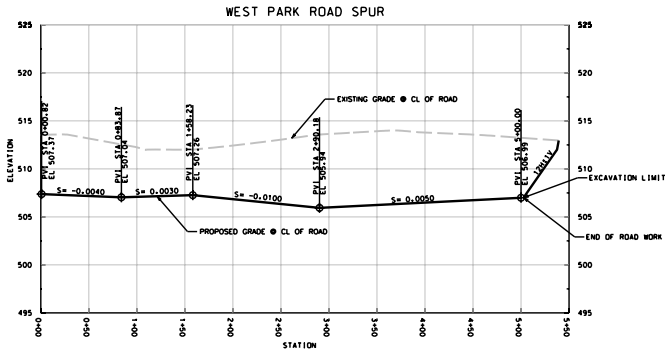
NOTES:

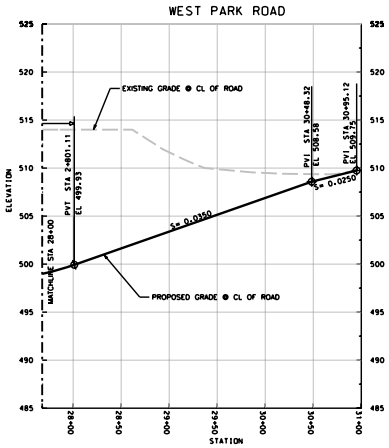
1. EDGE OF PAVEMENT AS SHOWN INDICATES FRONT FACE OF CURB.
2. REFER TO CU-01 TO CU-05 FOR UNDERGROUND UTILITIES.

HORIZONTAL ALIGNMENT TABLE – WEST PARK ROAD

	STATION	NORTHING	EASTING	RADIUS
PT	28+35.71	6959650.366	2340442.961	
POE	30+95.12	6959586.407	2340694.363	

ALL COORDINATES ARE TEXAS STATE PLANE, ZONE 2, GRID, FEET





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US Army Corps of Engineers
Fort Worth District

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FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
PLAN AND PROFILE
WEST PARK ROAD SPUR

SHEET IDENTIFICATION

CP-04

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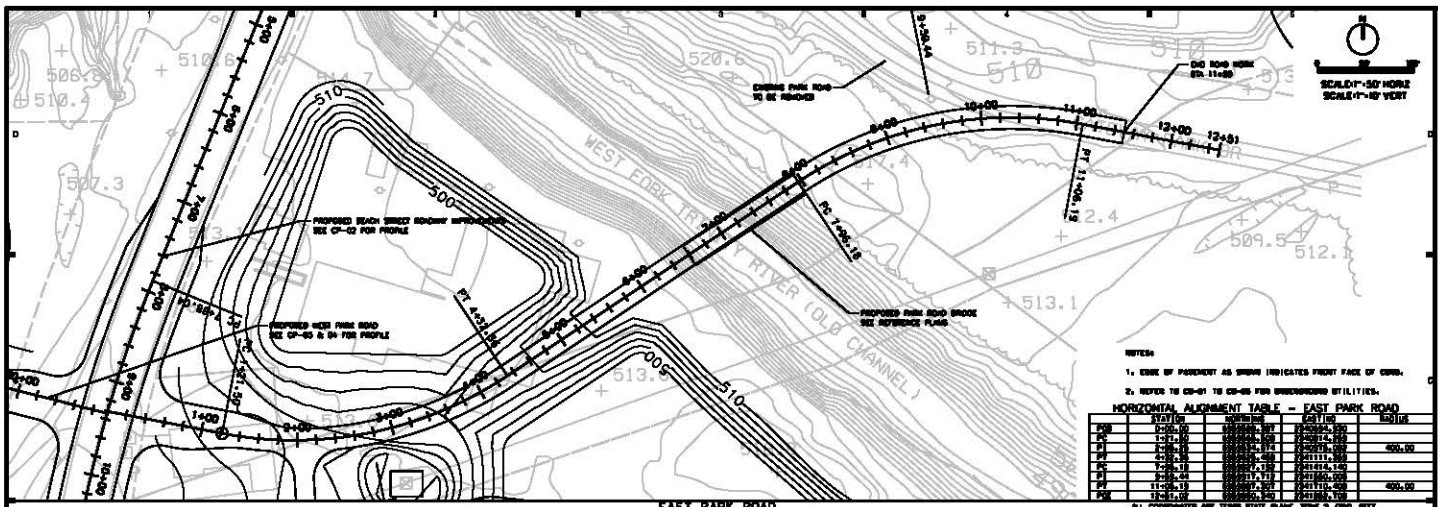
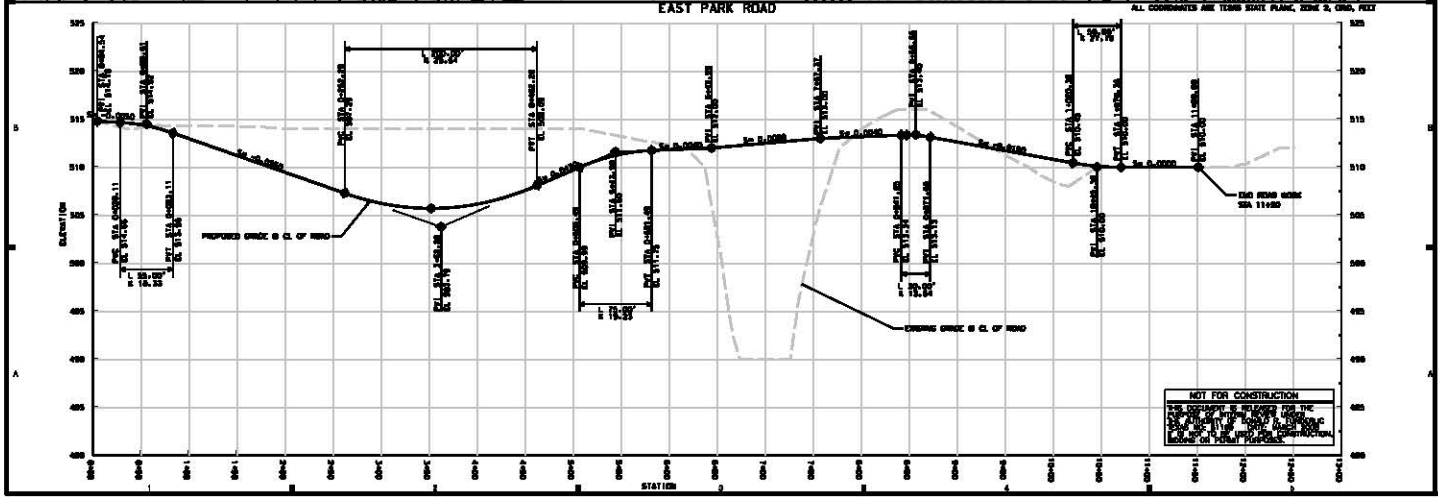


EAST PARK ROAD



US Army Corps of Engineers Fort Worth District

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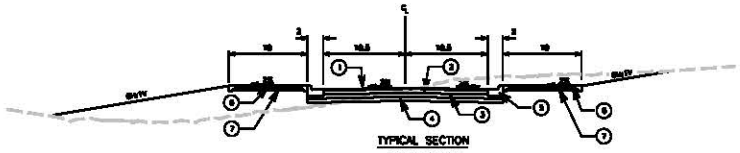
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
PLAN AND PROFILE
EAST PARK ROAD

SHEET IDENTIFICATION

CP-05



TYPICAL SECTION
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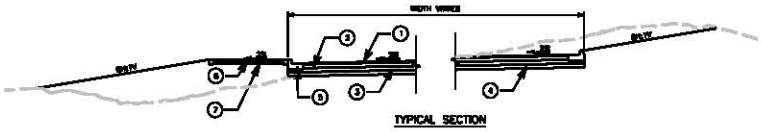
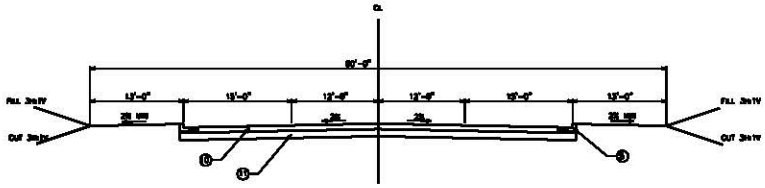
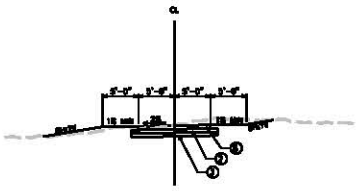


TYPICAL SECTION
PARKING AREAS
NOT TO SCALE

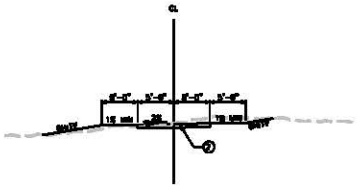


TYPICAL SECTION
BEACH STREET
NOT TO SCALE

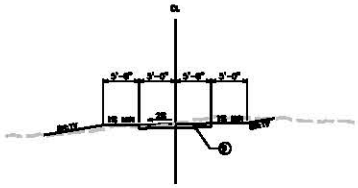
1. 1.5" HMAC SURFACE COURSE AND 2.5" HMAC BINDER COURSE
2. 6" AGGREGATE BASE COURSE AT 95%
3. 8" COMPACTED SUBBASE AT 90%
4. 6" New COMPACTED SUBBASE
5. 3" CONCRETE CURB WITH 3-#4 BARS REINF. SIL.
6. 4" THICK CONC. TRAIL WITH #4 BAR REINF. @ 24" CENTERS EACH WAY
7. 2" TRIMMED SOAD
8. 6" PORTLAND CEMENT CONCRETE W/ #4 BARS SPACED AT 18" OC
9. 6" MULCH
10. 8" REINFORCED CONCRETE PAVEMENT
11. STABILIZED SUBGRADE



TYPICAL SECTION
MAINTENANCE/ RECREATION TRAIL
NOT TO SCALE



TYPICAL SECTION
RECREATION ONLY TRAIL
NOT TO SCALE



TYPICAL SECTION
EQUESTRIAN TRAIL
NOT TO SCALE

NOT FOR CONSTRUCTION

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US Army Corps of Engineers
Fort Worth District

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FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
TYPICAL PAVEMENT SECTION

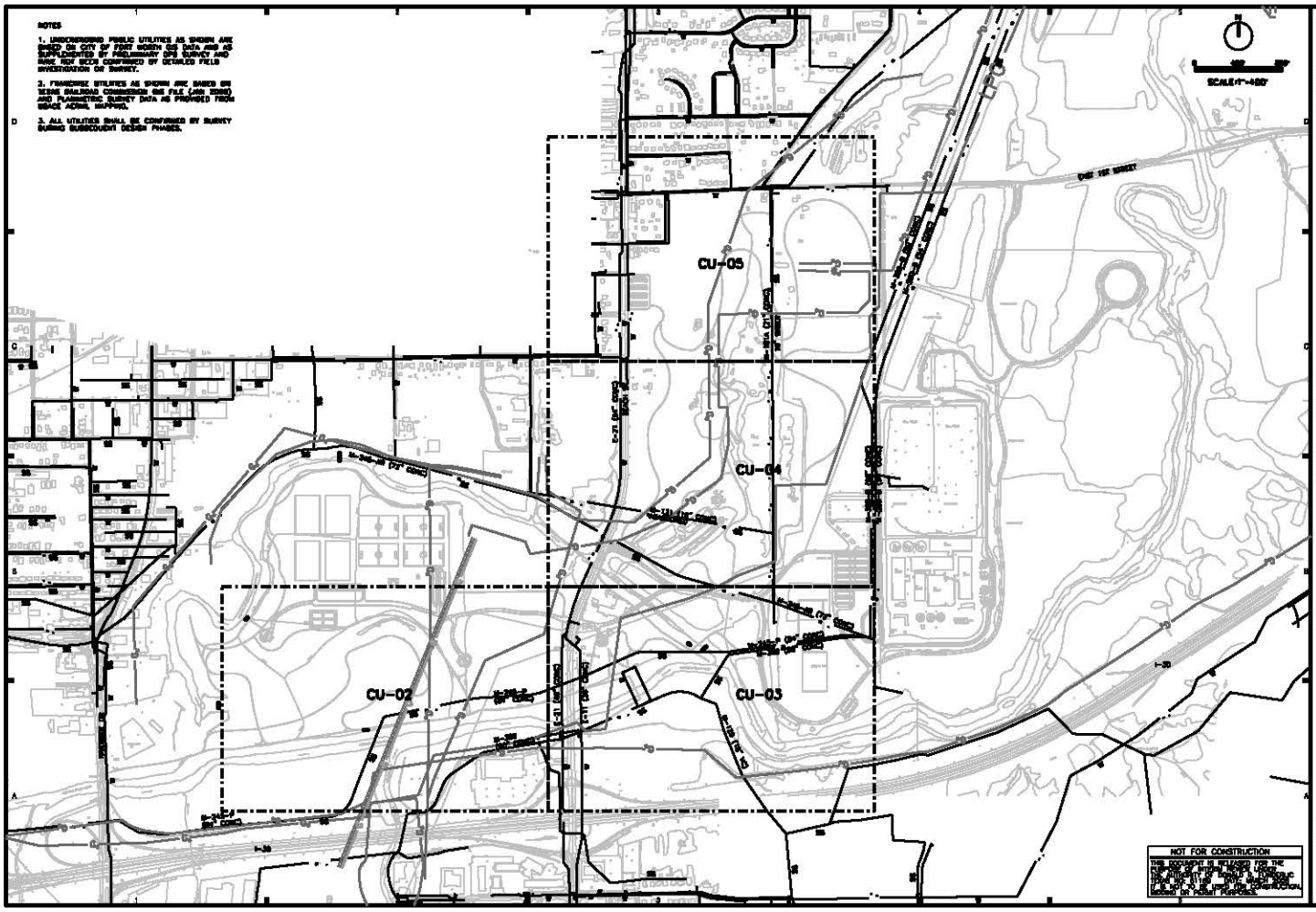
SHEET IDENTIFICATION
CP-06

NOTES

1. UNDERGROUND PUBLIC UTILITIES AS SHOWN ARE BASED ON CITY OF FORT WORTH GIS DATA AND AS SUPPLEMENTED BY PRELIMINARY GPS SURVEY AND MAY NOT BEEN CONFIRMED BY DETAILED FIELD INVESTIGATION OR SURVEY.

2. TRANSMISSIONS UTILITIES AS SHOWN ARE BASED ON TEXAS RAILROAD COMMISSION GIS FILE (JAN 2006) AND PLANIMETRIC SURVEY DATA AS PROVIDED FROM SPACE AERIAL MAPPING.

3. ALL UTILITIES SHALL BE CONFIRMED BY SURVEY DURING SUBSEQUENT DESIGN PHASES.



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US Army Corps of Engineers Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
UTILITY KEY PLAN
CARSON/GATEWAY SITE

SHEET IDENTIFICATION

CU-01

NOTES:

1. UNDERGROUND UTILITIES AS SHOWN ARE BASED ON CITY OF FORT WORTH GIS DATA AND AS SUPPLIMENTED BY PRELIMINARY GPS SURVEY AND HAVE NOT BEEN CONFIRMED BY DETAILED FIELD INVESTIGATION OR SURVEY.

2. LINE IDENTIFICATION NUMBERS REFER TO CITY OF FORT WORTH NOMENCLATURE AND ARE FOR REFERENCE PURPOSES.

3. FRANCHISE UTILITIES ARE BASED ON TEXAS RAILROAD COMMISSION GIS FILES (JAN 2000) AND PLANIMETRIC SURVEY DATA AS PROVIDED FROM USACE AERIAL MAPPING.

4. ALL UTILITIES SHALL BE CONFIRMED BY SURVEY DURING SUBSEQUENT DESIGN PHASES.

SCALE:1"=100'

PROPOSED FUTURE GAS PIPELINE - 36" WILL BE INSTALLED WITH PROPOSED SEWER WORK

PROPOSED FUTURE FRESH WATER LINE - 24" PROPOSED FUTURE PROPOSED WATER LINE - 30" WILL BE INSTALLED WITH PROPOSED SEWER WORK

EXISTING WATER PIPELINE - 24" TO BE PROTECTED DURING CONSTRUCTION

EXISTING LINE TO BE PROTECTED DURING CONSTRUCTION

EXISTING SEWER SHAFT TO REMAIN

EXISTING FUTURE SEWER GAS LINE - LINE TO BE PLACED DURING CONSTRUCTION

EXISTING LINE TO BE PROTECTED DURING CONSTRUCTION

EXISTING LINE TO BE PROTECTED DURING CONSTRUCTION

WEST FORK TRINITY RIVER

STOCKYARDS CREEK

LEGEND

- SANITARY SEWER
- WATER LINE
- NATURAL GAS LINE
- LIQUID FUEL LINE

NOT FOR CONSTRUCTION

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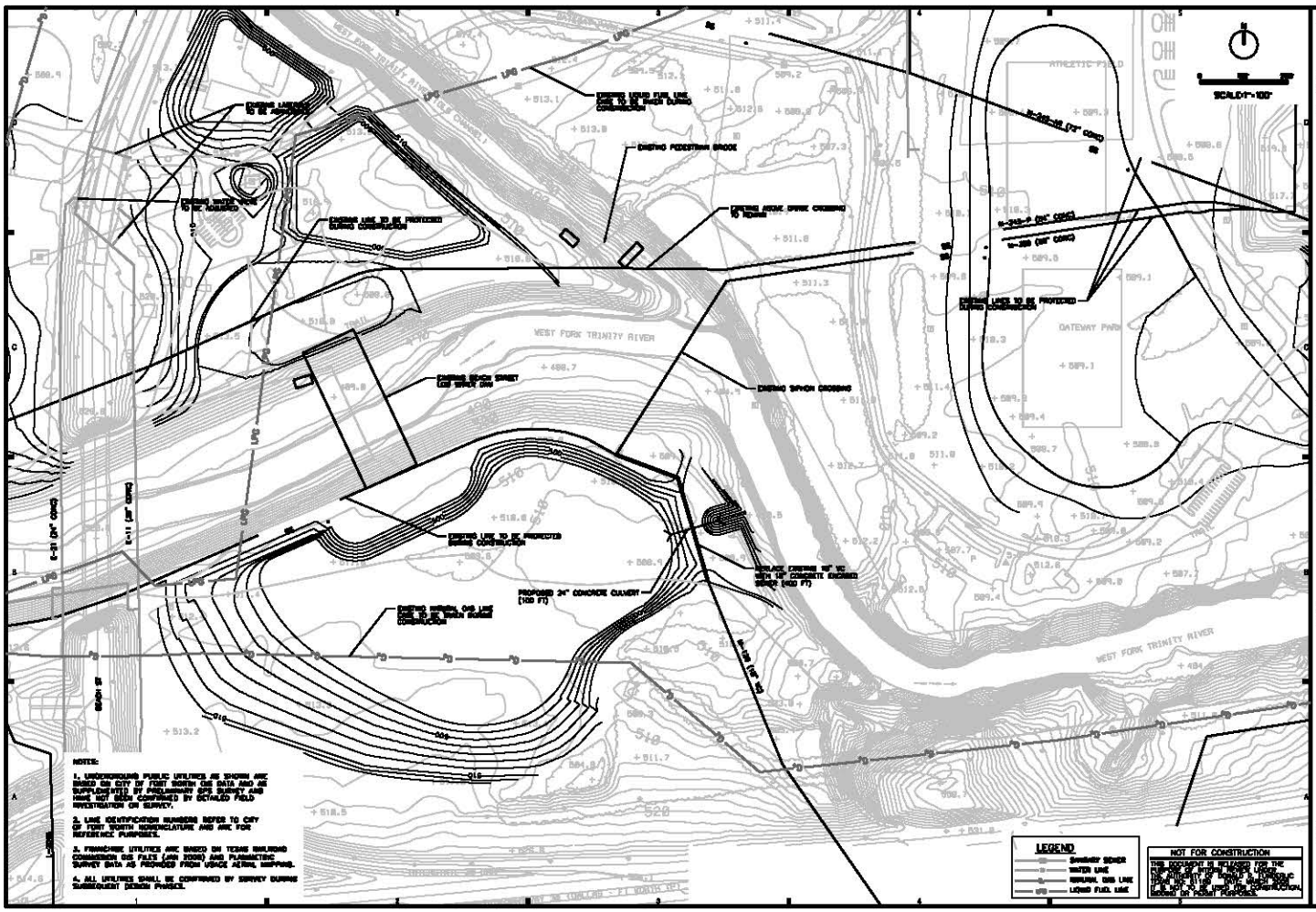
US Army Corps of Engineers Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
UTILITY PLAN
CARSON/GATEWAY SITE

SHEET IDENTIFICATION

CU-02


WEST FORK TRINITY RIVER
ATHLETIC FIELD
GATEWAY PARK
EXISTING PEDESTRIAN BRIDGE
EXISTING SIPHON CROSSING
PROPOSED 24" CONCRETE CULVERT (100 FT)
SCALE:1"=100'
NOTES:
1. UNDERGROUND PUBLIC UTILITIES AS SHOWN ARE BASED ON CITY OF FORT WORTH GIS DATA AND AS SUPPLEMENTED BY PRELIMINARY GPS SURVEY AND HAVE NOT BEEN CONFIRMED BY DETAILED FIELD INVESTIGATION OR SURVEY.
2. LINE IDENTIFICATION NUMBERS REFER TO CITY OF FORT WORTH NOMENCLATURE AND ARE FOR REFERENCE PURPOSES.
3. FRANCHISE UTILITIES ARE BASED ON TEXAS BUILDING COMMISSION GIS FILES (JAN 2000) AND PLANIMETRIC SURVEY DATA AS PROVIDED FROM USACE AERIAL MAPPING.
4. ALL UTILITIES SHALL BE CONFIRMED BY SURVEY DURING SUBSEQUENT DESIGN PHASES.
LEGEND
SANITARY SEWER
WATER LINE
NATURAL GAS LINE
LIQUID FUEL LINE
NOT FOR CONSTRUCTION
THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INFORM NEGRA LARGE THE AUTHORITY OF PRIMARY & PUBLIC TRUST NOT BUILD ... NOTE: ... DESIGN BY FORMAT PURPOSES.
US Army Corps of Engineers Fort Worth District
CDM
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
UTILITY PLAN
CARSON/GATEWAY SITE
SHEET IDENTIFICATION
CU-03

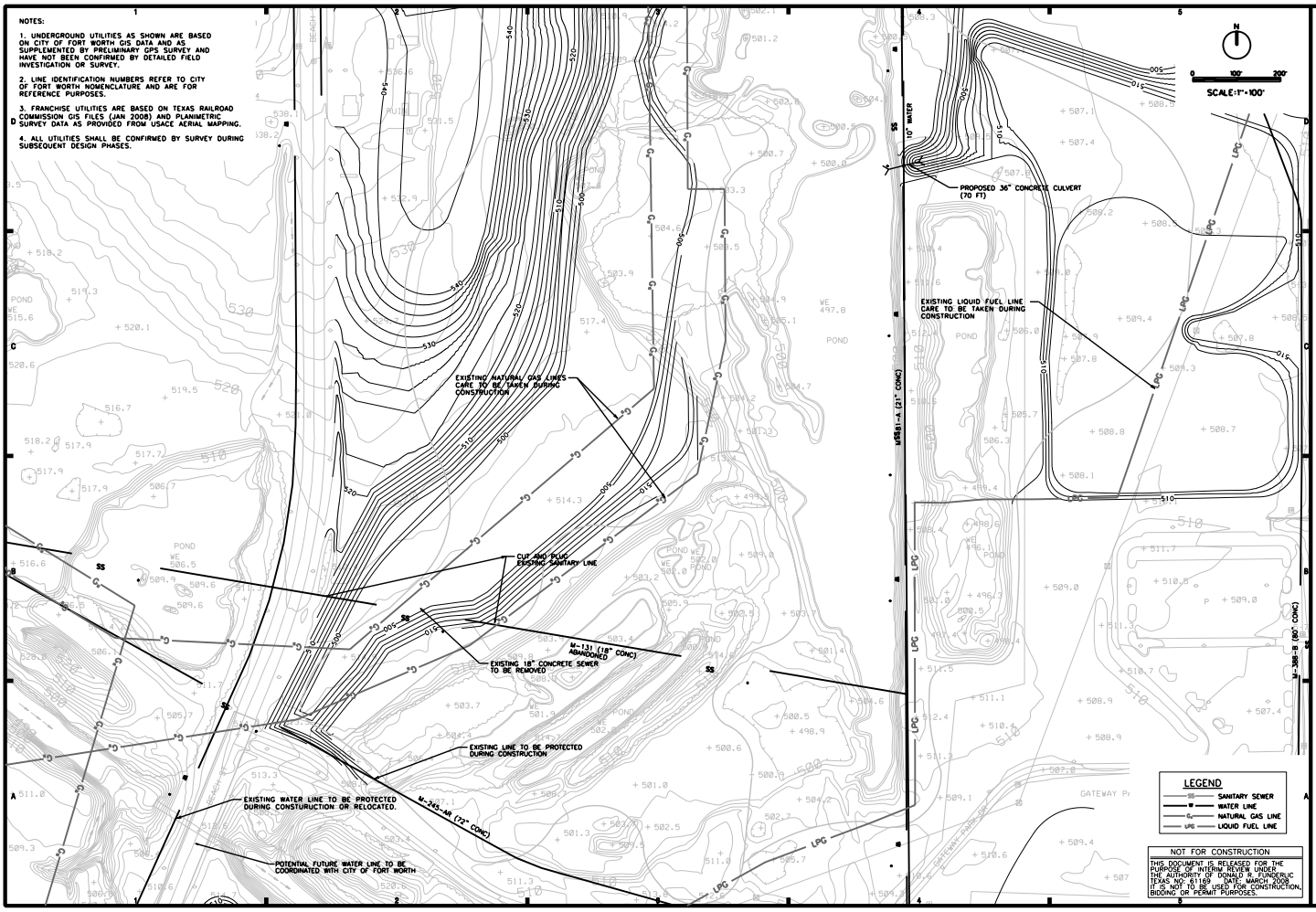
NOTES:

1. UNDERGROUND UTILITIES AS SHOWN ARE BASED ON CITY OF FORT WORTH GIS DATA AND AS SUPPLEMENTED BY PRELIMINARY GPS SURVEY AND HAVE NOT BEEN CONFIRMED BY DETAILED FIELD INVESTIGATION OR SURVEY.

2. LINE IDENTIFICATION NUMBERS REFER TO CITY OF FORT WORTH NOMENCLATURE AND ARE FOR REFERENCE PURPOSES.

3. FRANCHISE UTILITIES ARE BASED ON TEXAS RAILROAD COMMISSION GIS FILES (JAN 2008) AND PLANIMETRIC SURVEY DATA AS PROVIDED FROM USACE AERIAL MAPPING.

4. ALL UTILITIES SHALL BE CONFIRMED BY SURVEY DURING SUBSEQUENT DESIGN PHASES.



NOT FOR CONSTRUCTION

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US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
UTILITY PLAN
OXBOW-GATEWAY SITE

SHEET IDENTIFICATION
CU-04

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NOTES:

1. UNDERGROUND UTILITIES AS SHOWN ARE BASED ON CITY OF FORT WORTH GIS DATA AND AS SUPPLEMENTED BY PRELIMINARY GPS SURVEY AND HARC DIST DATA COMPARED BY DETAILED FIELD INVESTIGATION OR SURVEY.

2. LINE IDENTIFICATION NUMBERS REFER TO CITY OF FORT WORTH NOMENCLATURE AND ARE FOR REFERENCE PURPOSES.

3. FRANCHISE UTILITIES ARE BASED ON TEXAS RAILROAD COMMISSION GIS FILES (JAN 2005) AND PLANIMETRIC SURVEY DATA AS PROVIDED FROM USACE AERIAL MAPPING.

4. ALL UTILITIES SHALL BE CONFIRMED BY SURVEY DURING SUBSURFACE DESIGN PHASE.

LEGEND

- Sanitary Sewer
- Water Line
- Natural Gas Line
- Liquid Fuel Line

EXISTING WATER LINES TO BE PROTECTED DURING CONSTRUCTION

EXISTING NATURAL GAS LINES CAME TO BE TAKEN DURING CONSTRUCTION

EXISTING NATURAL GAS LINES CAME TO BE TAKEN DURING CONSTRUCTION

EXISTING LIQUID FUEL LINE CAME TO BE TAKEN DURING CONSTRUCTION

NOT FOR CONSTRUCTION

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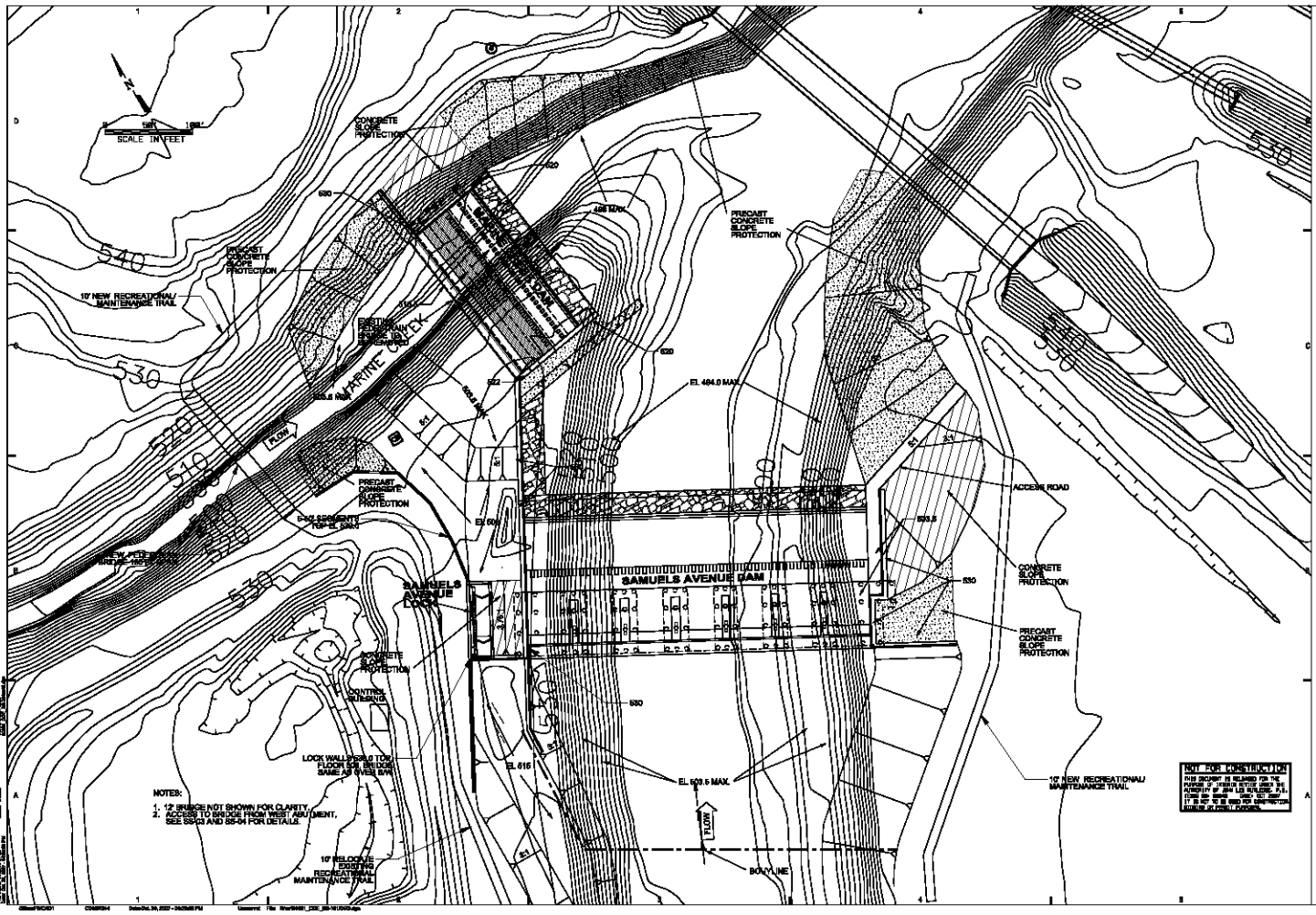
US Army Corps of Engineers Fort Worth District

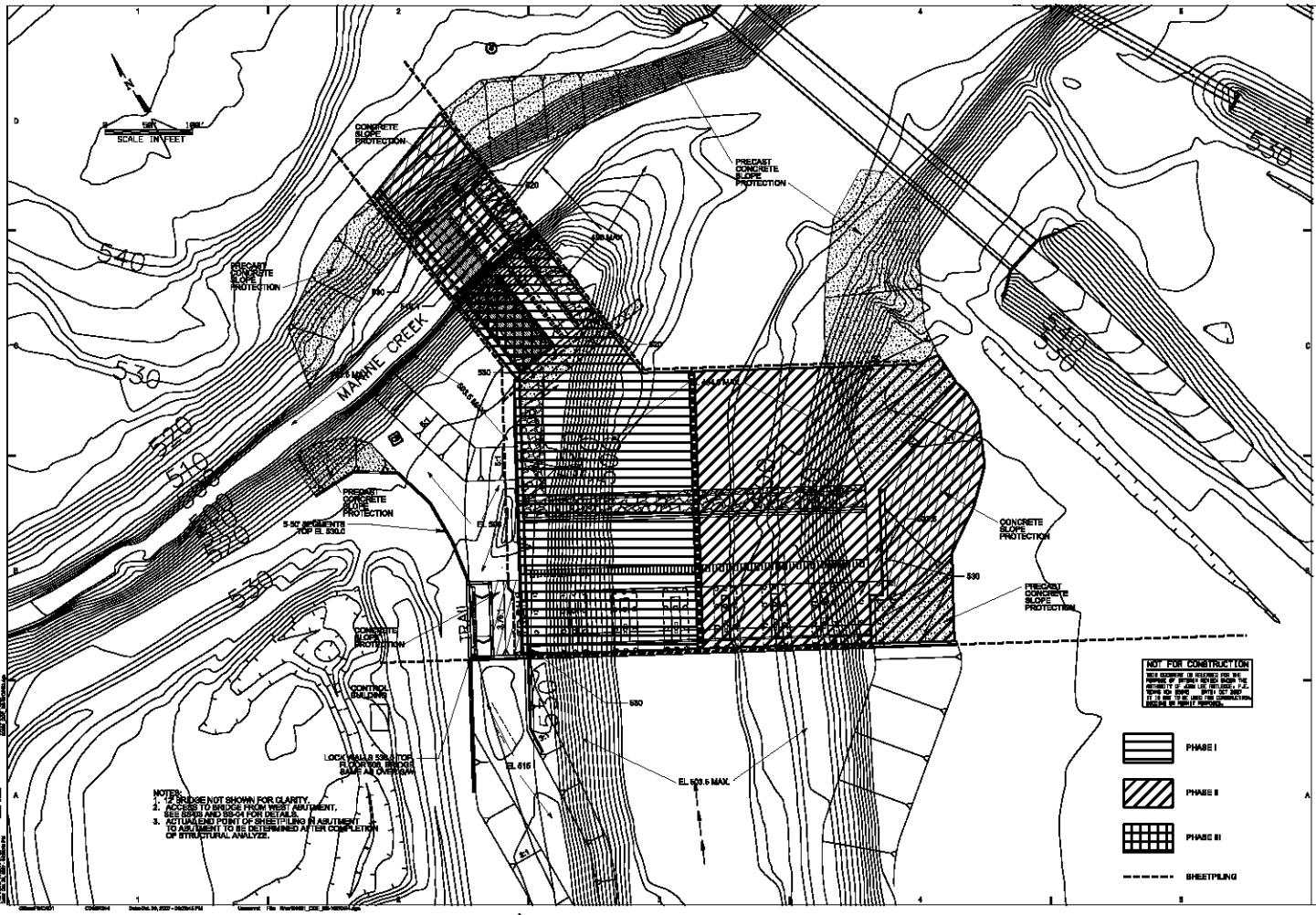
CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
VALLEY STORAGE MITIGATION
UTILITY PLAN
CARSON/GATEWAY SITE

SHEET IDENTIFICATION

CU-05


SCALE IN FEET
CONCRETE SLOPE PROTECTION
PRECAST CONCRETE SLOPE PROTECTION
10' NEW RECREATIONAL/ MAINTENANCE TRAIL
EXISTING RECREATIONAL/ MAINTENANCE TRAIL
MARINE CREEK
FLOW
EL 484.0 MAX.
ACCESS ROAD
SAMUELS AVENUE DAM
SAMUELS AVENUE LOCK
CONTROL BUILDING
LOCK WALLS SEALS TO FLOOR SB BRIDGE SAME AS OVER DAM
EL 616
EL 603.5 MAX.
BOAT LINE
10' INCLOSE EXISTING RECREATIONAL/ MAINTENANCE TRAIL
NOTES:
1. 12' BRIDGE NOT SHOWN FOR CLARITY.
2. ACCESS TO BRIDGE FROM WEST ABUTMENT, SEE SS03 AND SS-04 FOR DETAILS.
NOT FOR CONSTRUCTION
THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF PUBLIC REVIEW AND COMMENT. AUTHORITY OF FORT WORTH LIS BUILDING, P.E. FORM NO. 0000 DATED 00/00/0000. IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, OR ISSUED FOR PERMITS.
US Army Corps of Engineers Fort Worth District
CDM
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
SAMUELS AVENUE LOCK & DAM
SITE PLAN
SHEET IDENTIFICATION
SS-01



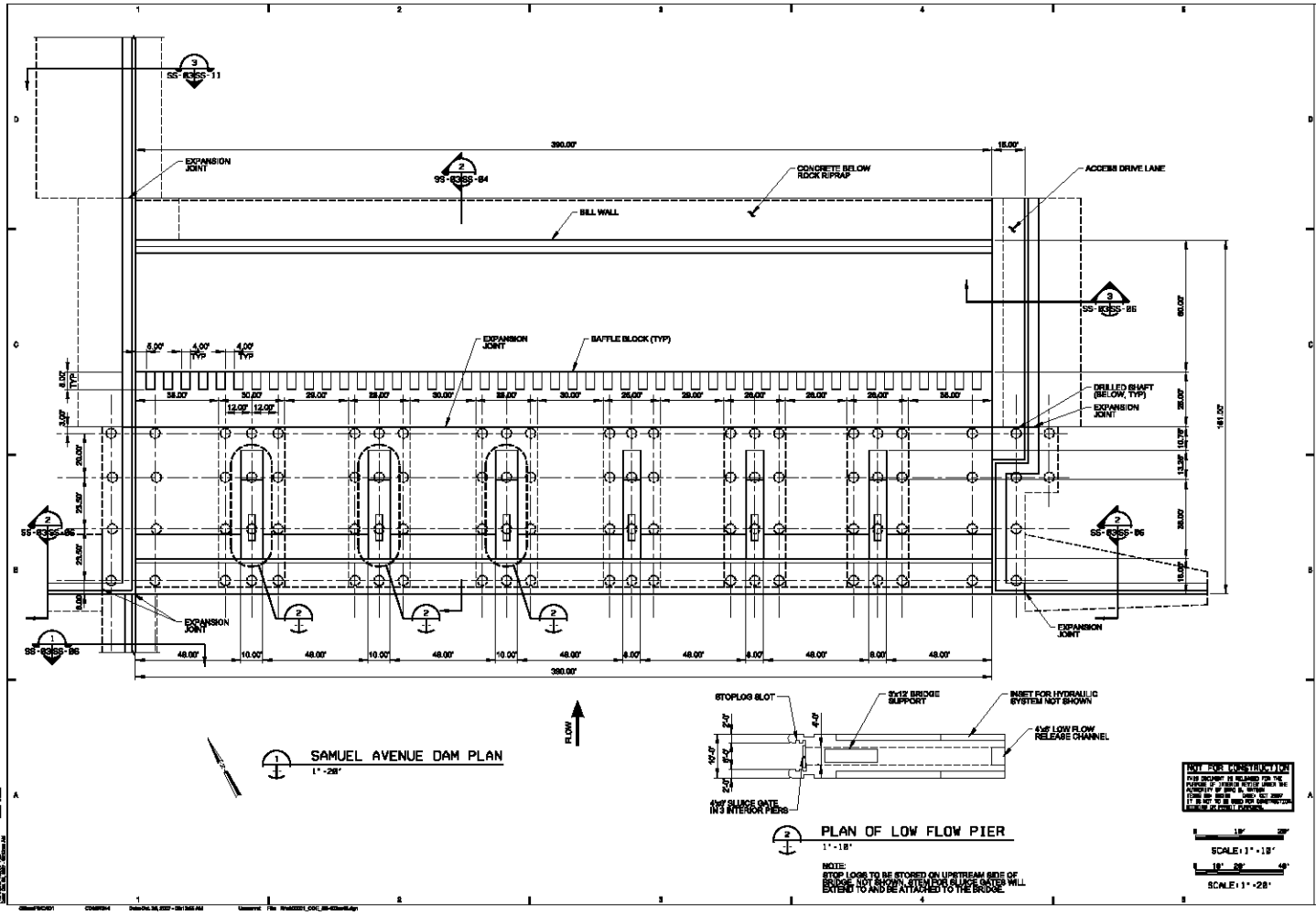
NOTES:
1. 12' BRIDGE NOT SHOWN FOR CLARITY.
2. ACCESS TO BRIDGE FROM WEST ABUTMENT, SEE SS-03 AND SS-04 FOR DETAILS.
3. ACTUAL END POINT OF SHEETPILING IN ABUTMENT TO ABUTMENT TO BE DETERMINED AFTER COMPLETION OF STRUCTURAL ANALYZE.

US Army Corps of Engineers Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUEL AVENUE DAM
SAMUEL AVENUE LOCK & DAM
PHASING PLAN

SHEET IDENTIFICATION
SS-02



1 SAMUEL AVENUE DAM PLAN
1" = 28'

2 PLAN OF LOW FLOW PIER
1" = 18'

NOTE:
STOP LOGS TO BE STORED ON UPSTREAM SIDE OF BRIDGE, NOT SHOWN. STEM FOR SLUICE GATES WILL EXTEND TO AND BE ATTACHED TO THE BRIDGE.

NOT FOR CONSTRUCTION

SCALE: 1" = 18'

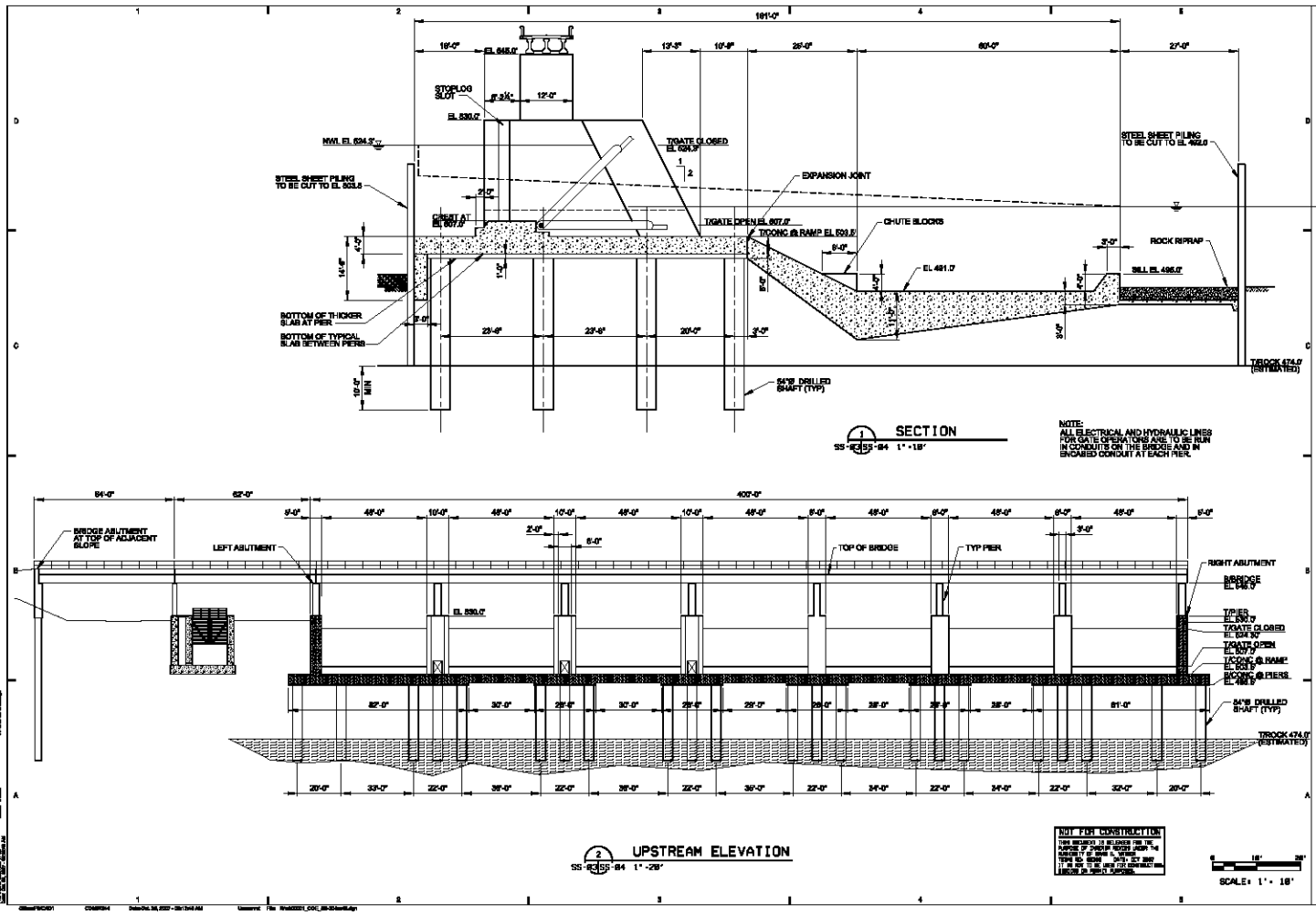
SCALE: 1" = 28'

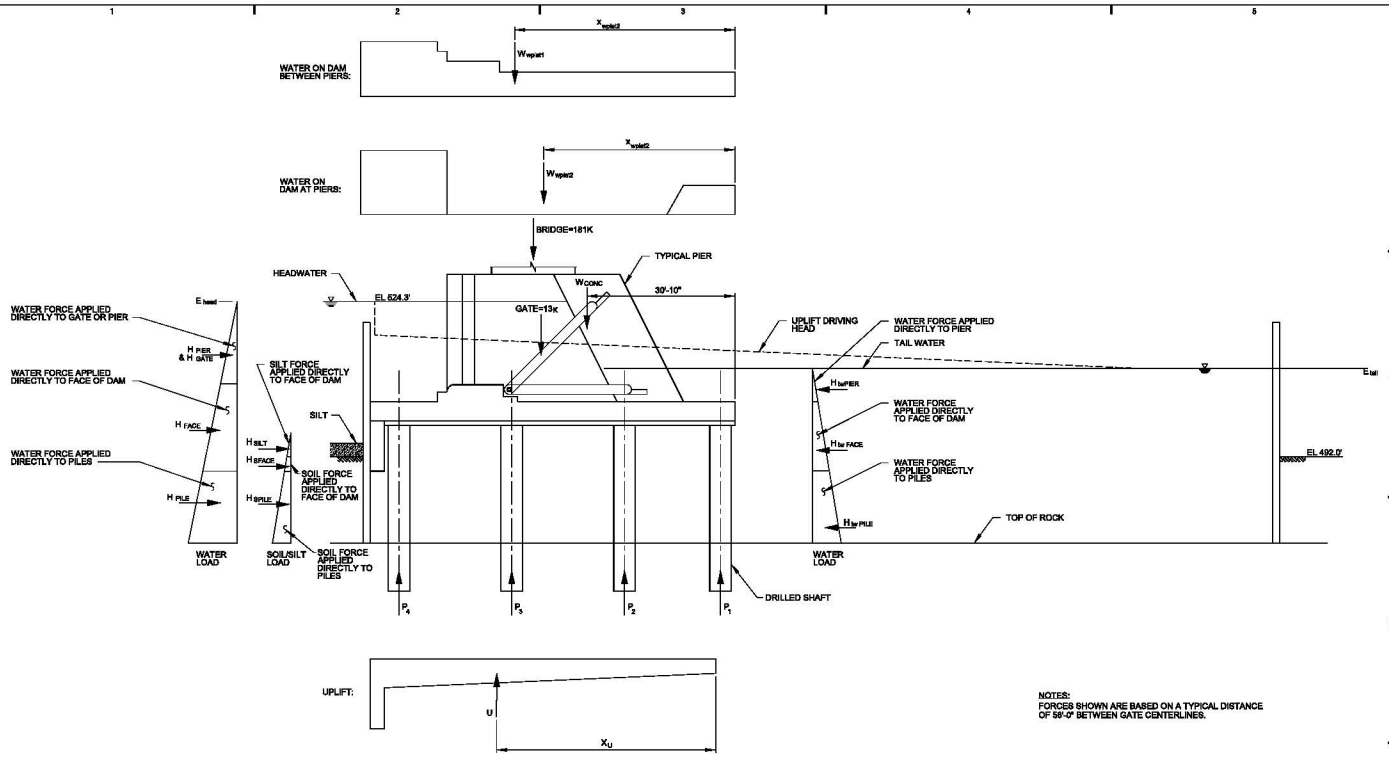
US Army Corps of Engineers Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
PLAN

SHEET IDENTIFICATION
SS-03


US Army Corps of Engineers
Fort Worth District
161'-0"
16'-0"
EL 545.0'
13'-3"
10'-9"
26'-0"
60'-0"
27'-0"
STOPLOG SLOT
12'-0"
EL 530.0'
NWL EL 524.3'
T/GATE CLOSED EL 524.3'
STEEL SHEET PILING TO BE CUT TO EL 495.0
STEEL SHEET PILING TO BE CUT TO EL 503.5
EXPANSION JOINT
CREST AT EL 507.0'
T/GATE OPEN EL 507.0'
T/CONC @ RAMP EL 503.5'
CHUTE BLOCKS
ROCK RIPRAP
EL 491.0'
SILL EL 495.0'
BOTTOM OF THICKER SLAB AT PIER
BOTTOM OF TYPICAL SLAB BETWEEN PIERS
23'-6"
23'-6"
20'-0"
54"Ø DRILLED SHAFT (TYP)
T/ROCK 474.0' (ESTIMATED)
SECTION
SS-02 SS-04 1" = 18'
NOTE:
ALL ELECTRICAL AND HYDRAULIC LINES FOR GATE OPERATORS ARE TO BE RUN IN CONDUITS ON THE BRIDGE AND IN ENCASED CONDUIT AT EACH PIER.
400'-0"
BRIDGE ABUTMENT AT TOP OF ADJACENT SLOPE
LEFT ABUTMENT
TOP OF BRIDGE
TYP PIER
RIGHT ABUTMENT
BRIDGE EL 545.0'
T/PIER EL 530.0'
T/GATE CLOSED EL 524.30'
T/GATE OPEN EL 507.0'
T/CONC @ RAMP EL 503.5'
T/CONC @ PIERS EL 495.0'
54"Ø DRILLED SHAFT (TYP)
T/ROCK 474.0' (ESTIMATED)
UPSTREAM ELEVATION
SS-02 SS-04 1" = 28'
NOT FOR CONSTRUCTION
SCALE: 1" = 18'
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
SECTION AND ELEVATION
SHEET IDENTIFICATION
SS-04



NOTES:
FORCES SHOWN ARE BASED ON A TYPICAL DISTANCE OF 59'-0" BETWEEN GATE CENTERLINES.

STABILITY ANALYSIS

1" = 10'

Load Case	E_{head} (ft-MSL)	E_{tail} (ft-MSL)	Vertical Forces on Drilled Shaft Supported Platform (kips per pier): Concrete W_{conc}	Water Above Platform W_{water1}	x_{water1}	W_{water2}	x_{water2}	Uplift U	x_U	Lateral Forces (kips per pier) H_{gate}	H_{gate}	H_{face}	H_{silt}	H_{face}	H_{pile}	H_{pier}	H_{gate}	H_{face}	H_{pile}	Forces on Drilled Shafts (kips per pier for line of shafts) P_1	P_2	P_3	P_4
1 No Flow	524.3	499	4923.5	1573.9	-62.9	204.6	-68.1	2786.0	-42.9	104.7	502.3	1851.5	1095.7	60	234.9	150	467.8	31.3		-27.8	189.3	444.4	699.5
2 10-yr	524.3	517.6	4923.5	3329.1	-42.5	309.4	-47.4	4295.1	-39.3	104.7	502.3	1851.5	1095.7	80	234.9	1050.4	665.4	218.8		135.4	276.4	429	587.8
3 25-yr	524.4	520.8	4923.5	4099.8	-39.5	361.7	-42.0	4585.6	-38.9	105.8	507.8	1857.7	1098.4	60	234.9	1445.9	980	301.2		211.1	323.3	455.1	587
4 100-yr	526.5	525	4923.5	5051.6	-37.8	458.6	-38.1	5154.9	-38.7	131.3	633.1	1767.1	1155.5	80	234.9	1943.3	1114.7	405		288.5	381.4	493	604.6
5 500-yr	533.8	531.4	4923.5	6617.2	-37.9	696.8	-37.8	6427.2	-38.6	234	1012.9	2224.7	1348.5	60	234.9	262	1288.7	561.2		328.8	424.1	536	647.9
6 SPF	540.7	537.8	4923.5	8159.0	-37.9	1018.0	-37.9	7719.4	-37.9	340.5	1402.2	2862.2	1541.5	80	234.9	3298.8	1482.7	725.2		373.3	470.4	584.6	698.8

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0 10' 20'
SCALE: 1" = 10'

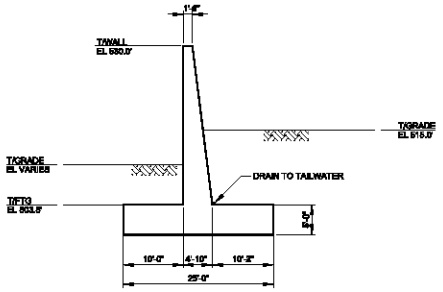
US Army Corps of Engineers
Fort Worth District

CDM

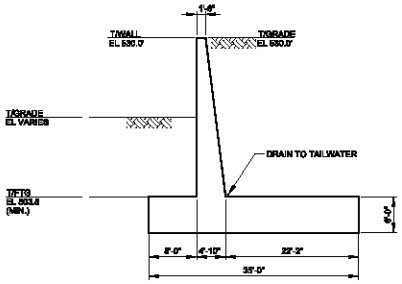
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
STABILITY ANALYSIS

SHEET IDENTIFICATION
SS-05

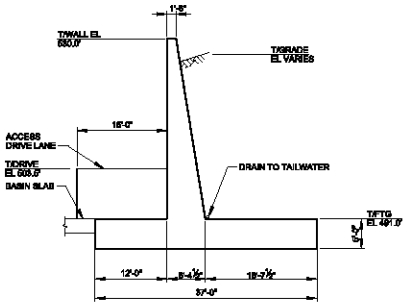
Office: FWDAD1 CDM07244 Date: Oct. 24, 2007 - 09:15:08 AM Username: File: N:\ed\50051_DOR_98-605\ed07.dgn



1 RIGHT TRAINING WALL AT LOCK
SS-03SS-06 1/8"=1'-0"



2 LEFT AND RIGHT TRAINING WALLS
SS-03SS-06 1/8"=1'-0"



3 RIGHT ABUTMENT WALL
SS-03SS-06 1/8"=1'-0"

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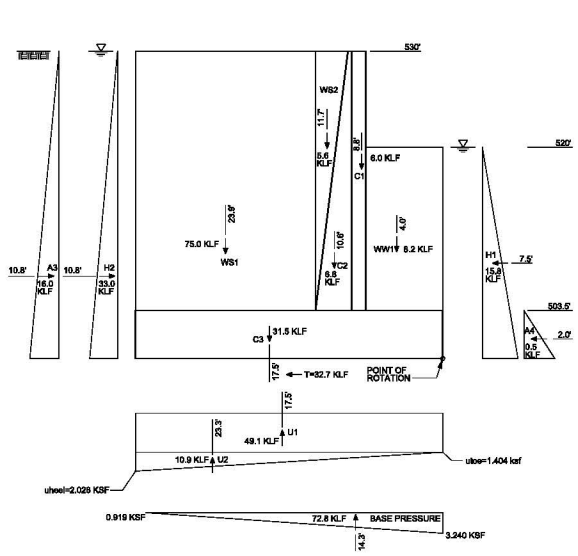
8' 2 8' 16'
1/8"=1'-0"

US Army Corps of Engineers
Fort Worth District

CDM

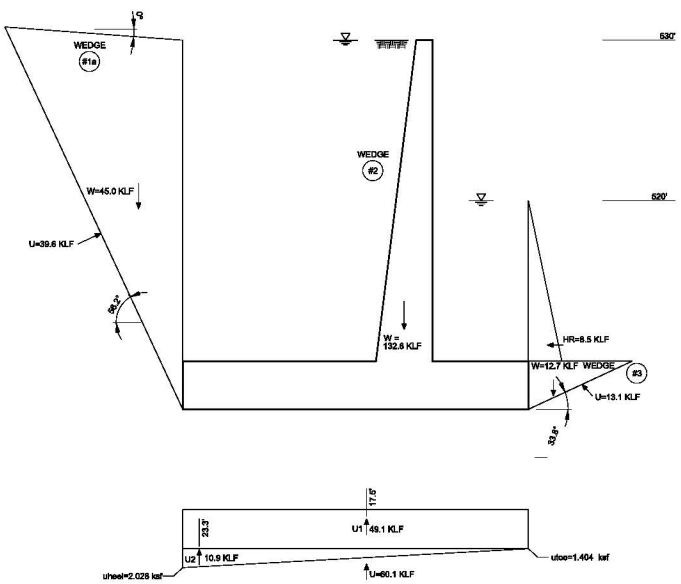
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
TRAINING WALLS AND RIGHT ABUTMENT WALL
DIMENSIONS

SHEET IDENTIFICATION
SS-06



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE



SLIDING STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY										
LOAD CASE	WATER @ HEEL	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF)		
								HEEL	TOE	FS
1(a)	530.0	520.0	32.7	0.0	72.8	3.25	100.0	0.919	3.240	13.73
1(b)	523.4	513.4	34.5	0.0	84.4	2.10	100.0	1.544	3.276	13.98
1(c)	516.8	506.8	35.0	0.0	95.9	1.14	100.0	2.205	3.246	14.31
1(d)	510.1	503.5	33.1	0.0	105.5	0.40	100.0	2.808	3.221	14.81
1(e)	503.5	503.5	31.2	0.0	113.1	-0.10	100.0	3.286	3.174	15.14

SLIDING ANALYSIS SUMMARY									
LOAD CASE	WATER @ HEEL	WATER @ TOE	DRIVING WEDGE		STRUCTURAL		RESISTING		FS SLIDE
			Φ	C (KSF)	Φ	C (KSF)	Φ	C (KSF)	
1(a)	530.0	520.0	32	0.0	32	0.0	32	0.0	1.51
1(b)	523.4	513.4	32	0.0	32	0.0	32	0.0	1.61
1(c)	516.8	506.8	32	0.0	32	0.0	32	0.0	1.73
1(d)	510.1	503.5	32	0.0	32	0.0	32	0.0	1.89
1(e)	503.5	503.5	32	0.0	32	0.0	32	0.0	2.03

SHEAR AND MOMENT ANALYSIS				
LOAD CASE	WALL		FOOTING	
	V_{MAX} (K/FT)	M_{MAX} (K-IN/FT)	V_{MAX} (K/FT)	M_{MAX} (K-IN/FT)
1(a)	24.1	2899	36.7	4164
1(b)	24.7	2654	46.4	5643
1(c)	23.9	2418	56.5	7183
1(d)	22.2	2293	65.2	8547
1(e)	21.5	2274	72.1	9640

LEGEND:

FX = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

I EXTREME INUNDATION FOLLOWED BY A RAPID DRAW DOWN EVENT. THE HEIGHT OF RETAINED WATER WAS ASSUMED TO BE 10-FT ABOVE THE WATER LEVEL AT THE TOE. THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS OVER THE HEEL RANGING FROM THE TOP OF WALL ELEVATION DOWN TO THE TOP OF FOOTING ELEVATION. ONLY THE MOST CRITICAL (WATER ELEVATION 530.0-FT) CASE, WITH RESPECT TO SLIDING, IS PRESENTED IN GRAPHICAL FORM.

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US Army Corps of Engineers
Fort Worth District

Symbol	Description	Date	Approved

Scale: 1in. = 10 FEET
Sheet Size: 22 x 34
Date: 10-Oct-2007
Drawn By: DAVID A. SCHMIDT
Checked By: DAVID A. SCHMIDT
Contract No.: W912EP-06-D-0002
Delivery Order: 0003
Contract Manager: TERRA

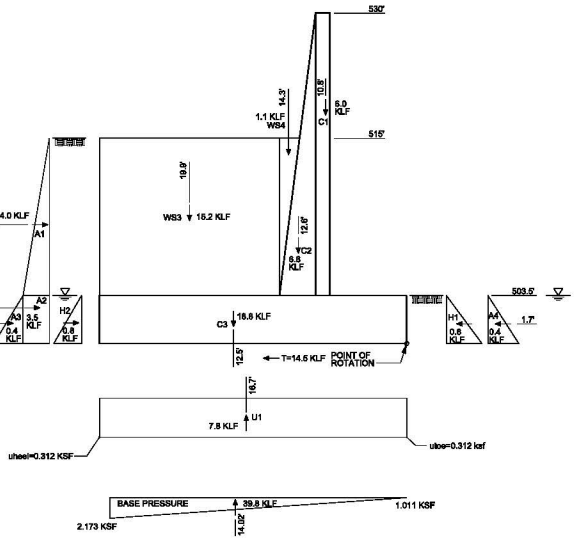
CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
RIGHT TRAINING WALL
STABILITY ANALYSIS

SHEET IDENTIFICATION

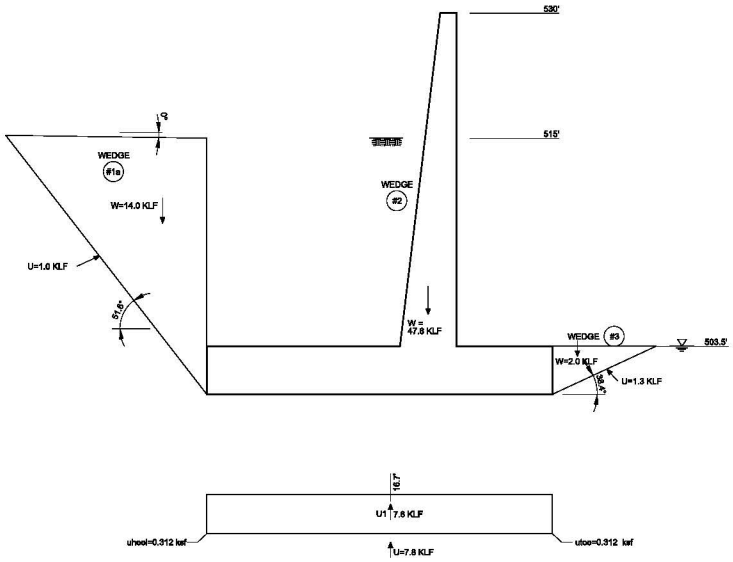
SS-07

Office: FWDAD1 CDM07244 Date: Oct. 24, 2007 - 05:00:34 PM Username: File: R:\M20001_DOF_06-007\ss06.dgn



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE



SLIDING STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY									
LOAD CASE	WATER @ HEEL	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF)	
								HEEL	TOE	FS
1(a)	530.0	530.0	3.8	0.0	26.4	-1.12	100.0	1.341	0.774	61.18
1(b)	523.4	523.4	3.8	0.0	27.2	-1.04	100.0	1.361	0.817	60.51
1(c)	516.8	516.8	3.8	0.0	28.4	-0.95	100.0	1.394	0.875	59.33
1(d)	510.1	510.1	5.9	0.0	33.4	-1.07	100.0	1.679	0.995	49.00
1(e)	503.5	503.5	7.6	0.0	39.8	-1.52	100.0	2.173	1.011	36.98

SLIDING ANALYSIS SUMMARY									
LOAD CASE	WATER @ HEEL	WATER @ TOE	DRIVING WEDGE		STRUCTURAL		RESISTING		FS SLIDE
			Φ	C (KSF)	Φ	C (KSF)	Φ	C (KSF)	
1(a)	530.0	530.0	32	0.0	32	0.0	32	0.0	5.55
1(b)	523.4	523.4	32	0.0	32	0.0	32	0.0	4.62
1(c)	516.8	516.8	32	0.0	32	0.0	32	0.0	3.75
1(d)	510.1	510.1	32	0.0	32	0.0	32	0.0	2.84
1(e)	503.5	503.5	32	0.0	32	0.0	32	0.0	2.66

SHEAR AND MOMENT ANALYSIS SUMMARY				
LOAD CASE	WALL		FOOTING	
	V_{MAX} (K-FT)	M_{MAX} (K-INFT)	V_{MAX} (K-FT)	M_{MAX} (K-INFT)
1(a)	2.0	93	12.5	787
1(b)	2.0	93	12.7	802
1(c)	2.0	93	13.1	824
1(d)	3.4	168	15.7	988
1(e)	4.0	186	19.7	1255

LEGEND:

FX = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

1 THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS RAGING FROM THE TOP OF WALL ELEVATION DOWN TO THE TOP OF FOOTING ELEVATION. ONLY THE MOST CRITICAL (WATER ELEVATION 503.5 FT) CASE WITH RESPECT TO SLIDING, IS PRESENTED IN GRAPHICAL FORM.

NOT FOR CONSTRUCTION

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US Army Corps of Engineers
Fort Worth District

Symbol	Description	Date

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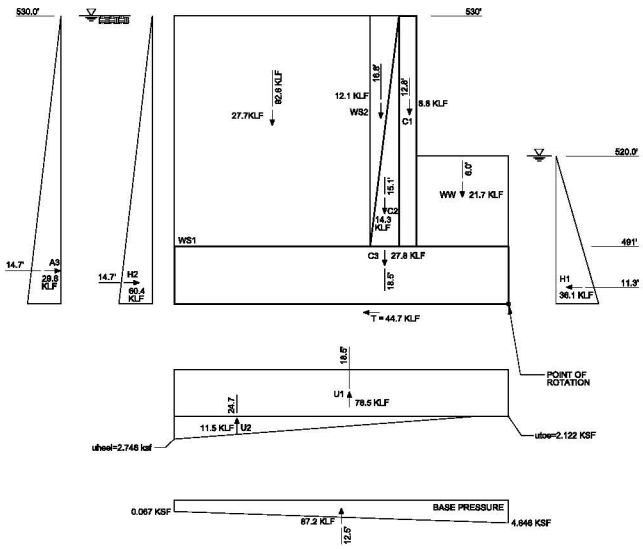
Date: 10-Oct-07
Drawn By: [illegible]
Checked By: [illegible]
Contract No.: W74RGG-05-D-0010
Delivery Order: 0003
Contract Number: 100004

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK DAM
LEFT TRAINING WALL
STABILITY ANALYSIS

SHEET IDENTIFICATION

SS-08



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY										
LOAD CASE	WATER @ HEEL	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF)		
								HEEL	TOE	FS
1(a)	530.0	520.0	53.9	0.0	87.2	5.99	100.0	0.067	4.646	4.47
1(b)	521.5	511.5	58.9	0.0	100.9	4.57	100.0	0.707	4.749	4.43
1(c)	513.0	503.0	61.7	0.0	114.7	3.20	100.0	1.493	4.705	4.53
1(d)	504.5	494.5	62.4	0.0	126.4	2.00	100.0	2.342	4.596	4.68
1(e)	496.0	491.0	60.0	0.0	140.0	1.16	100.0	3.074	4.494	4.83

SHEAR AND MOMENT ANALYSIS				
LOAD CASE	WALL		FOOTING	
	VMAX (K/FT)	MMAX (K-INFT)	VMAX (K/FT)	MMAX (K-INFT)
1(a)	44.5	7984	46.8	3587
1(b)	48.2	7982	49.1	3726
1(c)	49.7	7713	50.2	4229
1(d)	49.0	7401	54.2	5662
1(e)	46.9	7258	63.8	6895

LEGEND:

FX= SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

NOTE:

THE DAM AND BASIN ARE ASSUMED TO BE CAPABLE OF RESISTING THE NET SLIDING FORCE ON THE WALL.

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

I EXTREME INUNDATION FOLLOWED BY A RAPID DRAW DOWN EVENT. THE HEIGHT OF RETAINED WATER WAS ASSUMED TO BE 10-FT ABOVE THE WATER LEVEL AT THE TOE. THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS OVER THE HEEL, RANGING FROM THE TOP OF WALL ELEVATION DOWN TO THE TOP OF FOOTING ELEVATION. ONLY THE MORE CRITICAL (WATER ELEVATION 496.0-FT) CASE, WITH RESPECT TO SLIDING, IS PRESENTED IN GRAPHICAL FORM.

NOT FOR CONSTRUCTION

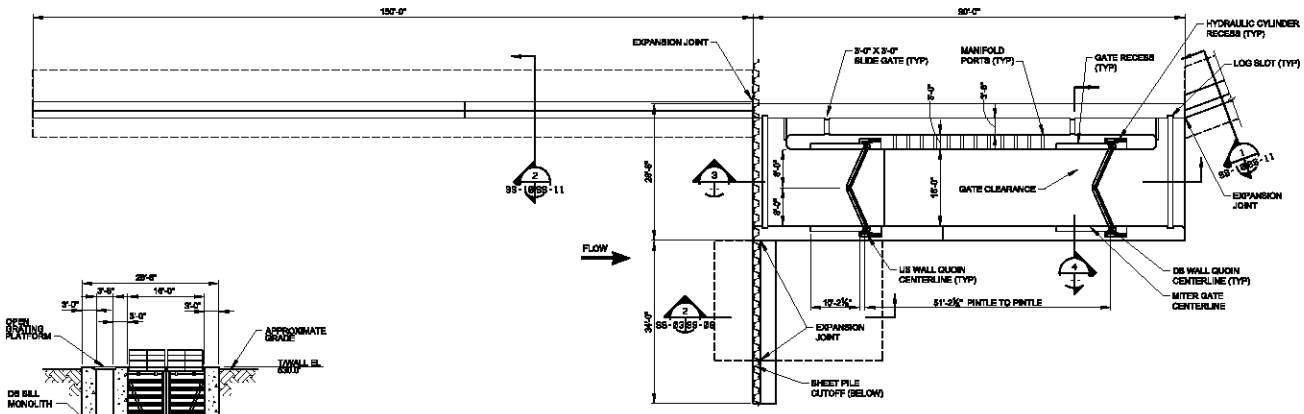
THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW UNDER THE AUTHORITY OF [illegible] DATE OCT 2007 IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

US Army Corps of Engineers
Fort Worth District

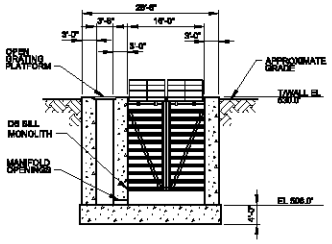
CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
RIGHT ABUTMENT WALL
STABILITY ANALYSIS

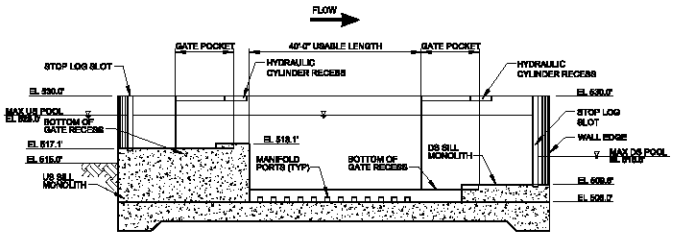
SHEET IDENTIFICATION
SS-09



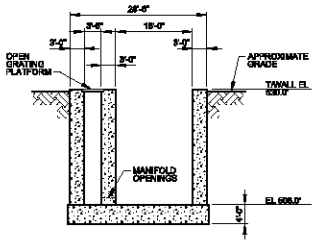
LOCK PLAN
1" = 18'



LOCK SECTION
1" = 18'



LOCK SECTION
1" = 18'



LOCK SECTION
1" = 18'

NOT FOR CONSTRUCTION

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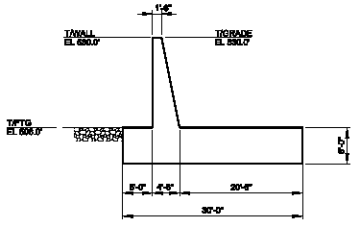
SCALE: 1" = 18'

US Army Corps of Engineers
Fort Worth District

CDM

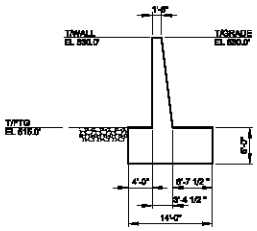
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
LOCK
PLAN AND SECTION

SHEET IDENTIFICATION
SS-10



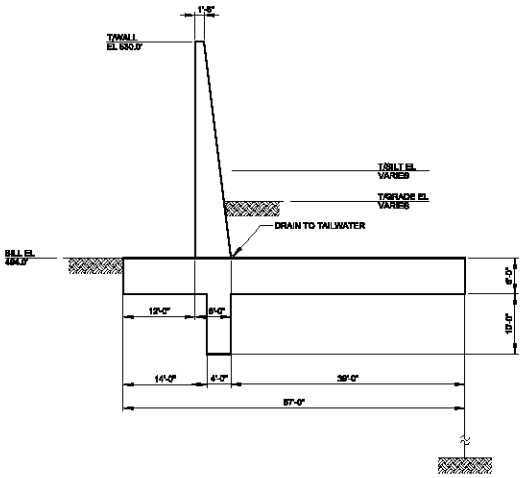
DOWNSTREAM TRAINING WALL AT LOCK

1 SS-10 SS-11 1/8"=1'-0"



LEFT TRAINING WALL AT LOCK

2 SS-10 SS-11 1/8"=1'-0"



FLOOD WALL

3 SS-10 SS-11 1/8"=1'-0"

NOT FOR CONSTRUCTION

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8' 4 0 8' 16'

1/8"=1'-0"

US Army Corps of Engineers
Fort Worth District

No.	Revision Description	Date
1		
2		
3		

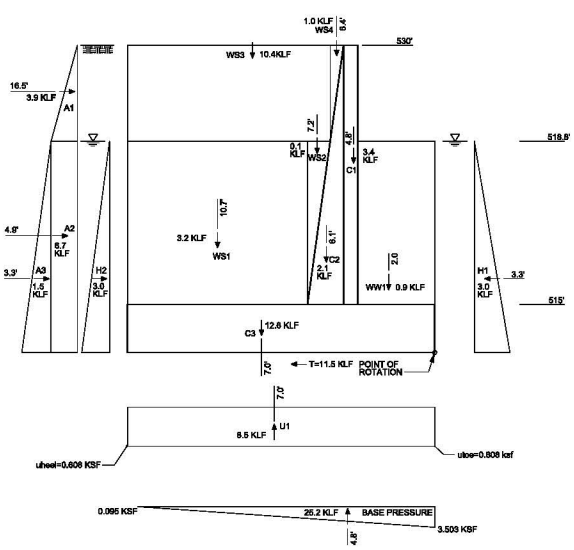
Sol No.	W912QR-07-R-0007
Sol Title	SAM-ELS
Sol Type	Design-Build
Project No.	2007
Contract No.	W912QR-08-C-0010
Contract Title	SAM-ELS
Contract Date	10/24/2007

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAM ELS AVENUE DAM
TRAINING WALLS AT LOCK AND FLOOD WALL
DIMENSIONS

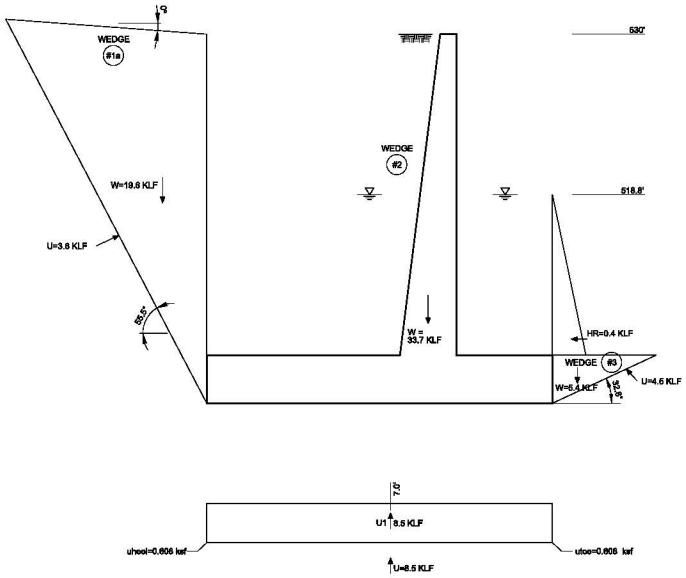
SHEET IDENTIFICATION

SS-11



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE



SLIDING STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY										
LOAD CASE	WATER @ HEEL	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF)		
								HEEL	TOE	FS
1(a)	530.0	530.0	6.2	0.0	17.9	1.56	100.0	0.426	2.137	14.41
1(b)	526.3	526.3	8.4	0.0	20.4	2.16	100.0	0.106	2.804	10.64
1(c)	522.5	522.5	10.1	0.0	22.8	2.32	100.0	0.011	3.242	9.34
1(d)	518.8	518.8	11.5	0.0	25.2	2.21	100.0	0.095	3.503	8.67
1(e)	515.0	515.0	12.4	0.0	27.6	1.97	100.0	0.306	3.635	8.39

SLIDING ANALYSIS SUMMARY										
LOAD CASE	WATER @ HEEL	WATER @ TOE	DRIVING WEDGE		STRUCTURAL		RESISTING		FS SLIDE
			Φ	C (KSF)	Φ	C (KSF)	Φ	C (KSF)	
1(a)	530.0	530.0	32	0.0	32	0.0	32	0.0	2.00
1(b)	526.3	526.3	32	0.0	32	0.0	32	0.0	1.77
1(c)	522.5	522.5	32	0.0	32	0.0	32	0.0	1.67
1(d)	518.8	518.8	32	0.0	32	0.0	32	0.0	1.63
1(e)	515.0	515.0	32	0.0	32	0.0	32	0.0	1.63

SHEAR AND MOMENT ANALYSIS				
LOAD CASE	WALL		FOOTING	
	VMAX (K/FT)	MMAX (K-IN/FT)	VMAX (K/FT)	MMAX (K-IN/FT)
1(a)	3.4	206	7.6	190
1(b)	4.9	325	9.7	244
1(c)	6.0	387	11.1	282
1(d)	6.7	409	12.1	305
1(e)	6.9	412	12.6	319

LEGEND:

FX = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

I THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS RANGING FROM THE RETAINED GRADE ELEVATION DOWN TO THE TOP OF FOOTING ELEVATION. ONLY THE MOST CRITICAL (WATER ELEVATION 518.8-FT) CASE, WITH RESPECT TO SLIDING, IS PRESENTED IN GRAPHICAL FORM.

NOT FOR CONSTRUCTION

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW REVISED UNDER THE AUTHORITY OF MICHAEL J. BOMAR, P.E. 71765 ON DATE: JANUARY 07, 2008

IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

US Army Corps of Engineers
Fort Worth District

Symbol	Date	Description

Scale: 1/4" = 1'-0"
Date: 12-Dec-07
Drawn by: CDM
Checked by: CDM
Approved by: CDM
Contract No.: W74RGG-05-D-0010
Delivery Order: 0003
Contract Manager: TERRA

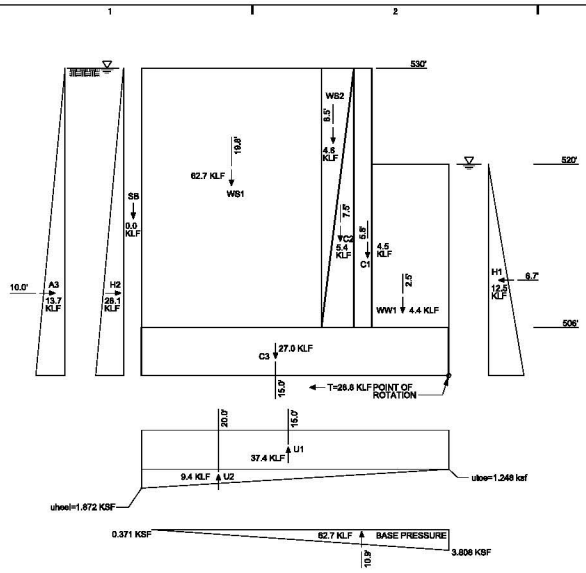
CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
UPSTREAM LOCKWALL
STABILITY ANALYSIS

SHEET IDENTIFICATION

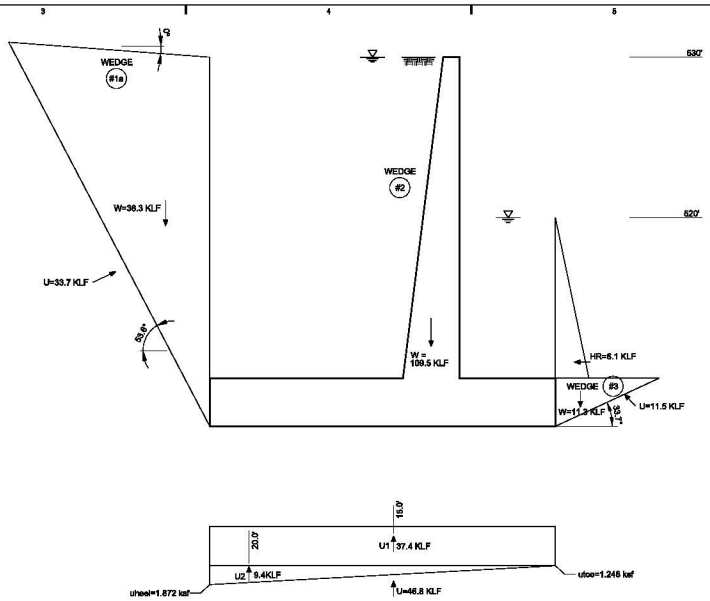
SS-12

Office: FWDAD1 CDM07244 Date: Dec 24, 2007 - 04:12:53 PM Username: Files: R:\M20001_DOF_98-419\e54.dgn



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE



SLIDING STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY										
LOAD CASE	WATER @ HEEL	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF)		
								HEEL	TOE	FS
1(a)	530.0	520.0	28.8	0.0	62.7	4.11	100.0	0.371	3.808	11.37
1(b)	526.3	516.3	29.6	0.0	68.4	3.44	100.0	0.710	3.847	11.48
1(c)	516.3	516.3	22.8	0.0	78.3	1.42	100.0	1.866	3.352	13.96
1(d)	511.3	511.3	25.0	0.0	86.7	1.22	100.0	2.185	3.592	13.10
1(e)	506.0	506.0	26.4	0.0	95.2	0.94	100.0	2.575	3.773	12.57

SLIDING ANALYSIS SUMMARY									
LOAD CASE	WATER @ HEEL	WATER @ TOE	DRIVING WEDGE		STRUCTURAL		RESISTING		FS SLIDE
			Φ	C (KSF)	Φ	C (KSF)	Φ	C (KSF)	
1(a)	530.0	520.0	32	0.0	32	0.0	32	0.0	1.50
1(b)	526.3	516.3	32	0.0	32	0.0	32	0.0	1.56
1(c)	516.3	516.3	32	0.0	32	0.0	32	0.0	1.98
1(d)	511.3	511.3	32	0.0	32	0.0	32	0.0	1.99
1(e)	506.0	506.0	32	0.0	32	0.0	32	0.0	2.03

SHEAR AND MOMENT ANALYSIS				
LOAD CASE	WALL		FOOTING	
	Vmax (K/FT)	Mmax (K-IN/FT)	Vmax (K/FT)	Mmax (K-IN/FT)
1(a)	20.7	2228	31.7	2910
1(b)	20.9	2094	36.5	3591
1(c)	15.9	1619	48.7	5558
1(d)	17.2	1690	54.7	6318
1(e)	17.6	1690	61.2	7180

LEGEND:

FX = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

I EXTREME INUNDATION FOLLOWED BY A RAPID DRAW DOWN EVENT. THE HEIGHT OF RETAINED WATER WAS ASSUMED TO BE 10-FT ABOVE THE WATER LEVEL AT THE TOE. THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS RANGING FROM THE RETAINED GRADE ELEVATION DOWN TO THE TOP OF THE CREST (ELEVATION 518.0'). ONLY THE MOST CRITICAL (WATER ELEVATION OVER HEEL AT 520.0-FT) CASE, WITH RESPECT TO SLIDING, IS PRESENTED IN GRAPHICAL FORM.

NOT FOR CONSTRUCTION

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW UNDER THE AUTHORITY OF [illegible] DATED [illegible] 2007. IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

US Army Corps of Engineers
Fort Worth District

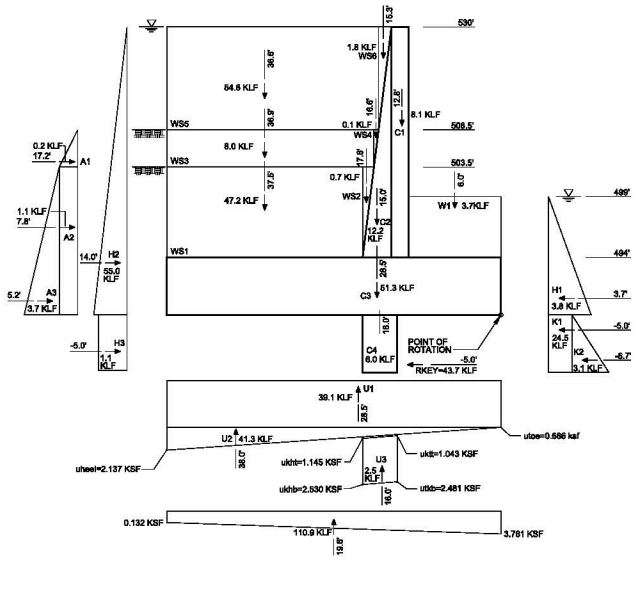
CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
DOWNSTREAM LOCKWALL
STABILITY ANALYSIS

SHEET IDENTIFICATION

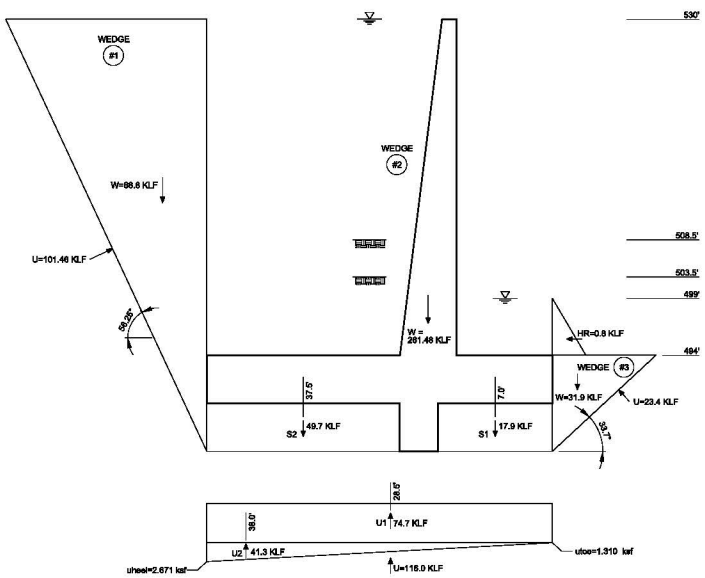
SS-13

Office: FWDAD1 CDM07244 Date: Oct. 24, 2007 - 04:14:07 PM Username: Files: N:\ut20001_DOF_98-419\ss05.dgn



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE



SLIDING STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY									
LOAD CASE	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF)		
							HEEL	TOE	FS
1(a)	515.0	9.0	0.0	87.4	8.74	100.0	0.122	2.943	9.65
1(b)	510.0	17.1	0.0	94.7	9.24	100.0	0.046	3.278	8.63
1(c)	505.0	23.5	0.0	102.1	9.25	100.0	0.047	3.535	8.00
1(d)	500.0	28.4	0.0	109.5	8.94	100.0	0.112	3.729	7.61
1(e)	499.0	29.2	0.0	110.9	8.86	100.0	0.132	3.761	7.55

SLIDING ANALYSIS SUMMARY									
LOAD CASE	WATER @ TOE	DRIVING WEDGE (#1)		STRUCTURAL WEDGE (#2)		RESISTING WEDGE (#3)		FS SLIDE
		Φ	C (KSF)	Φ	C (KSF)	Φ	C (KSF)	
1(a)	515.0	32	0.0	32	0.0	32	0.0	2.06
1(b)	510.0	32	0.0	32	0.0	32	0.0	1.78
1(c)	505.0	32	0.0	32	0.0	32	0.0	1.62
1(d)	500.0	32	0.0	32	0.0	32	0.0	1.52
1(e)	499.0	32	0.0	32	0.0	32	0.0	1.51

SHEAR AND MOMENT ANALYSIS				
LOAD CASE	WALL		FOOTING	
	VMAX (K/FT)	MMAX (K-IN/FT)	VMAX (K/FT)	MMAX (K-IN/FT)
1(a)	28.9	4782	42.4	6985
1(b)	34.7	5427	44.9	7145
1(c)	38.9	5772	48.4	7691
1(d)	41.6	5911	52.6	8552
1(e)	41.9	5823	53.6	8755

LEGEND:

FX= SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

I EXTREME INUNDATION FOLLOWED BY A RAPID DRAW DOWN EVENT. THE HEIGHT OF RETAINED WATER WAS ASSUMED TO BE AT ELEVATION 530.0 FT. THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS OVER THE TOE RANGING FROM THE TOP OF WALL ELEVATION DOWN TO THE TOP OF FOOTING ELEVATION. ONLY THE MOST CRITICAL (WATER ELEVATION 499.0 FT) CASE, WITH RESPECT TO SLIDING, IS PRESENTED IN GRAPHICAL FORM.

NOT FOR CONSTRUCTION

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW REVISED UNDER THE AUTHORITY OF DAVID A. PETERSON, P.E. 72346 ON DATE: JANUARY 07, 2008 IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

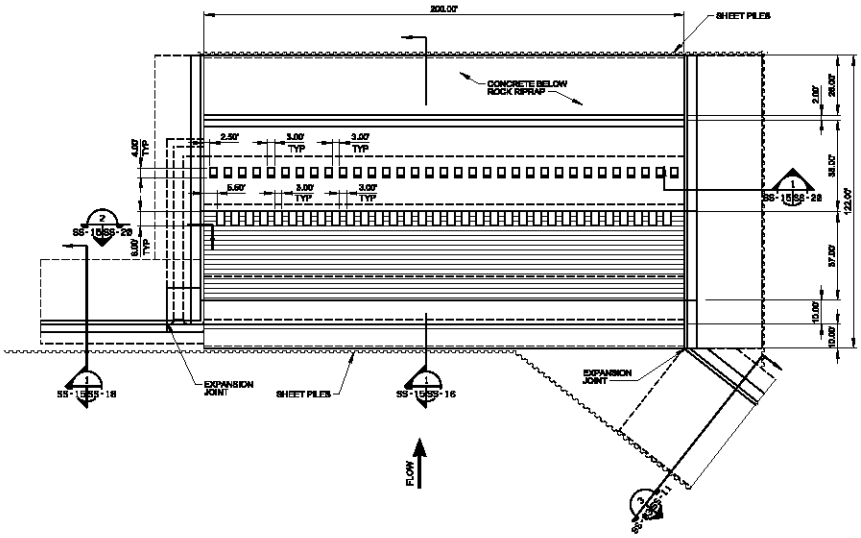
US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
SAMUELS AVENUE DAM
FLOODWALL
STABILITY ANALYSIS

SHEET IDENTIFICATION

SS-14



MARINE CREEK DAM PLAN
1" = 28'

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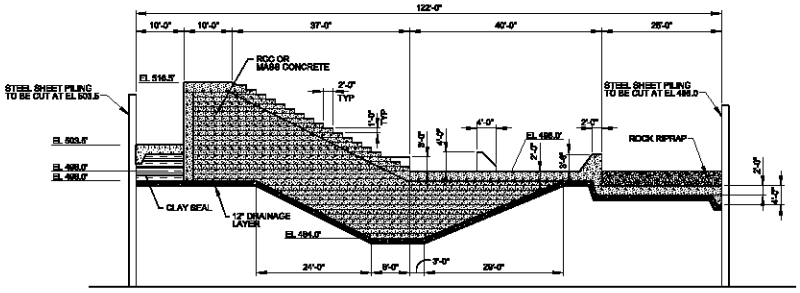
0 12' 24' 48'
SCALE: 1" = 28'

US Army Corps of Engineers
Fort Worth District

CDM

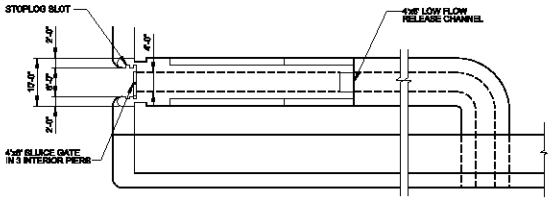
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK DAM
PLAN

SHEET IDENTIFICATION
SS-15



SECTION

SS-15 SS-16 1"=10'



PLAN OF LOW FLOW PIER

SS-15 SS-16 1"=5'

NOT FOR CONSTRUCTION

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SCALE: 1" = 5'

SCALE: 1" = 10'

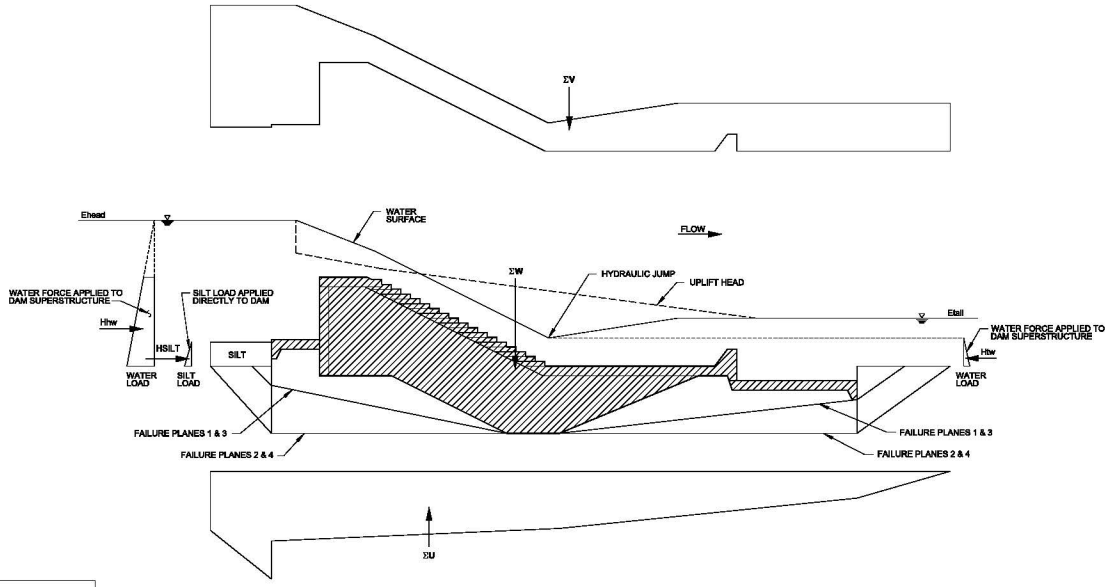
US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK DAM
SECTION

SHEET IDENTIFICATION

SS-16



STABILITY ANALYSIS

1" = 10'

Marine Creek Dam Schedule

Load Case		E_{head} (ft-MSL)	E_{tail} (ft-MSL)	Req'd FS (Sliding)	Failure Plane	General Wedge Theory: Summation of Vertical Loads (kif) ΣW	ΣV	ΣU	Summation of Lateral ΣH$_L$	ΣH$_W$	FS
1	Normal Pool	516.5	499	2	1	236.2	22.5	125.4	10.9	0.0	2.5
					2	288.6	34.6	168.2	10.9	0.0	4.1
					3	288.6	23.3	151.6	10.9	0.0	3.2
					4	341.8	35.6	194.5	10.9	0.0	5.0
2	10-yr	522.6	510	2	1	236.3	73.9	206.1	18.0	0.0	1.9
					2	288.3	88.5	253.1	18.0	0.0	3.0
					3	290.3	82.1	241.7	18.0	0.0	2.7
					4	341.9	97.1	288.8	18.0	0.0	4.0
3	50-yr	524.8	513	1.7	1	236.6	87.0	229.6	20.5	0.0	1.7
					2	287.9	102.4	278.0	20.5	0.0	2.6
					3	290.8	97.6	268.1	20.5	0.0	2.4
					4	342.0	113.2	316.4	20.5	0.0	3.5
4	100-yr	525.7	515	1.7	1	236.6	102.2	243.7	21.5	0.0	1.7
					2	287.9	118.3	292.8	21.5	0.0	2.7
					3	290.5	114.0	283.8	21.5	0.0	2.5
					4	341.8	130.4	333.0	21.5	0.0	3.5
5	500-yr	526.9	517	1.3	1	236.2	119.5	258.6	22.9	0.1	1.6
					2	288.2	136.2	308.6	22.9	0.1	2.6
					3	290.5	132.7	300.4	22.9	0.1	2.5
					4	342.0	149.5	350.4	22.9	0.1	3.5
6	Extreme	530	521	1.3	1	236.7	133.2	280.8	26.5	0.3	1.4
					2	287.4	150.1	342.3	26.5	0.3	2.1
					3	291.3	149.5	336.4	26.5	0.3	2.1
					4	342.0	167.0	388.1	26.5	0.3	3.0

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0 10' 20'

SCALE: 1" = 10'

US Army Corps of Engineers
Fort Worth District

Symbol	Date	Description

Scale: 1" = 10'
Date: [illegible]
Drawn by: [illegible]
Checked by: [illegible]
Approved by: [illegible]
Contract No.: [illegible]
Date Approved: [illegible]
Contract Number: [illegible]

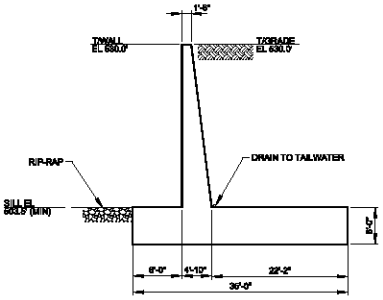
CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK DAM
STABILITY ANALYSIS

SHEET IDENTIFICATION

SS-17

Office: FWDAD1 CDM07244 Date: Oct. 24, 2007 - 09:17:27 AM Username: File: N:\d200001_DOF_06-417\e06.dgn



1 TRAINING WALL
SS-18 1/8"=1'-0"

NOT FOR CONSTRUCTION

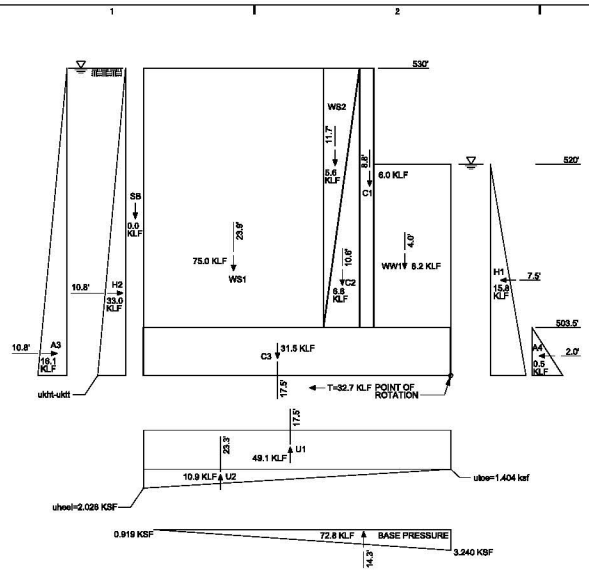
1/8"=1'-0"

US Army Corps of Engineers
Fort Worth District

CDM

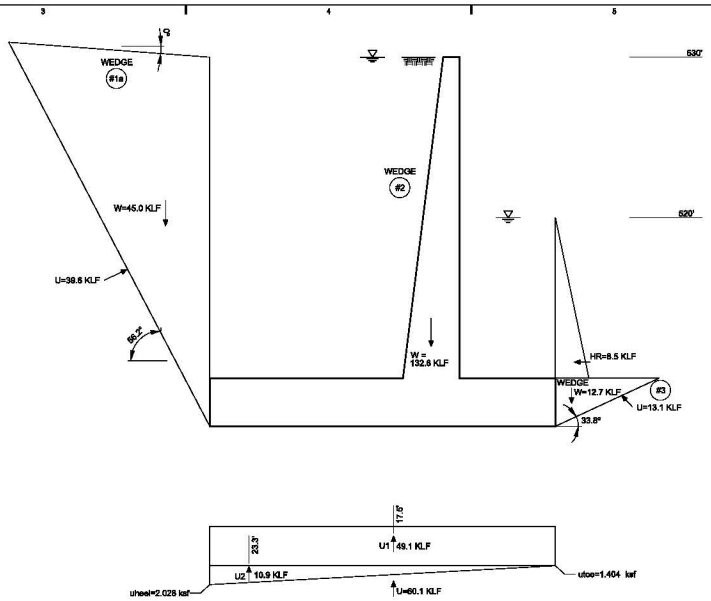
POST WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK
LEFT TRAINING WALL
DIMENSIONS

SHEET IDENTIFICATION
SS-18



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE



SLIDING STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY										
LOAD CASE	WATER @ HEEL	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF)		
								HEEL	TOE	FS
1(a)	530.0	520.0	32.7	0.0	72.8	3.25	100.0	0.919	3.240	13.73
1(b)	523.4	513.4	34.5	0.0	84.4	2.10	100.0	1.544	3.276	13.98
1(c)	516.8	506.8	35.0	0.0	95.9	1.14	100.0	2.205	3.246	14.31
1(d)	510.1	503.5	33.1	0.0	105.5	0.40	100.0	2.806	3.221	14.81
1(e)	503.5	503.5	31.2	0.0	113.1	-0.10	100.0	3.288	3.174	15.14

SLIDING ANALYSIS SUMMARY									
LOAD CASE	WATER @ HEEL	WATER @ TOE	DRIVING WEDGE		STRUCTURAL		RESISTING		FS SLIDE
			Φ	C (KSF)	Φ	C (KSF)	Φ	C (KSF)	
1(a)	530.0	520.0	32	0.0	32	0.0	32	0.0	1.51
1(b)	523.4	513.4	32	0.0	32	0.0	32	0.0	1.61
1(c)	516.8	506.8	32	0.0	32	0.0	32	0.0	1.73
1(d)	510.1	503.5	32	0.0	32	0.0	32	0.0	1.89
1(e)	503.5	503.5	32	0.0	32	0.0	32	0.0	2.03

SHEAR AND MOMENT ANALYSIS				
LOAD CASE	WALL		FOOTING	
	V_{MAX} (K/FT)	M_{MAX} (K-IN/FT)	V_{MAX} (K/FT)	M_{MAX} (K-IN/FT)
1(a)	24.1	2899	38.7	4164
1(b)	24.7	2654	46.4	5643
1(c)	23.9	2418	56.5	7183
1(d)	22.2	2293	65.2	8547
1(e)	21.5	2274	72.1	9640

LEGEND:

FX = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

I EXTREME INUNDATION FOLLOWED BY A RAPID DRAW DOWN EVENT. THE HEIGHT OF RETAINED WATER WAS ASSUMED TO BE 10-FT ABOVE THE WATER LEVEL AT THE TOE. THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS OVER THE HEEL RANGING FROM THE TOP OF WALL ELEVATION DOWN TO THE TOP OF FOOTING ELEVATION. ONLY THE MOST CRITICAL (WATER ELEVATION 530.0-FT) CASE, WITH RESPECT TO SLIDING, IS PRESENTED IN GRAPHICAL FORM.

NOT FOR CONSTRUCTION

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW REVISED UNDER THE AUTHORITY OF DAVID A. BOWLES, P.E. TEXAS NO. 83921 DATE: OCT. 2007

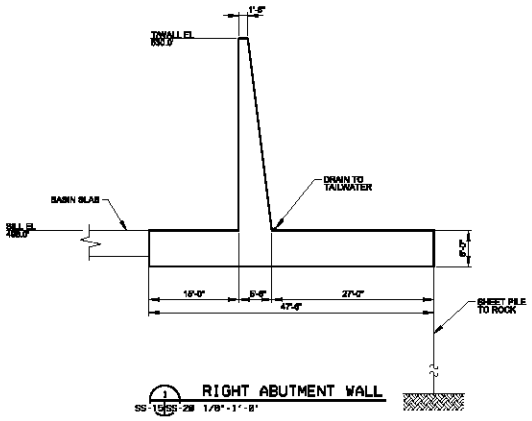
US Army Corps of Engineers
Fort Worth District

CDM

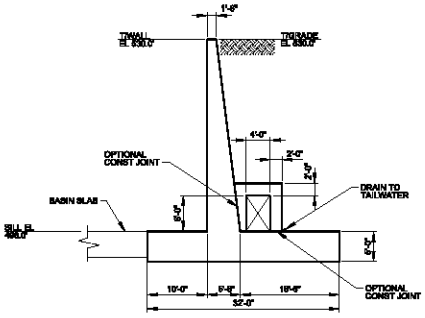
FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK DAM
LEFT TRAINING WALL
STABILITY ANALYSIS

SHEET IDENTIFICATION

SS-19



1 RIGHT ABUTMENT WALL
SS-19 SS-20 1/8"=1'-0"



2 LEFT ABUTMENT WALL
SS-19 SS-20 1/8"=1'-0"

NOT FOR CONSTRUCTION

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW UNDER THE AUTHORITY OF BRENT A. WHITE, DATED 10 JUNE 2022. IT IS NOT TO BE USED FOR CONSTRUCTION UNTIL IT IS FINALLY APPROVED.

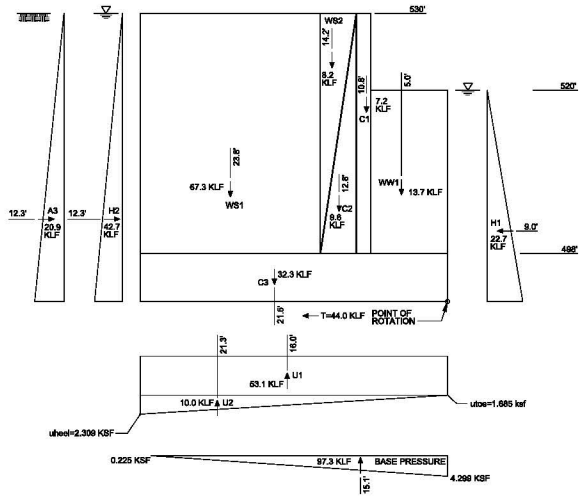
8' 2 8' 16'
1/8"=1'-0"

US Army Corps of Engineers
Fort Worth District

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK
ABUTMENT WALLS
DIMENSIONS

SHEET IDENTIFICATION
SS-20



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY

LOAD CASE	WATER @ HEEL	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF) HEEL	TOE	FS
1(a)	530.0	520.0	40.9	0.0	66.1	5.23	100.0	0.040	4.092	5.55
1(b)	522.0	512.0	44.0	0.0	77.5	3.64	100.0	0.767	4.076	5.69
1(c)	514.0	504.0	45.1	0.0	88.9	2.28	100.0	1.592	3.962	5.97
1(d)	506.0	498.0	43.7	0.0	99.4	1.24	100.0	2.388	3.828	6.26
1(e)	498.0	498.0	41.4	0.0	107.6	0.62	100.0	2.977	3.759	6.43

SHEAR AND MOMENT ANALYSIS

LOAD CASE	WALL V_{MAX} (K/FT)	WALL M_{MAX} (K-IN/FT)	FOOTING V_{MAX} (K/FT)	FOOTING M_{MAX} (K-IN/FT)
1(a)	32.5	4763	34.8	2202
1(b)	34.3	4543	35.6	2239
1(c)	34.2	4239	36.4	3266
1(d)	32.3	4038	45.5	4305
1(e)	31.3	4005	52.5	5082

LEGEND:

FX = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

NOTE:

THE DAM AND BASIN ARE ASSUMED TO BE CAPABLE OF RESISTING THE NET SLIDING FORCE ON THE WALL.

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

I EXTREME INUNDATION FOLLOWED BY A RAPID DRAW DOWN EVENT. THE HEIGHT OF RETAINED WATER WAS ASSUMED TO BE 10-FT ABOVE THE WATER LEVEL AT THE TOE. THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS OVER THE HEEL RANGING FROM THE TOP OF WALL ELEVATION DOWN TO THE TOP OF FOOTING ELEVATION. ONLY THE MOST CRITICAL (WATER ELEVATION OVER HEEL AT 530.0-FT) CASE, WITH RESPECT TO ROTATION, IS PRESENTED IN GRAPHICAL FORM.

NOT FOR CONSTRUCTION

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW UNDER THE AUTHORITY OF [illegible] DATED [illegible] 2007 IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

US Army Corps of Engineers
Fort Worth District

Symbol	Description	Date

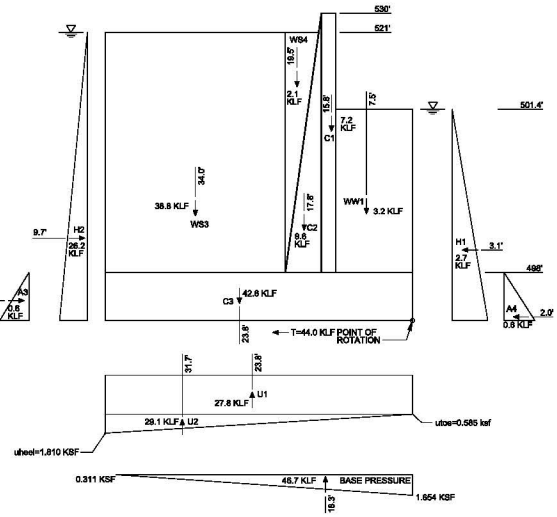
Sol. No. W912QR-07-B-0210
Dwg. No. [illegible]
Sheet No. [illegible]
Date Prepared [illegible]
Drawn By [illegible]
Checked By [illegible]
Date Reviewed [illegible]
Date Approved [illegible]

CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK DAM
LEFT ABUTMENT WALL
STABILITY ANALYSIS

SHEET IDENTIFICATION

SS-21



ROTATIONAL STABILITY ANALYSIS

NOT TO SCALE

ROTATIONAL ANALYSIS SUMMARY										
LOAD CASE	WATER @ HEEL	WATER @ TOE	FX TOTAL (KLF)	FY TOTAL (KLF)	FZ TOTAL (KLF)	e (FT)	BASE IN COMPRESSION (%)	BEARING PRESSURE (KSF)		
								HEEL	TOE	FS
1(a)	521.0	501.4	29.0	0.0	46.7	5.41	100.0	0.311	1.654	3.20

SHEAR AND MOMENT ANALYSIS				
LOAD CASE	WALL		FOOTING	
	Vmax (K/FT)	Mmax (K-IN/FT)	Vmax (K/FT)	Mmax (K-IN/FT)
1(a)	16.2	1514	21.6	2472

LEGEND:

FX = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL X DIRECTION (POSITIVE TOWARD CHANNEL) CONSIDERING ANY UPLIFT EFFECTS BUT WITHOUT SHEAR KEY RESISTANCE.

FY = SUM OF ALL HORIZONTAL FORCES IN THE GLOBAL Y DIRECTION CONSIDERING ANY UPLIFT EFFECTS

FZ = SUM OF ALL VERTICAL FORCES IN THE GLOBAL Z DIRECTION (POSITIVE DOWNWARD) CONSIDERING ANY UPLIFT EFFECTS

e = DISTANCE BETWEEN RESULTANT AND CENTROID OF BASE CONSIDERING ANY UPLIFT EFFECTS

NOTE:

THE DAM AND BASIN ARE ASSUMED TO BE CAPABLE OF RESISTING THE NET SLIDING FORCE ON THE WALL.

DESIGN PARAMETERS:

WATER = 0.0625 KCF
CONCRETE = 0.150 KCF
WIND = NOT CONSIDERED
SEISMIC = NOT CONSIDERED

WALL LOADS DUE TO SOIL:
ABOVE WATER TABLE = 0.065
KSF/FT BELOW WATER TABLE = 0.0325 KSF/FT

LOADING CONDITIONS:

I EXTREME INUNDATION FOLLOWED BY A RAPID DRAW DOWN EVENT. THE HEIGHT OF RETAINED WATER WAS ASSUMED TO BE 10-FT ABOVE THE WATER LEVEL AT THE TOE. THE ANALYSIS WAS RUN FOR A SERIES OF WATER ELEVATIONS OVER THE HEEL RANGING FROM THE TOP OF WALL ELEVATION DOWN TO THE TOP OF FOOTING ELEVATION. ONLY THE MOST CRITICAL (WATER ELEVATION OVER HEEL AT 522.0-FT) CASE, WITH RESPECT TO ROTATION, IS PRESENTED IN GRAPHICAL FORM.

NOT FOR CONSTRUCTION

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US Army Corps of Engineers
Fort Worth District

Symbol	Description	Date

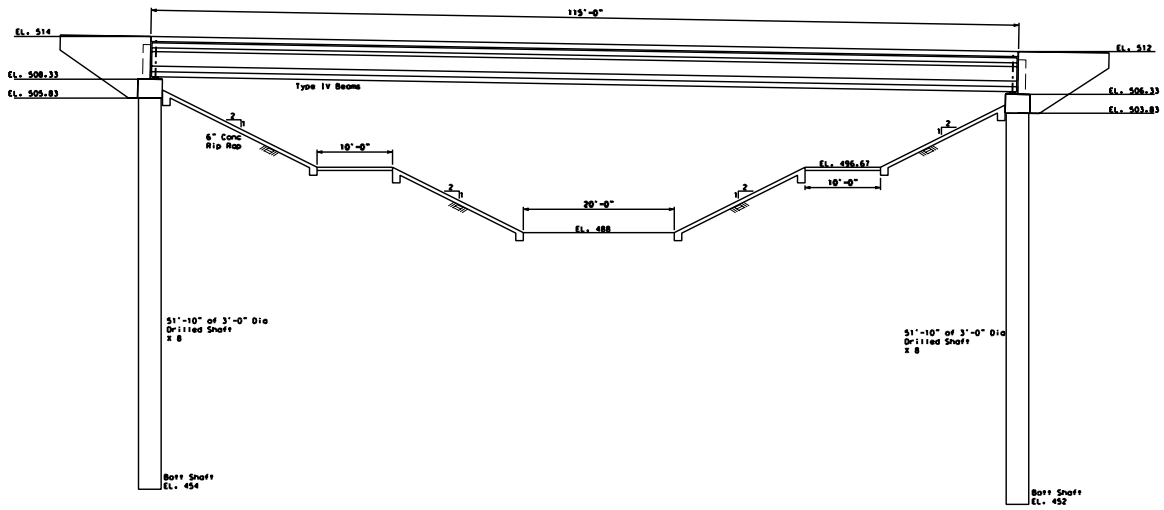
CDM

FORT WORTH CENTRAL CITY
PRELIMINARY DESIGN - SUPPLEMENT
MARINE CREEK DAM
RIGHT ABUTMENT WALL
STABILITY ANALYSIS

SHEET IDENTIFICATION

SS-22

Office: FWDAD1 CDM07244 Date: Oct. 24, 2007 - 04:18:04 PM Username: File: R:\a020051_DOF_98-623\ss04.dgn



NOTE:

REFERENCE DRAWING IS FROM THE REPORT ENTITLED:
"RIVERSIDE OXBOW, FROM THE INTERIM FEASIBILITY STUDY AND INTEGRATED ENVIRONMENTAL ASSESSMENT (APRIL 2005)"
DRAWING IS NOT TO SCALE.

1" = 5'

ENGINEERING DIVISION CIVIL DESIGN BRANCH	U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS		
DESIGNED BY: K. LEY	TRINITY RIVER BASIN, TEXAS RIVERSIDE OXBOW FORT WORTH, TEXAS		
DRAWN BY: K. LEY	BEACH STREET ELEVATION		
REVIEWED BY: K. SHARPE			
SUBMITTED BY: WILLIAM A. WALLACE, P.E. CHIEF, STRUCTURE SECTION	SOL. NO.	DATED:	
	CONTR. NO.		PLATE
	DRAWING NUMBER RS-01	SHEET NO. 51 OF	

CADD FILE NAME: stw.dgn

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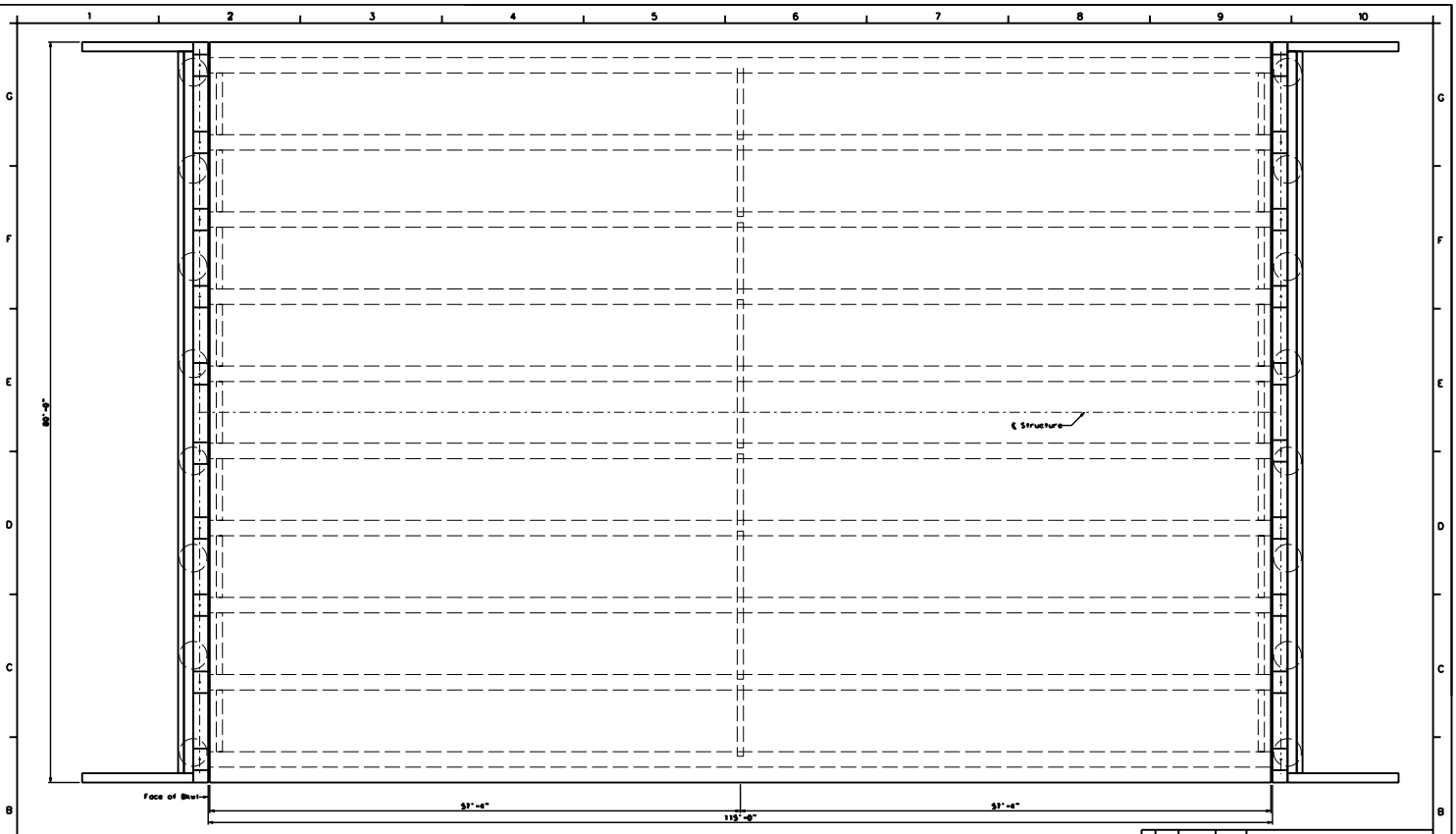

NOTE:

REFERENCE DRAWING IS FROM THE REPORT ENTITLED:
"RIVERSIDE OXBOW, FROM THE INTERIM FEASIBILITY STUDY AND INTEGRATED ENVIRONMENTAL ASSESSMENT (APRIL 2005)"
DRAWING IS NOT TO SCALE.

1" = 6'

REFERENCE FILE NAME	REFERENCE FILE DESCRIPTION

SUBMITTED BY:	WILLIAM A. WALLACE, P.E. CHIEF, STRUCTURE SECTION	SOL. NO.	DATED:
		CONTR. NO.	PLATE
		DRAWING NUMBER RS-02	SHEET NO. 52 OF

ENGINEERING DIVISION
CIVIL DESIGN BRANCH

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY: K. LEY
DRAWN BY: K. LEY
REVIEWED BY: W. SHARPE

TRINITY RIVER BASIN, TEXAS
RIVERSIDE OXBOW
FORT WORTH, TEXAS

BEACH STREET
PLAN

CADD FILE NAME: plan.dgn

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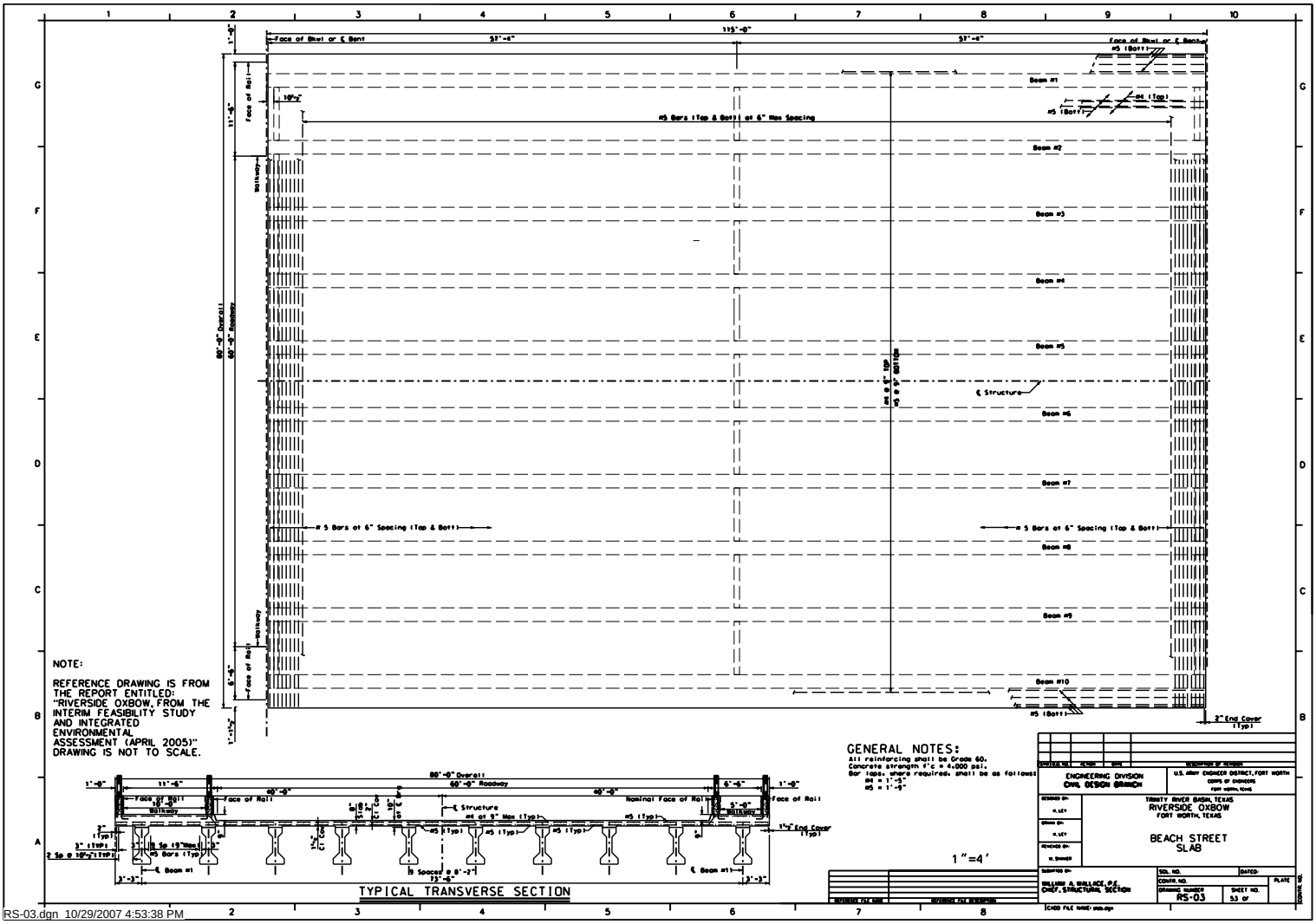

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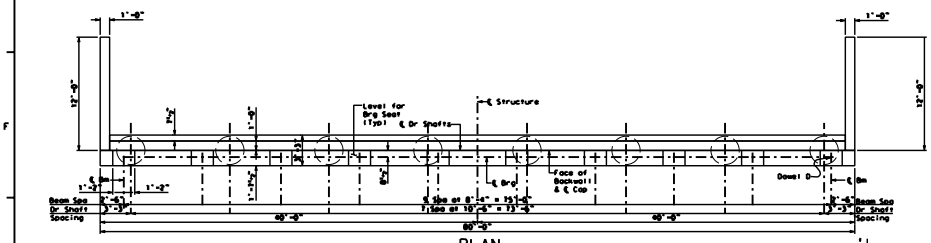
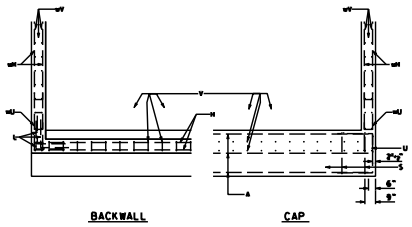
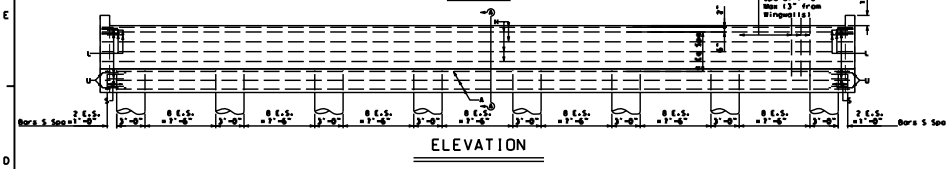
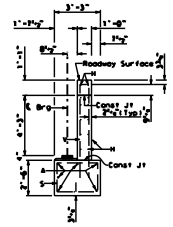
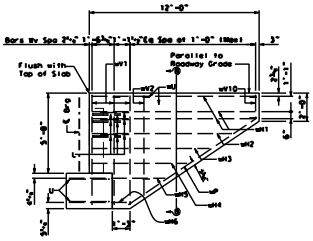


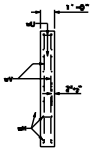


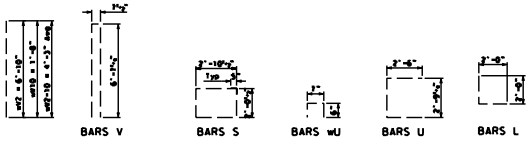


GENERAL NOTES:
Concrete strength f'c = 3,600 psi
All cap and wall reinforcing shall be Grade 60









NOTE:

REFERENCE DRAWING IS FROM THE REPORT ENTITLED:
"RIVERSIDE OXBOW, FROM THE INTERIM FEASIBILITY STUDY AND INTEGRATED ENVIRONMENTAL ASSESSMENT (APRIL 2005)"
DRAWING IS NOT TO SCALE.

SCALE: 1" = 4'

ENGINEERING DIVISION
CIVIL DESIGN BRANCH

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

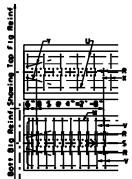
TRINITY RIVER BASIN, TEXAS
RIVERSIDE OXBOW
FORT WORTH, TEXAS

BEACH STREET
ABUTMENT

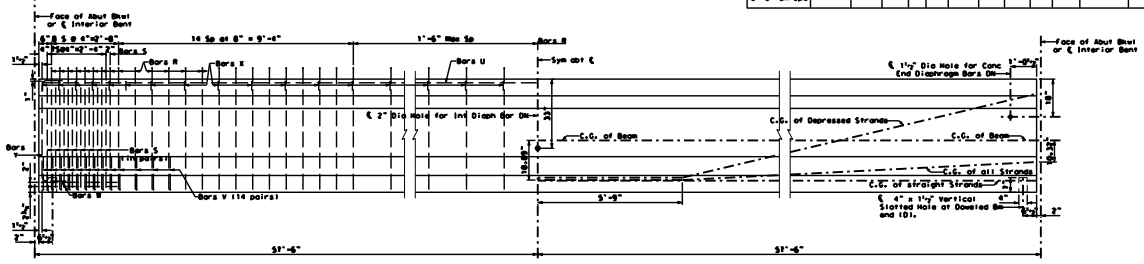
WILLIAM A. WALLACE, P.E.
CHIEF, STRUCTURE SECTION

DRAWING NUMBER RS-04
SHEET NO. 54 OF

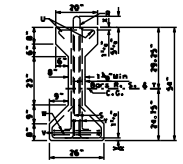
RS-04.dgn 10/29/2007 4:53:48 PM



	SPAN LENGTH (ft)	BEAM TYPE		PRESTRESSING STRANDS						CONCRETE	
				TOTAL				DEPRESSED		RELEASE STRGTH	MINIMUM 28 DAY COMP STRGTH
				NO.	SIZE (in)	STRGTH f's (ksi)	"e" ℄ (in)	"e" END (in)	NO.	TO (in)	f'ci (psi)	f'c (psi)
Type C Beams 60' Rdwy 8" Slab 8'-3" Bm Spa	115	IV		56	1/2	270K	18.89	10.32	12	52.0	6505	7065

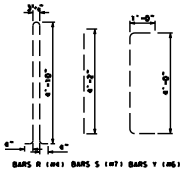


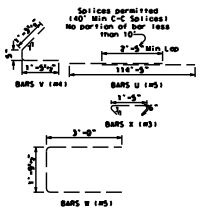
ELEVATION OF BEAM



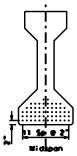
TYPE IV BEAM

AREA 788.4 in²
I 260,403 in⁴
Wt 821 Lb./LF

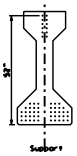




GENERAL NOTES:
Designed in accordance with current AASHTO Standard Specifications.
All concrete shall be Class H. All reinforcing bars shall be Grade 60.
Bottom corners of all beam flanges and outside corners of exterior beam ends shall be chamfered ¾" or rounded to a 1½" radius.
Prestress losses for the designed beam have been calculated for a relative humidity of 60 percent.
Strands for the designed beam shall be ½" 270 ksi low relaxation strands pretensioned to 31.0 k each.



TYPE IV BM



TYPE IV BM

NOTE:

REFERENCE DRAWING IS FROM THE REPORT ENTITLED:
"RIVERSIDE OXBOW, FROM THE INTERIM FEASIBILITY STUDY AND INTEGRATED ENVIRONMENTAL ASSESSMENT (APRIL 2005)"
DRAWING IS NOT TO SCALE.

1" = 1½"

ENGINEERING DIVISION CIVIL DESIGN BRANCH	U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS
DESIGNED BY: R. LEY	TRINITY RIVER BASIN, TEXAS RIVERSIDE OXBOW FORT WORTH, TEXAS
DRAWN BY: R. LEY	BEACH STREET I-BEAM
REVIEWED BY: W. SHARP	
SUBMITTED BY: WILLIAM A. WALLACE, P.E. CHIEF, STRUCTURAL SECTION	SOL. NO. / DATED / CONTR. NO. / DRAWING NUMBER RS-05 / SHEET NO. 55 OF / PLATE
REFERENCE FILE NAME / REFERENCE FILE DESCRIPTION	CADD FILE NAME: beam.dgn

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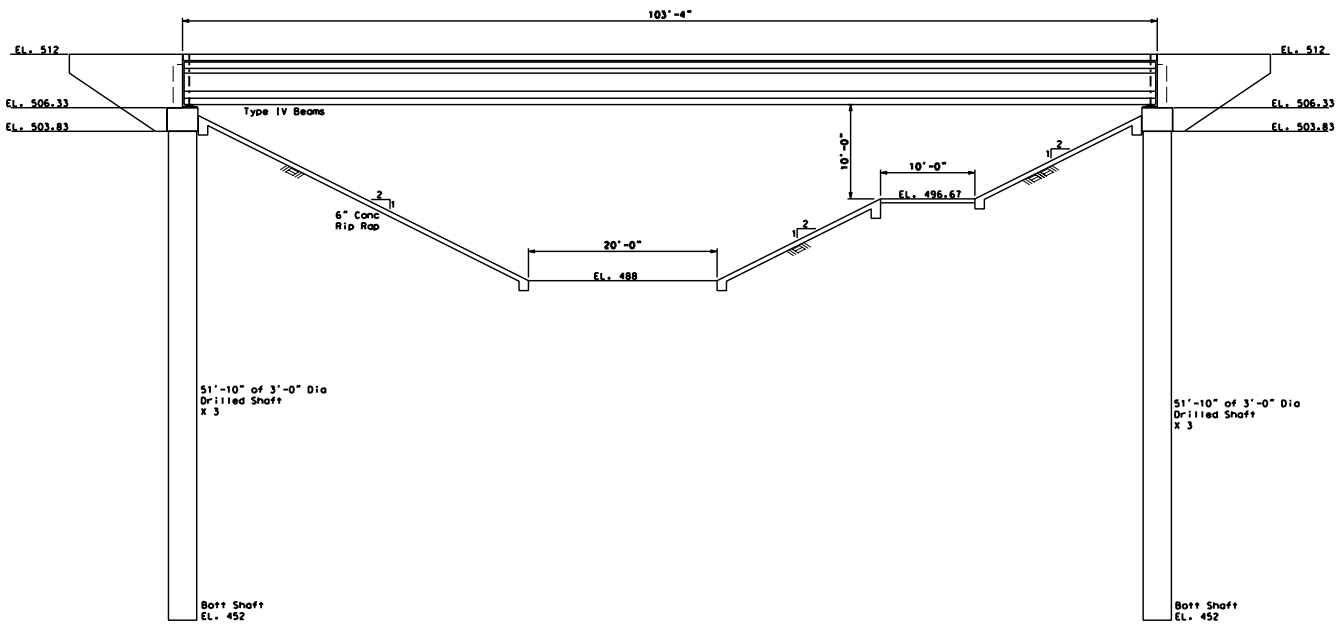

NOTE:

REFERENCE DRAWING IS FROM THE REPORT ENTITLED:
"RIVERSIDE OXBOW, FROM THE INTERIM FEASIBILITY STUDY AND INTEGRATED ENVIRONMENTAL ASSESSMENT (APRIL 2005)"
DRAWING IS NOT TO SCALE.

1" = 4'

ENGINEERING DIVISION CIVIL DESIGN BRANCH	U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS		
DESIGNED BY: R. LEY	TRINITY RIVER BASIN, TEXAS RIVERSIDE OXBOW FORT WORTH, TEXAS		
DRAWN BY: R. LEY	PARK ROAD ELEVATION		
REVIEWED BY: W. SHANDS			
SUBMITTED BY: WILLIAM A. WALLACE, P.E. CHIEF, STRUCTURAL SECTION	SOL. NO.	DATED:	
	CONTR. NO.		PLATE
	DRAWING NUMBER RS-06	SHEET NO. 5 of	

REFERENCE FILE NAME: REFERENCE FILE DESCRIPTION: CADD FILE NAME: stw.dgn

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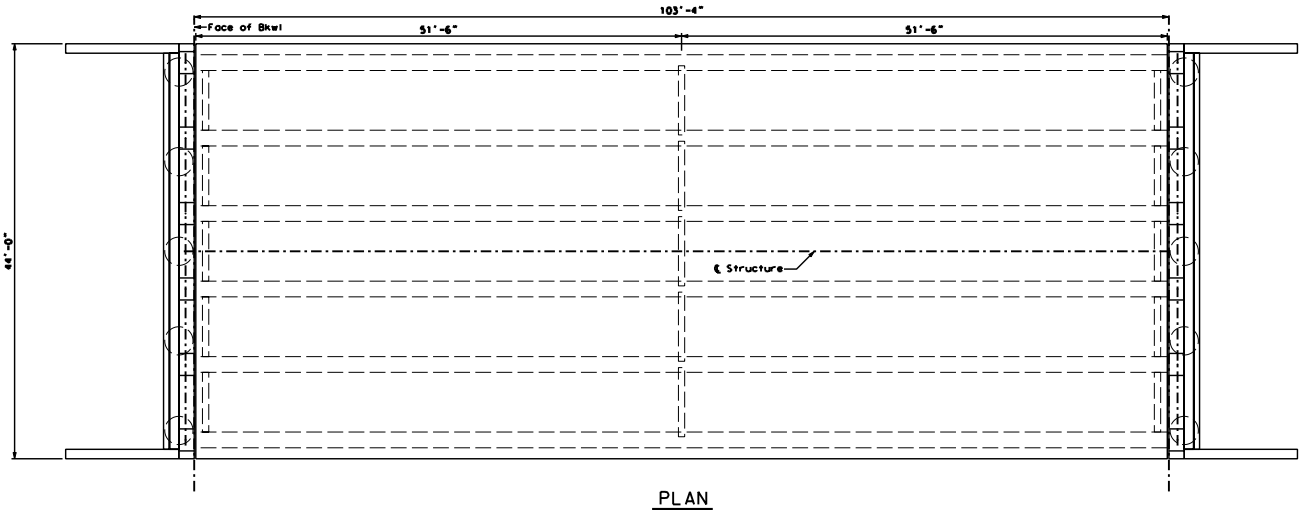

PLAN

1" = 4'

NOTE:

REFERENCE DRAWING IS FROM THE REPORT ENTITLED:
"RIVERSIDE OXBOW, FROM THE INTERIM FEASIBILITY STUDY AND INTEGRATED ENVIRONMENTAL ASSESSMENT (APRIL 2005)"
DRAWING IS NOT TO SCALE.

ENGINEERING DIVISION CIVIL DESIGN BRANCH	U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS
DESIGNED BY: R. LEY DRAWN BY: R. LEY REVIEWED BY: W. SHANDS	TRINITY RIVER BASIN, TEXAS RIVERSIDE OXBOW FORT WORTH, TEXAS PARK ROAD PLAN
SUBMITTED BY: WILLIAM A. WALLACE, P.E. CHIEF, STRUCTURAL SECTION	SOL. NO. / DATED: CONTR. NO. DRAWING NUMBER: RS-07 SHEET NO.: 5/2 OF PLATE

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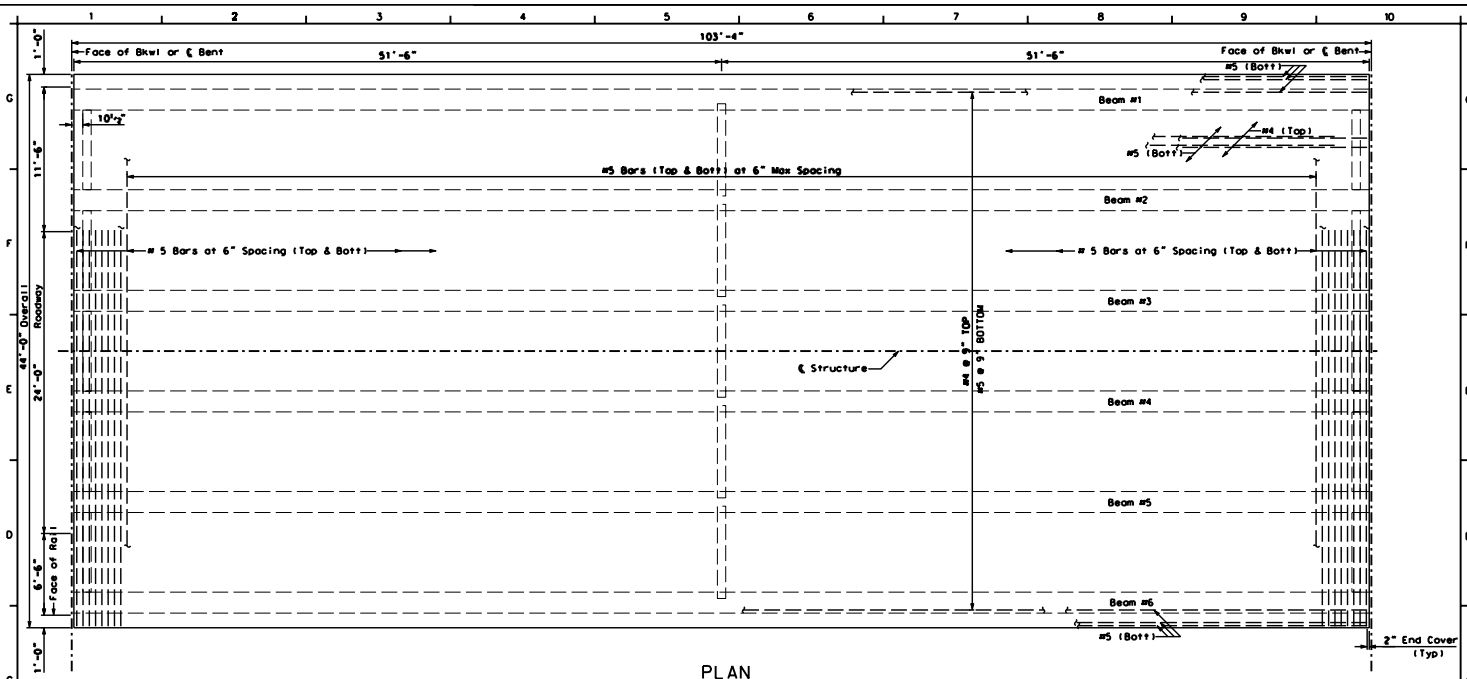
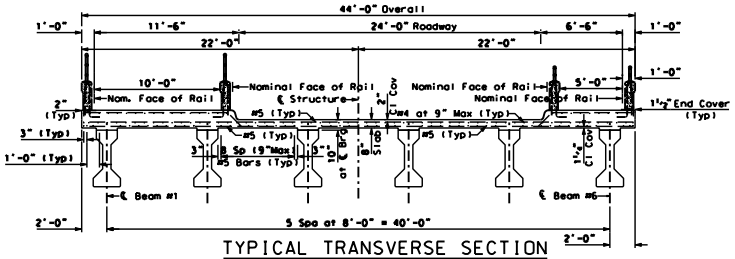


PLAN

NOTE:

REFERENCE DRAWING IS FROM THE REPORT ENTITLED:
"RIVERSIDE OXBOW, FROM THE INTERIM FEASIBILITY STUDY AND INTEGRATED ENVIRONMENTAL ASSESSMENT (APRIL 2005)"
DRAWING IS NOT TO SCALE.



TYPICAL TRANSVERSE SECTION

GENERAL NOTES:

All reinforcing shall be Grade 60.
Concrete strength f'c = 4,000 psi.
Bar laps, where required, shall be as follows:
#4 = 1'-5"
#5 = 1'-9"

1" = 3'

ENGINEERING DIVISION CIVIL DESIGN BRANCH	U.S. ARMY ENGINEER DISTRICT, FORT WORTH CORPS OF ENGINEERS FORT WORTH, TEXAS		
DESIGNED BY: R. LEY DRAWN BY: R. LEY REVIEWED BY: W. SHARPE	TRINITY RIVER BASIN, TEXAS RIVERSIDE OXBOW FORT WORTH, TEXAS PARK ROAD SLAB		
SUBMITTED BY: WILLIAM A. WALLACE, P.E. CHIEF, STRUCTURAL SECTION	SOL. NO.	DATED:	
	CONTR. NO.		PLATE
	DRAWING NUMBER RS-08	SHEET NO. 5/13 OF	

REFERENCE FILE NAME: REFERENCE FILE DESCRIPTION: CADD FILE NAME: rs08.dgn

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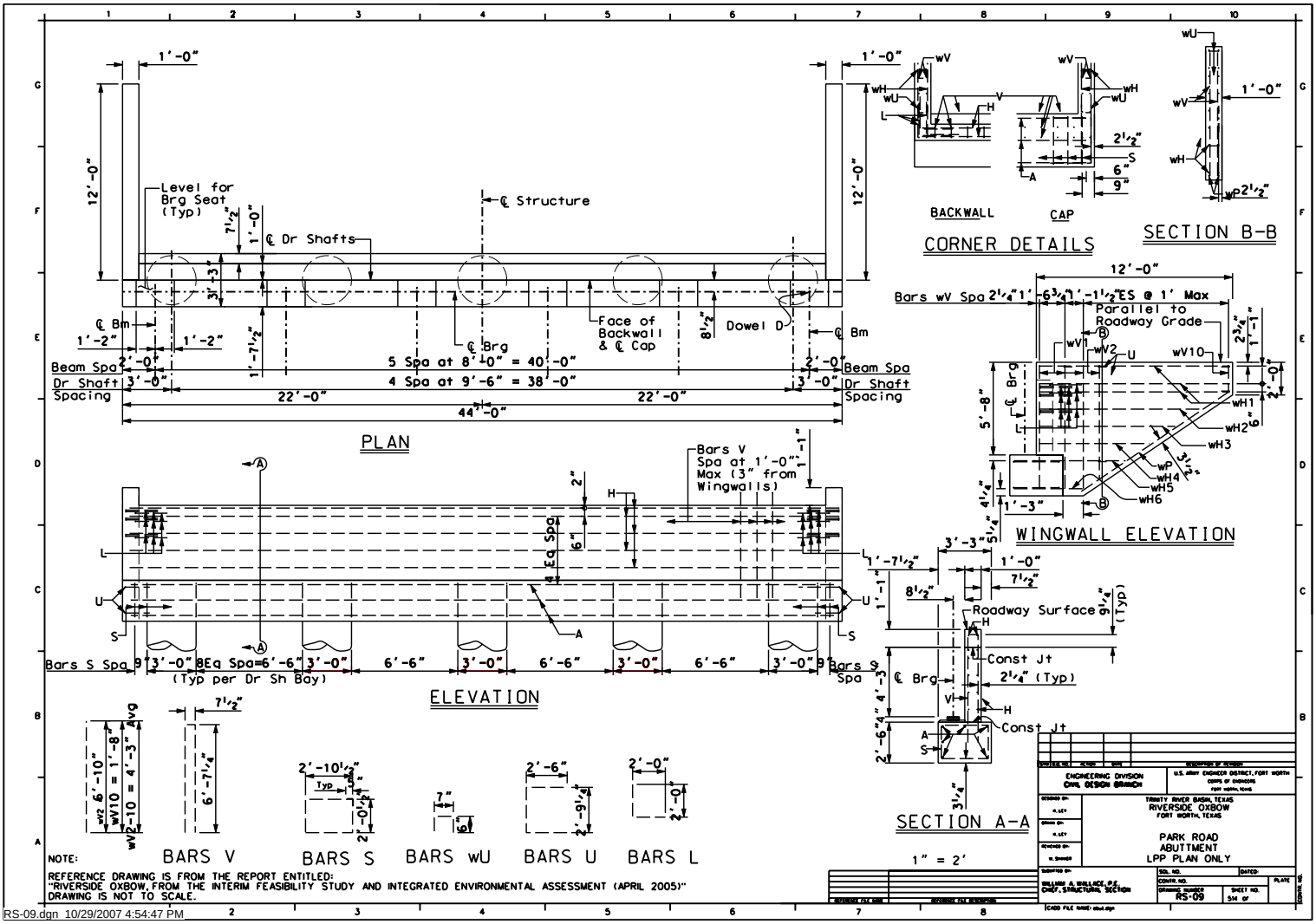

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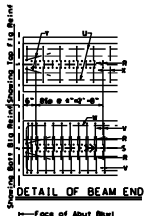
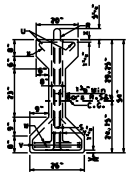


DETAIL OF BEAM END

ELEVATION OF BEAM

	SPAN LENGTH (ft)	BEAM TYPE		PRESTRESSING STRANDS							CONCRETE	
				TOTAL					DEPRESSED		RELEASE STRGTH	MINIMUM 28 DAY COMP STRGTH
				NO.	SIZE (in)	STRGTH f's (ksi)	"e" ℄ (in)	"e" END (in)	NO.	TO (in)	f'ci (psi)	f'c (psi)
Type IV Beams 30' Rdwy 8" Slab 8'-8" Bm Spa	102	IV		44	½	270K	20.02	12.02	8	52.0	5478	6218

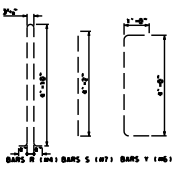


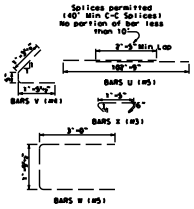
TYPE IV BEAM

AREA 788.4 in.²

I 260,403 in.⁴

wt 821 Lb./LF





GENERAL NOTES:

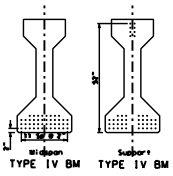
Designed in accordance with current AASHTO Standard Specifications.

All concrete shall be Class H. All reinforcing bars shall be Grade 60.

Bottom corners of all beam flanges and outside corners of exterior beam ends shall be chamfered ¾" or rounded to a 1½" radius.

Prestress losses for the designed beam have been calculated for a relative humidity of 60 percent.

Strands for the designed beam shall be "y" 270 ksi low relaxation strands pretensioned to 31.0 k each.



TYPE IV BM TYPE IV BM

NOTE:

REFERENCE DRAWING IS FROM THE REPORT ENTITLED:
"RIVERSIDE OXBOW, FROM THE INTERIM FEASIBILITY STUDY AND INTEGRATED ENVIRONMENTAL ASSESSMENT (APRIL 2005)"
DRAWING IS NOT TO SCALE.

1" = 1½"

SYM	D.O. NO.	ACTION	DATE	DESCRIPTION OF REVISION

ENGINEERING DIVISION
CIVIL DESIGN BRANCH

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY: R. LEY
DRAWN BY: R. LEY
REVIEWED BY: W. SHARPP

TRINITY RIVER BASIN, TEXAS
RIVERSIDE OXBOW
FORT WORTH, TEXAS

PARK ROAD
I-BEAM

SUBMITTED BY: WILLIAM A. WALLACE P.E.
CHIEF, STRUCTURAL SECTION

SOL. NO. | DATED:
CONTR. NO. | PLATE
DRAWING NUMBER RS-10 | SHEET NO. 5/5 of

REFERENCE FILE NAME | REFERENCE FILE DESCRIPTION

CADD FILE NAME: beam.dgn

CONTR. NO.

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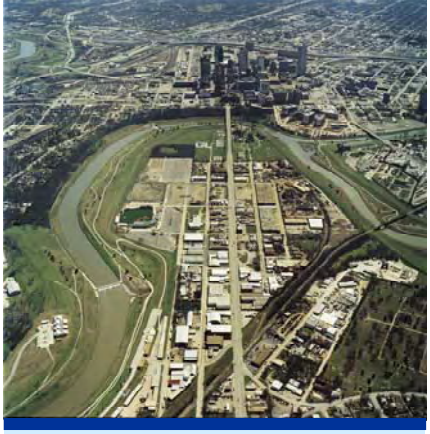
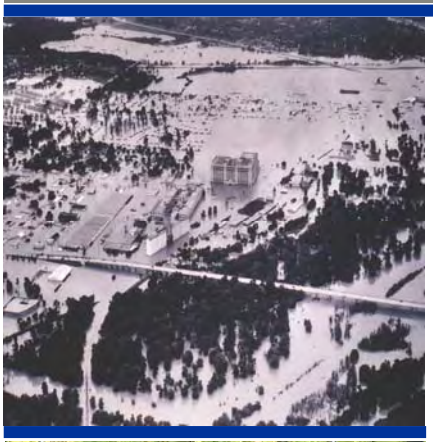
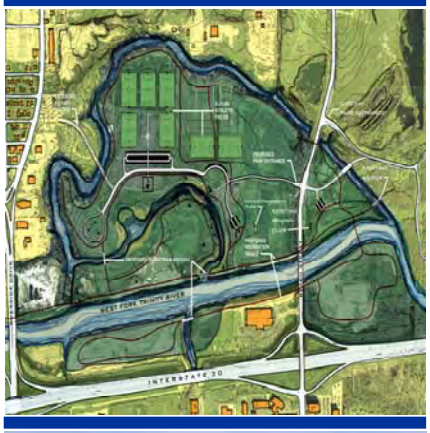






Rendering Image courtesy of CDM

Fort Worth Central City Preliminary Design

Socioeconomics and Environmental Justice

Final Supplement No. 1 to the Final Environmental Impact Statement

Appendix D

March 2008

Appendix D

Socioeconomic and Environmental Justice Assessment Supplement No. 1 to the Final Environmental Impact Statement

for the

Central City Project, Upper Trinity River, Texas

Central City Project - The stated preferred alternative in the authorized Central City FEIS, described as the Community Based Alternative, addressed four objectives; flood protection, ecosystem improvement, urban revitalization, and recreation. The authorized Central City Project would require approximately 5,250 acre-feet of additional valley storage to accommodate flow alterations by the project's configuration. This additional valley storage is identified in the authorized report as being provided primarily by the Riverbend Hydraulic Valley Storage Area and by smaller areas near University Drive, Samuels Avenue, and on I-35 sites just downstream of the dam close to Riverside Park.

Additionally, the Central City FEIS outlines measures to mitigate for losses wetlands, riparian woodlands, and upland woodlands primarily in these hydraulic mitigation sites. Mitigation requirements include development of emergent wetland, establishment of riparian woodland, establishment upland forest, as well as management of existing riparian woodland and upland forest. Mitigation for aquatic impacts to Marine and Lebow Creeks include diverting flows to the mid-reach of Lebow Creek, channel modifications, a gravity flow pipeline from the Samuels Avenue Dam impoundment, and additional mitigation measures for Ham Branch.

One of the controversial aspects of the authorized Central City Project was the issue of the use of private lands for public use and the potential use of eminent domain to acquire needed real estate.

Riverside Oxbow and the Modified Central City Project - The original interim feasibility report and IES identified the National Ecosystem Restoration Plan (NER) as one that "will restore the biological integrity of the wetland and bottomland hardwood communities through a combination of measures directed at either specific habitat types or specific problems within the existing ecosystem." The project consists primarily of reestablishing low flows through the natural channel of the West Fork of the Trinity River featuring a notched control structure in the existing floodway channel to allow flows through the old cutoff oxbow, facilitating restoration of the oxbow's aquatic and riparian woodland complex. Restoration of the cutoff oxbow would include demolition and replacement the existing Beach Street Bridge. Ecosystem restoration features include the creation emergent wetland, open water, and vegetative fringe habitat within the project area. Various hardwood improvement measures would be implemented on existing riparian forest within the floodplain, including a riparian corridor along the West Fork from Riverside Drive to East 1st Street. A buffer zone of grasses and forbs would be established as well as reforestation of disturbed and grassland areas with native trees and shrubs and preservation and habitat improvement measures on native prairie and scrub/shrub floodplain terrace. A variation of this plan, the Locally Preferred Plan, calls for additional features including relocation of the entrance to Gateway Park to include a new access road and bridge over the oxbow channel. Additionally, the local sponsor wanted to include acquisition of a portion of the Tandy zone to restore the native prairie grasslands.

Recreational features include pedestrian and equestrian trails, recreation access points with parking off of Riverside Drive, and west of Beach Street and south of the oxbow channel. Restroom facilities would be provided at each of the access points.

The Modified Central City Project shifts the valley storage and ecosystem restoration from the upstream sites specified in the authorized EIS downstream to the Riverside Oxbow area. Starting with the valley storage requirement of 5,250 acre-feet identified in the authorized Central City Project, an analysis determined that some, but not all, of the valley storage requirement could be met within the Riverside Oxbow area. Other valley storage sites were revisited with the intent of minimizing the acquisition of private land resulting in the identification of 22 sites within the combined study area that could accommodate the valley storage requirements. This list was further refined to one consisting of 17 preferred sites.

The Modified Project lists preferred valley storage sites consisting of the Rockwood Park West site, a 21.6 acre City of Fort Worth-owned site; the Samuels Avenue sites, covering approximately 37.8 acres lying on both the north and south banks of the West Fork; the Riverside Park site, a 13 acre site also owned by the City of Fort Worth; the Ham Branch site, a 500 acre site along US Hwy 287; the Riverside Oxbow sites, consisting of 200 acres; and the Gateway Park sites, which consist of 225 acres.

Study Area Demographics (Existing and Future)

The socioeconomic assessment for the initial Central City EIS found that the project area, as defined in that document, is predominantly Hispanic with several Census blocks displaying populations that are predominantly black. The inclusion of the Riverside Oxbow project does not significantly change the racial and ethnic composition of the study proposed in the Central City EIS. While there is essentially no one living within the actual footprint of the Riverside Oxbow project, the boundary does intersect two Census blocks containing subdivisions that may be potentially impacted due to their proximity. The following is a revision of the Central City study area demographics amended to reflect the addition of the Riverside Oxbow project.

Race and Ethnicity - The following table depicts the racial and ethnic makeup for Tarrant County, the original Central City study area, the Riverside Oxbow area, and the revised study area for the years 2000 and 1990.

Table 1
Racial Composition – County, Original Study Area, Riverside Oxbow Area, and Revised Study Area

	Tarrant County				Original Study Area			
	1990		2000		1990		2000	
Total Population	1,170,103	100.0%	1,446,219	100.0%	36,932	100.0%	38,945	100.0%
Male	578,095	49.4%	713,549	49.3%	19,245	52.1%	20,409	52.4%
Female	592,008	50.6%	732,670	50.7%	17,687	47.9%	18,536	47.6%
Hispanic	133,979	11.5%	285,338	19.7%	18,930	51.3%	23,658	60.7%
White	859,883	73.5%	895,446	61.9%	11,348	30.7%	10,373	26.6%
Black	140,512	12.0%	180,457	12.5%	6,078	16.5%	4,275	11.0%
Asian, Hawaiian, PI	29,175	2.5%	52,303	3.6%	285	0.8%	306	0.8%
American Indian	5,575	0.5%	6,856	0.5%	189	0.5%	171	0.4%
Other	979	0.1%	25,819	1.8%	116	0.3%	162	0.4%

	Riverside Oxbow				Revised Study Area			
	1990		2000		1990		2000	
Total Population	1,602	100.0%	2,053	100.0%	38,534	100.0%	40,998	100.0%
Male	868	54.2%	1,091	53.1%	20,113	52.2%	21,500	52.4%
Female	734	45.8%	962	46.9%	18,421	47.8%	19,498	47.6%
Hispanic	375	23.4%	1,095	53.3%	19,305	50.1%	24,753	60.4%
White	1,123	70.1%	910	44.3%	12,471	32.4%	11,283	27.5%
Black	18	1.1%	11	0.5%	6,096	15.8%	4,286	10.5%
Asian, Hawaiian, PI	56	3.5%	0	0.0%	341	0.9%	306	0.7%
American Indian	30	1.9%	22	1.1%	219	0.6%	193	0.5%
Other	0	0.0%	15	0.7%	116	0.3%	177	0.4%

As was noted in the initial Central City EIS, total population for Tarrant County increased almost 24 percent from 1990 to 2000 while the total population for the original study area increased by five percent. The Riverside Oxbow area increased by 28 percent between 1990 and 2000, giving the new revised study area an increase of 6.4 percent. All ethnic groups saw increases in population in Tarrant County with the Hispanic population having the largest, an increase of 113 percent. The Hispanic population increased almost 25 percent in the original study area and increased almost 200 percent for the Riverside Oxbow area. The revised study area Hispanic population increased by 28.2 percent.

Income Levels - The following charts illustrate the income distribution for County, the original Central City study area, the Riverside Oxbow area, and the revised study area based on household income for the 1990 and 200 censuses. Chart 1 depicts this income distribution for 1990.

Chart 1

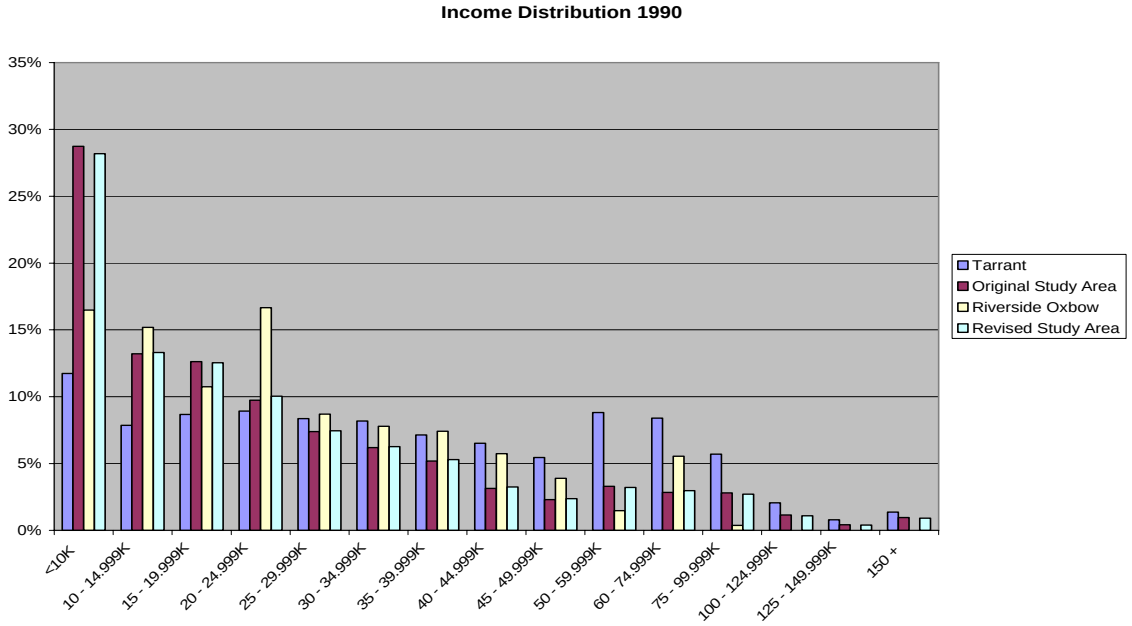
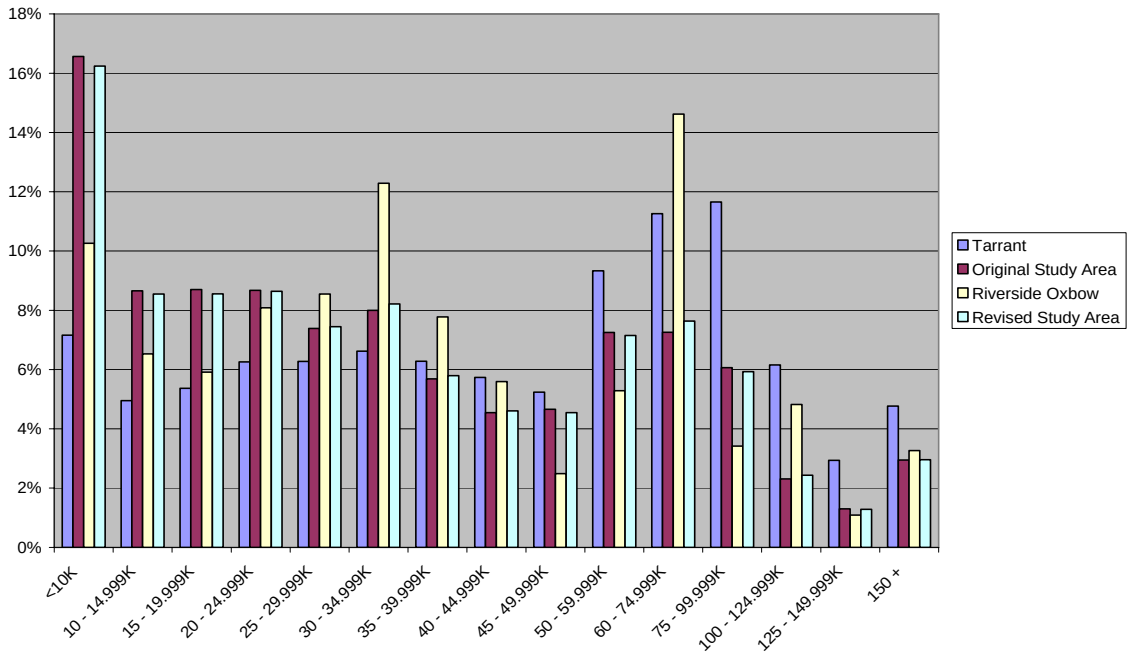


Chart 1 shows a relatively even distribution of income for the county with only 11.7 percent of the households having incomes less than $10,000. Almost 29 percent of the

households in the original study area had incomes less than $10,000 while almost 17 percent of the households in the Riverside Oxbow area had incomes less than $10,000. The revised study area displays income distribution patterns very similar to the original study area. Chart 2 shows the income distribution for the County, the original Central City study area, the Riverside Oxbow area, and the revised study area for 2000.

Chart 2

Income Distribution 2000



In 2000, the percentage of households having incomes less than $10,000 decreased to 7.2 percent for Tarrant County and decreased to 16.6 percent for the original study area. The Riverside Oxbow area decreased to 10.3 percent for the percentage below $10,000. Again, the revised study area displays an almost identical pattern as the original study area.

Table 2 displays the number of households, aggregate household income, and average household income for Tarrant County, the original Central City study area, the Riverside Oxbow area, and the revised study area in 1990 and 2000.

Table 2
Household Income – County, Original Study Area, Riverside Oxbow Area, and Revised Study Area

	Tarrant County		Original Study Area	
	1990	2000	1990	2000
Total Households	439,335	534,019	11,539	11,955
Agg. Household Income	17,607,117,254	32,100,894,600	313,840,671	539,184,900
Avg. Household Income	40,077	60,112	27,198	45,101

	Riverside Oxbow		Revised Study Area	
	1990	2000	1990	2000
Total Households	540	643	12,079	12,598
Agg. Household Income	13,289,198	34,720,900	327,129,869	573,905,800
Avg. Household Income	24,610	53,998	27,083	45,555

Average household income for the original study area was 32 percent less than the county in 1990 and 25 percent less than that of the county in 2000. the Riverside Oxbow area was almost 39 percent less than the county in 1990 but the gap shrunk to just over 10 percent in 2000. The patterns for the revised study area are very close to that of the original study area.

Poverty Status - Table 3 describes the poverty status of Tarrant County, the original Central City study area, the Riverside Oxbow area, and the revised study area.

Table 3
Poverty Status – County, Original Study Area, Riverside Oxbow Area, and Revised Study Area

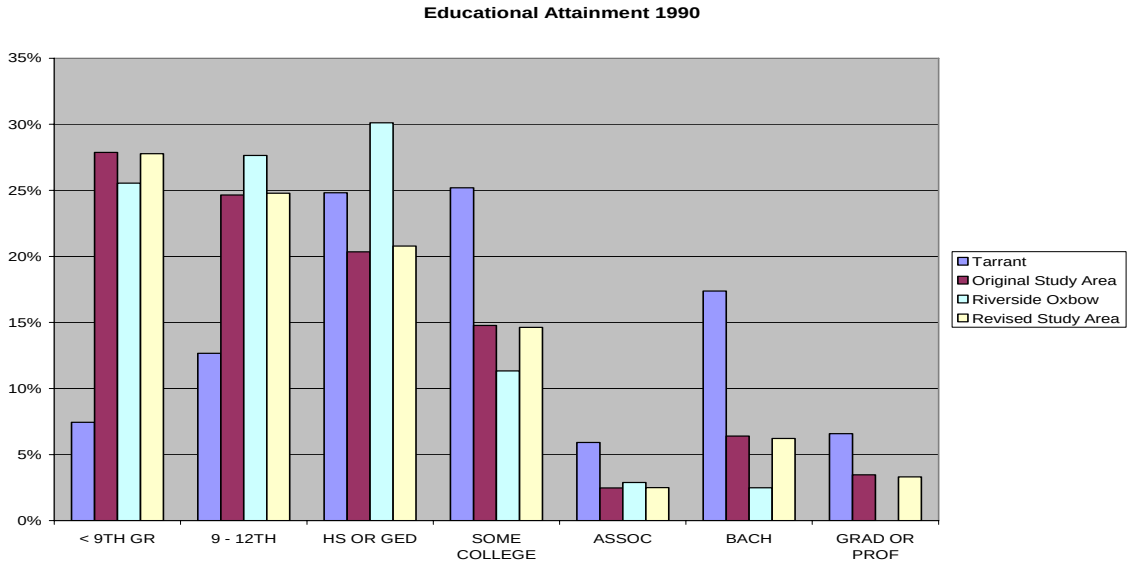
	Tarrant County		Original Study Area	
	1990	2000	1990	2000
Total Population for Poverty Level	1,149,013	1,421,383	33,959	35,737
Total Population Above Poverty Level	1,022,460	1,270,895	23,307	27,715
Total Population Below Poverty Level	126,553	150,488	10,652	8,022
Percent Above Poverty Level	89.0%	89.4%	68.6%	77.6%
Percent Below Poverty Level	11.0%	10.6%	31.4%	22.4%

	Riverside Oxbow		Revised Study Area	
	1990	2000	1990	2000
Total Population for Poverty Level	1,602	2,053	35,561	37,790
Total Population Above Poverty Level	1,280	1,733	24,587	29,448
Total Population Below Poverty Level	322	320	10,974	8,342
Percent Above Poverty Level	79.9%	84.4%	69.1%	77.9%
Percent Below Poverty Level	20.1%	15.6%	30.9%	22.1%

The percentage of the population in Tarrant County living below the poverty level was eleven percent for 1990 and declined slightly to 10.6 percent in 2000. The original study area had 31.4 percent of its population living below the poverty level in 1990 and decreased to 22.4 percent in 2000. The Riverside Oxbow area by contrast, had 20.1 percent of its population living below the poverty level in 1990. The percentage living below the poverty decreased to 15.6 percent in 2000, a larger drop relative to the county. The revised study area is within a percentage point of the original study area in both 1990 and 2000.

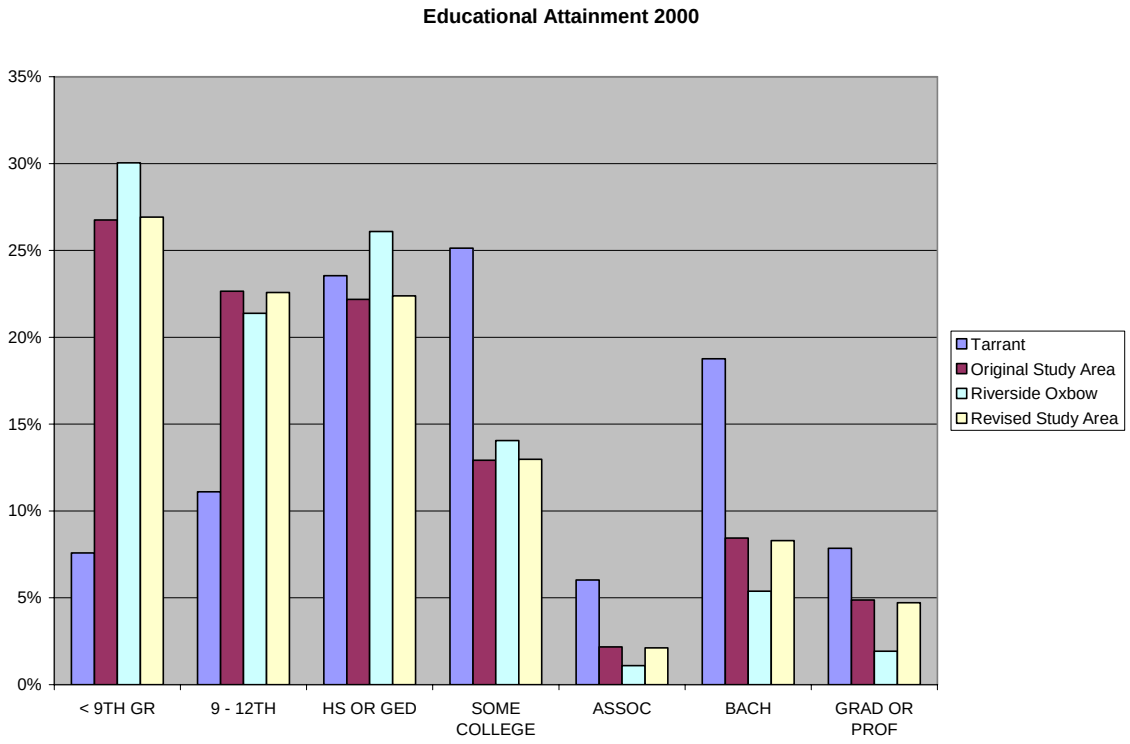
Educational Attainment. Chart 3 depicts educational attainment for Tarrant County, the original Central City study area, the Riverside Oxbow area, and the revised study area for 1990.

Chart 3



In 1990, almost 28 percent of the population of the original study area had less than a ninth grade education of those 25 and over. This compares with only 7.4 percent of the population 25 and over for Tarrant County. Almost 26 percent of the population of the Riverside Oxbow area had less than a ninth grade education in 1990. The Riverside Oxbow area also had substantially lower rates of college attendance than the county as a whole. The revised study area had roughly the same educational pattern as the original study area. Chart 4 depicts educational attainment for 2000.

Chart 4



This chart displays many of the same disparities in educational attainment between Tarrant County, the original study area, the Riverside Oxbow area, and the revised study area. The original and revised study areas did see small percentage reductions in lower levels of educational attainment for 2000 but these were offset by increases in higher levels of educational attainment, particularly attainment of bachelor's degrees as well as professional and graduate degrees. The Riverside Oxbow area did however see increases in the percentage of those with less than a 9th grade education bringing with it reductions in the percentage of those attending and graduating from high school but did see increases in rates of college attendance and increases in the attainment of bachelor's and graduate degrees.

Unemployment - Table 4 displays the unemployment rates in 1990 and 2000 for Tarrant County, the original Central City study area, the Riverside Oxbow area, and the revised study area.

Table 4
Unemployment Rates – County, Original Study Area, Riverside Oxbow Area, and Revised Study Area

	Tarrant County		**Original Study Area**	
	1990	**2000**	**1990**	**2000**
Male Labor Force	349,640	408,737	8,893	9,488
Employed	329,516	391,793	7,852	8,723
Unemployed	20,124	16,944	1,041	752
Unemployment Rate	5.8%	4.1%	11.7%	7.9%
Female Labor Force	285,758	340,752	5,648	6,280

Employed	269,429	323,594	4,959	5,489
Unemployed	16,329	17,158	689	791
Unemployment Rate	5.7%	5.0%	12.2%	12.6%
Combined Labor Force	635,398	749,489	14,541	15,768
Employed	598,945	715,387	12,811	14,212
Unemployed	36,453	34,102	1,730	1,543
Unemployment Rate	5.7%	4.6%	11.9%	9.8%

	Riverside Oxbow		**Revised Study Area**	
	1990	2000	1990	2000
Male Labor Force	549	480	9,442	9,968
Employed	490	469	8,342	9,192
Unemployed	59	11	1,100	763
Unemployment Rate	10.7%	2.3%	11.7%	7.7%
Female Labor Force	336	273	5,984	6,553
Employed	319	255	5,278	5,744
Unemployed	17	18	706	809
Unemployment Rate	5.1%	6.6%	11.8%	12.3%
Combined Labor Force	885	753	15,426	16,521
Employed	809	724	13,620	14,936
Unemployed	76	29	1,806	1,572
Unemployment Rate	8.6%	3.9%	11.7%	9.5%

The combined unemployment rate for Tarrant County for 1990 stood at 5.7 percent while the same rate for the original study area was 11.9 percent (11.7 percent for the revised study area). The Riverside Oxbow area was 8.6 percent. In 2000, the combined unemployment rate for Tarrant was 4.6 percent, 9.8 percent for the original study area (9.5 for the revised), and 3.9 percent for the Riverside Oxbow area.

Housing Characteristics - The following table describes the average home values, as well as percentage of home ownership, and the percentage of rentals for the County, the original and revised study areas, and the Riverside Oxbow area.

Table 5
Housing Characteristics – County, Original Study Area, Riverside Oxbow Area, and Revised Study Area

	Tarrant County		**Original Study Area**	
	1990	**2000**	**1990**	**2000**
Total Housing Units	491,152	565,830	13,260	12,958
Occupied Housing Units	438,634	533,864	11,622	11,829
Vacant Housing Units	52,518	31,966	1,638	1,129
Owner Occupied	254,897	324,754	5,610	5,669
Renter Occupied	183,737	209,110	6,012	6,160
Agg. Val. For Owner Occ. Units	20,212,397,000	33,328,205,000	315,415,500	469,925,000
Avg. Val. For Owner Occ. Units	79,296	102,626	56,224	82,894
Owner Occupied %	58.1%	60.8%	48.3%	47.9%
Renter Occupied %	41.9%	39.2%	51.7%	52.1%

Vacancy Rate	10.7%	5.6%	12.4%	8.7%

	Riverside Oxbow		Revised Study Area	
	1990	**2000**	**1990**	**2000**
Total Housing Units	653	718	13,913	13,676
Occupied Housing Units	553	665	12,175	12,494
Vacant Housing Units	100	53	1,738	1,182
Owner Occupied	356	417	5,966	6,086
Renter Occupied	197	248	6,209	6,408
Agg. Val. For Owner Occ. Units	11,791,000	39,537,500	327,206,500	509,462,500
Avg. Val. For Owner Occ. Units	33,121	94,814	54,845	83,711
Owner Occupied %	64.4%	62.7%	49.0%	48.7%
Renter Occupied %	35.6%	37.3%	51.0%	51.3%
Vacancy Rate	15.3%	7.4%	12.5%	8.6%

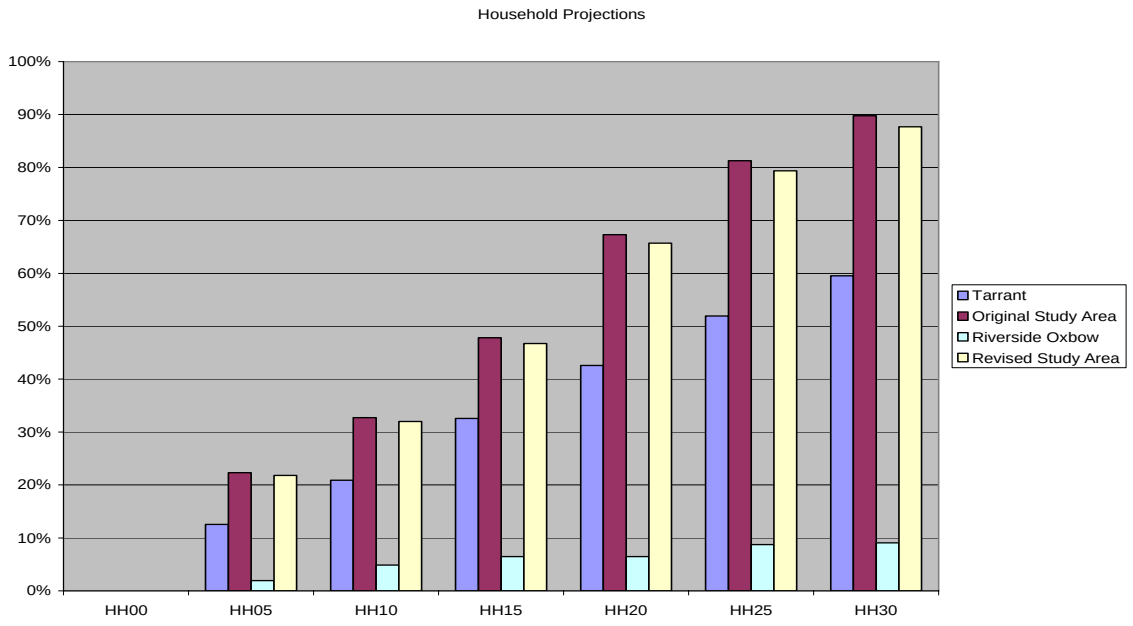
The original and revised study areas have lower home ownership rates than the County. The revised study area sees slightly average values for owner occupied housing compared to the original study area due to slightly higher values for the Riverside Oxbow area.

Projections (Future Without Project Conditions)

The following information is based on the North Central Texas Council of Governments' Demographic Forecast, which provides long-range, small-area household and employment projections for use in intra-regional infrastructure planning and resource allocations in the metropolitan area of North Central Texas. The Demographic Forecast is conducted by NCTCOG's Research and Information Services Department under review and oversight of the Demographic Methodologies Task Force. The Forecast has a 30-year time horizon, with 2000 as the base year and 2030 as the end year. Data applicable for a county level are used for Tarrant County, while data for the project area are disaggregated down to the traffic survey zone for those TSZ's that coincide with the project study area. This information includes projections for the number of households, household population, and employment. Additionally, these projections should be considered as what would occur in the absence of the Trinity River Vision.

Households - Chart 7 depicts the growth rate of households for Tarrant County, the original study area, the Riverside Oxbow area and the revised study area for the period beginning in 2000 and running to 2030.

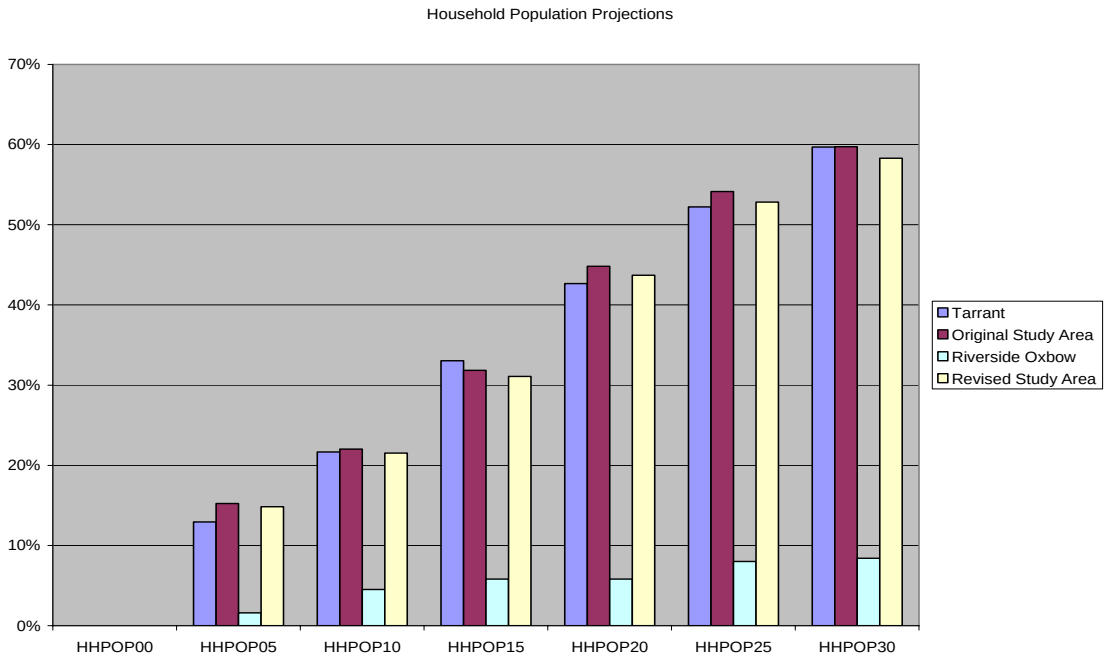
Chart 7



The number of households for Tarrant County is projected to grow by almost 60 percent between 2000 and 2030. By comparison, households for the original study area are expected to grow by almost 90 percent. Households for the Riverside Oxbow area are expected to only increase by nine percent. This relatively low growth rate subsequently drops the growth rate for the revised study area slightly.

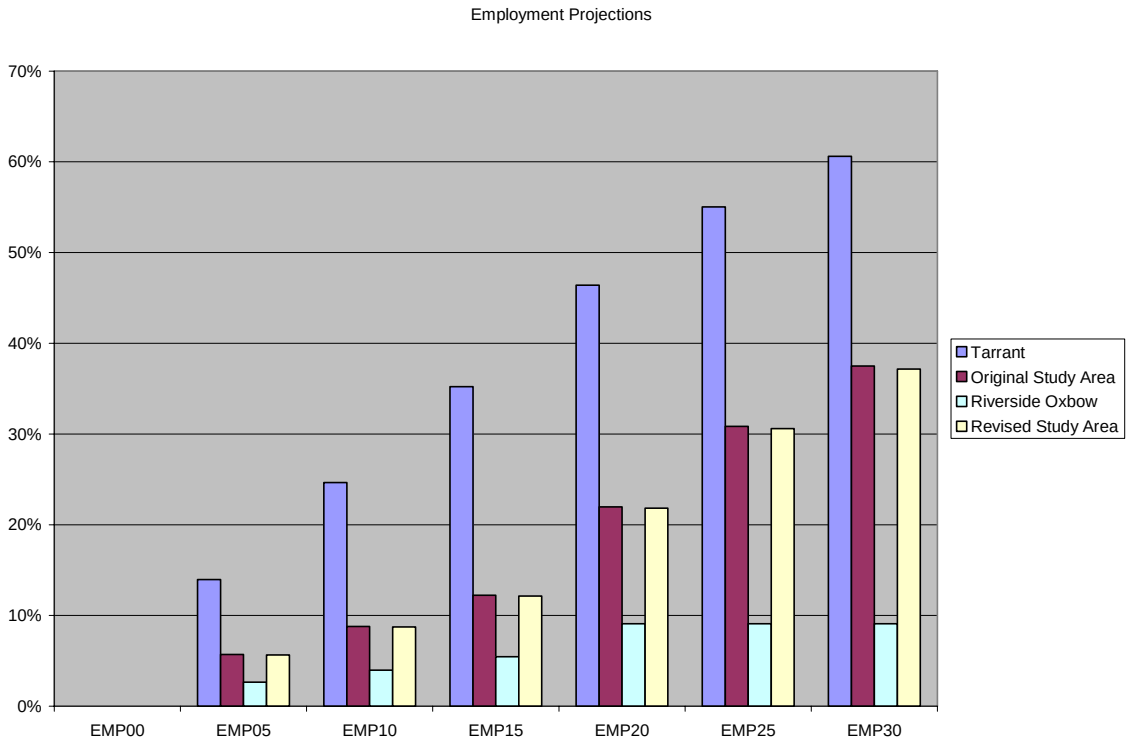
Household Population - Household population for Tarrant County is projected to grow by almost 60 percent. Growth in household population for the original study area is expected to grow at roughly the same rate. Growth in household population for the Riverside Oxbow is expected to only grow by 8.4 percent between 2000 and 2004. again, this low growth rate produces a slightly lower rate for the revised study area. This is depicted in Chart 8.

Chart 8



Employment - Employment for the period from 2000 to 2030 is expected to grow by almost 61 percent for Tarrant County. Employment for the original study area is expected to grow by only 37.5 percent while employment growth is expected to only grow by nine percent for the Riverside Oxbow area. This slow rate again pulls down the employment growth rate for the revised study area slightly. Employment projection rates are displayed in Chart 9.

Chart 9



Riverside Oxbow Land Use

The following table lists the total number of square acres within the Riverside Oxbow area with its associated land use classification based on 2007 Tarrant Appraisal District data. Just over 45 percent of the land within the Riverside Oxbow area is classified as vacant platted. Commercial makes up just over 30 percent and residential comprises less than one percent of the of the total land use for the area. Figure 1 graphically displays these land use patterns.

Table 6
Riverside Oxbow Land Use

Classification	Number of parcels	Square Acres	%
Vacant Platted	33	533.0	45.1%
Commercial/Industrial	26	358.8	30.3%
Acreage	20	198.6	16.8%
Utilities	8	84.6	7.2%
Residential	10	7.5	0.6%
Total	**97**	**1182.4**	**100.0%**

Effected Populations

In accordance with Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations” in assessing the potential impacts to minority populations within the study area, data in Appendix I of the FEIS listed 25 of the 40 2000 Census blocks within the original study area as having minority populations over 50 percent.

Of the 25 Census blocks, 20 contain Hispanic populations of more than 50 percent while the remaining five have African American populations of more than 50 percent. The revise study area adds two Census blocks that intersect the Riverside Oxbow project. The racial composition and median income for these two Census blocks are listed below in Tables 7 and 8. These Census blocks are depicted in Figure 2.

Table 7
Minority Populations of Riverside Oxbow Census Blocks

Census Block	White	Hispanic	Black	Am. Indian	Asian	Haw. or PI	Other	2 or More
1012.01.002	53.6%	43.6%	1.1%	1.0%	0.0%	0.0%	0.0%	0.7%
1012.02.006	35.5%	62.6%	0.0%	1.1%	0.0%	0.0%	0.0%	0.8%

Of the two Census blocks intersecting the Riverside Oxbow project area, 1012.02.006 shows to have a Hispanic population of 62.6 percent. The other Census block shows a Hispanic population of 43.6 percent. There is an issue with Census block however. This Census block extends eastward out of the Riverside Oxbow area ending at East Loop 820. This Census block includes subdivisions outside the Riverside Oxbow area that may be diluting Hispanic populations from subdivisions that may be impacted. We will discuss these subdivisions in more detail when we discus income and housing values.

Table 8 depicts the median income of the two Riverside Oxbow Census blocks.

Table 8
Median Income of Riverside Oxbow Census Blocks

Census Block	Median Household Income	Poverty Threshold for Family of Three	Above (+) / Below (-) Poverty Threshold
1012.01.002	$43,317	$13,290	$30,027
1012.02.006	$29,583	$13,290	$16,293

Neither of the two Census blocks displays populations living at or below the poverty threshold. Again, however, Census block 1012.02.006 includes subdivisions that dilute the median incomes of those subdivisions that may be impacted.

Potentially Impacted Neighborhoods

Housing values for the subdivisions within the two Census blocks intersecting the Riverside Oxbow area, based on 2007 Tarrant Appraisal District values for land and structures, are depicted in Table 9. Of those subdivisions listed below, 17 are identified as being potentially impacted. Figure 3 depicts these neighborhoods and their proximity to the Riverside Oxbow project area.

Table 9
Housing Value for Riverside Oxbow Census Block Subdivisions

Subdivision	Parcels	Total Value	Average Value
Baker, E L Subdivision*	5	$173,600	$34,720
Carver Place*	1	$34,900	$34,900
Davenport, Bert M Subdivision*	10	$589,500	$58,950
Eastview Addition*	8	$289,400	$36,175
Gilmore, G W Addition*	47	$1,815,771	$38,633
Kendall Subdivision*	6	$325,900	$54,317

King Oaks Addition*	66	$4,055,600	$61,448
Lynch, John Survey*	1	$85,700	$85,700
Page Co's East Side Addn*	106	$4,665,867	$44,018
Page's East Side*	12	$564,700	$47,058
Riverside Addition-Ft Worth*	157	$7,380,300	$47,008
Shutter Addition*	34	$1,850,300	$54,421
Tinsley Addition*	1	$120,300	$120,300
Tinsley, Lewis G Survey*	3	$181,017	$60,339
Waller, Benjamin E Survey*	3	$179,700	$59,900
Warren, Alex C Survey*	4	$128,700	$32,175
Woodrose Addition*	27	$2,998,100	$111,041
Akers, John Survey	4	$171,500	$42,875
Enos, Mamie Revision	5	$109,400	$21,880
Garden Of Eden Addition	10	$197,418	$19,742
Jones Court Addition	20	$1,023,000	$51,150
Louis, Joe Addition	7	$106,100	$15,157
Norris, William Survey	1	$54,000	$54,000
Oakview Addition	45	$2,619,100	$58,202
Richland Gardens Addition	1	$153,300	$153,300
River Bend Estates	188	$67,609,780	$359,626
Russell Addition	1	$58,900	$58,900

*Potentially impacted subdivisions

The span of average housing values for the two Census blocks ranges from $15,157 for the Joe Louis Addition to $359,626 for the River Bend Estates subdivision. Among the potentially impacted neighborhoods, the average housing values range from $32,175 for the Alex C. Warren to $120,300 for the Tinsley Addition. A comparison of the average housing values for those residential houses in the two Riverside Oxbow Census Blocks identified as being potentially impacted area are listed in Table 10.

Table 10
Average Housing Value Comparison for Riverside Oxbow Area Residences

Census Blocks	Parcels	Total Value	Average Value
1012.01.002	209	$12,404,955	$59,354
1012.02.006	282	$13,034,400	$46,221

Since the average housing value for those potentially impacted in Census block 1012.01.002 are actually higher, we can reasonably assume that this Census block, like 1012.02.006, does not exhibit a significantly high percentage residents living at or below the poverty level. From a racial and ethnic composition perspective, Census block 1012.01.002 shows a Hispanic population of 43.6 percent. Stated earlier, the population for this Census block is diluted by subdivisions outside the potentially impacted area. Considering the proximity of these potentially impacted subdivisions to those in Census block 1012.02.006, and the relatively high Hispanic population in the Census block overall, it is also a reasonably safe assumption that those potentially impacted subdivisions in 1012.01.002 have a significant population for consideration under EO 12898.

Consideration of Potential Impacts from Construction Activities on Protected Populations

The potential exists for short-term adverse impacts from construction of the Modified Project Alternative to occur to those identified neighborhoods within proximity to the Riverside Oxbow area. According to the Texas Department of Transportation, traffic counts on Beach Street, the major north/south thoroughfare running through these potentially impacted neighborhoods, averaged approximately 15,000 vehicles daily in 2004 between SH-121 and IH-30 and is expected to grow to 26,000 vehicles by 2030. Traffic, namely heavy duty, multiple-axle vehicles associated with construction activities of the Modified Project, could be expected to increase as construction commences during the short-term. Additionally, noise from the associated construction of the Modified Project could also impact these neighborhoods.

Camp Dresser & McKee (CDM) retained Trinity Consultants to assist in the review of potential noise impacts from construction activities and preparation of an emissions analysis for the Modified Central City Project. This analysis would also identify the potential impacts to those identified neighborhoods in the vicinity of the Riverside Oxbow area.

The focus of the air analysis is to identify the potential for increased construction related air emissions as a result of work proposed in the Riverside Oxbow area and to demonstrate that traffic-related emission changes resulting from the proposed project do not result in adverse cumulative impacts as evaluated in relation to the National Ambient Air Quality Standards (NAAQS) and regional air quality planning efforts. The analysis concluded that no long-term adverse air impacts are expected from implementation of the Modified Central City Project and that air quality impacts would mainly consist of airborne particulate matter (PM) generated by earth moving activities and construction traffic on unpaved roads, as well as emissions from construction equipment identified previously in the initial Central City FEIS, all of which should be minimized by Best Management Practices. NOx and VOC emissions are calculated as being less than 100 tons per year.

The focus on the construction impacts is to identify where the proximity and intensity of the work to nearby residential receptors would be greatest. Common temporary noise producers in urban areas include construction noise from heavy equipment operation, building of foundations and structures, earthwork, and trenching and utility installation. The analysis identified that noise impacts could be significantly mitigated by 1) the extended distance between the construction activity and noise receptors, 2) trees and vegetation along the creek bottom area and elsewhere between the construction area and receptors, 3) depressed elevation of the construction area due to the excavation cuts, and 4) the addition of an elevated excavation deposit area southeast of the intersection of North Beach and East 1st Street. Mitigation for hauling activities are identified as 1) ensuring trucks have working muffler systems, 2) managing haul truck speed and acceleration, and 3) limiting haul truck activity to daytime hours.

Environmental and Recreational Impacts

Estimates based on construction activities of the authorized Central City project and the associated residential and commercial development and recurring business will generate $4.3 billion in economic activity and employ almost 42,000 over a 40-year period. While the majority of this anticipated economic activity is expected to directly benefit those parts of the city in close proximity to Trinity Uptown, the beneficial impacts from the Modified Project to be realized by those neighborhoods close to the Riverside Oxbow area will generally come in the form of recreational amenities and improved environmental quality. As noted, the Riverside Oxbow project will reestablish low flows in the natural channel through a control structure restoring the oxbow's aquatic and riparian woodland complex. Other ecosystem restoration features include the creation emergent wetland, open water, and vegetative fringe habitat within the project area.

Recreational features specified in the original Riverside Oxbow interim feasibility report include pedestrian and equestrian trails, recreation access points with parking, and restroom

facilities. The draft concept recreation plan for Gateway Park, done by Gideon Toal depicts the following amenities.

- Soccer and baseball fields
- Mountain bike course
- Amphitheater and river education center
- Dog park
- Hiking and equestrian trails
- Equestrian center
- Skate park
- Boat house with canoe launch
- Picnic/playground areas
- Basketball courts
- Splash park

While all of these amenities may not be realized, this draft concept is intended to demonstrate the ability to develop hydraulic mitigation while providing the required environmental restoration components.

In assessing the balance between the short-term impacts of construction versus the longer-term beneficial impacts of the recreational amenities and environmental restoration features of the Modified Project, depending on the level and amount of amenities, these potentially impacted neighborhoods should benefit significantly from the recreational opportunities and the improved environmental quality afforded by the Modified Project.

Public Meetings

The Notice of Intent for the Supplemental EIS was published in the Federal Register on February 16, 2007. A formal public scoping was not held since measures to address the concerns of those potentially impacted populations within proximity of the Riverside Oxbow project area were conducted during the scoping phase for the initial Riverside Oxbow project report beginning with a series of public meetings held with local citizens and interest groups regarding the future of the Trinity River and its tributaries. As part of the Public Involvement process for the Riverside Oxbow interim feasibility report, two public meetings were held at the local library branch with citizens interested in the river segment that includes the Riverside Oxbow area. Additionally, the Parks and Community Services Department of the City of Fort Worth held a series of public meetings with citizens interested in the update of the Gateway Park Master Plan. Study participants, including USACE, the City of Fort Worth, Tarrant Regional Water District, Streams and Valleys, Inc., US Fish and Wildlife, and the Texas Parks and Wildlife Department, worked to keep residents of the Riverside Oxbow study area apprised of any relevant concerns. Comments from the Riverside Oxbow public meetings are compiled in Appendix J of the Riverside Oxbow, Upper Trinity River Feasibility Study.

Comments of special interest to protected populations close to the Riverside Oxbow area included situating lighting on playing fields so that light pollution is reduced; concerns that future zoning may force some neighborhoods to be connected to trails that may not want to be; the installation of security phones in Gateway Park; creation of overlay districts to protect zoning; and better access to trails.

A Public Meeting was held on January 24, 2008 during the 45-day public comment period and conducted at a location approximately one mile from those identified neighborhoods providing another opportunity for those residing around the Riverside Oxbow area to articulate potential concerns. Approximately 200 attended the meeting with 70 attendees submitting either oral or written comments. Of the seven of the comments expressing opposition to the either the initial or modified project, two attendees were opposed to the cost of the project; another two

thought efforts should be focused on Fossil Creek; another was opposed to the use of eminent domain; and another was concerned about the impacts to Riverside Park. An additional comment expressed conditional support provided that the EIS considered the interaction between the Gateway Park floodplain and the drilling for natural gas occurring within the vicinity of the Riverside Oxbow area. No comments surfaced regarding specific impacts to protected populations during this meeting.

Notice of Availability and Fair Contracting Workshops

Once the Draft Supplemental was completed, both English and Spanish versions of the Notice of Availability were posted on the District's website. Just as had been done with the initial Central City Draft EIS, copies of the Draft Supplemental were also sent to the Fort Worth Hispanic Chamber of Commerce for review and comments as another means of soliciting potential concerns from the Hispanic community. The Hispanic Chamber has also participated, along with representatives of USACE and other federal and local entities in contracting workshops to encourage the participation of potentially protected populations in the fair contracting process.

A Public Notice was mailed to the known interested public of more than 2,000 concurrently with publication of the NOI in the Federal Register. While no neighborhood associations exist within those neighborhoods identified for the Supplemental EIS, included in the mailing lists were representatives of those neighborhood associations surrounding the Riverside Oxbow area as well as the area's City of Fort Worth Parks board member. Comments resulting for the NOI and Public Notice included 11 telephone contacts ranging from individuals seeking to determine whether their property would be affected to inquiries regarding the status of the Study and Supplemental EIS. Five letters were also received, three of which were in regard to either reopening the oxbows, eminent domain, or correcting errors in the original Central City EIS. The other two consisted of correspondence with US Fish and Wildlife and the League of Women Voters.

Assessment of Protected Populations and Potential Impacts

Of the two Census blocks intersecting the Riverside Oxbow project area, one contains a majority Hispanics and the other shows a high percentage of Hispanics but may be diluted by subdivisions containing higher populations of Anglos that are not expected to be impacted. For the purposes of this analysis, both Census blocks are treated as though a majority of Hispanics reside in both. Measures of income, both in terms median income and housing values, for populations of interest within both Census blocks indicate that these potentially protected populations did not warrant consideration on these terms.

Outreach to potentially impacted protected populations began with the scoping activities originating out of the initial Riverside Oxbow report. Continued outreach to all potentially impacted populations included publishing of the Notice of Intent for the Supplemental EIS in the Federal Register, mailing of a Public Notice to the known interested public including surrounding neighborhood associations, coordinating availability of the Draft Supplemental with the Hispanic Chamber of Commerce, and posting both English and Spanish versions of the Notice of Availability on the District's website. The solicitation of comments from potentially impacted populations culminated with a Public Meeting held in very close proximity to those identified neighborhoods.

An analysis was conducted for both the potential noise impacts from construction related activities and emissions for the Modified Central City Project. The analysis determined there would be no long-term adverse air impacts noting that any short-term impacts could be mitigated for by using Best Management Practices. Additionally, the analysis identified a number of activities that would mitigate for any short-term noise producers in the area. Despite these short-term impacts, the Modified Central City Project will provide substantial environmental and

recreational amenities to those identified neighborhoods that, in the long run, should significantly outweigh those activities occurring in the short run.

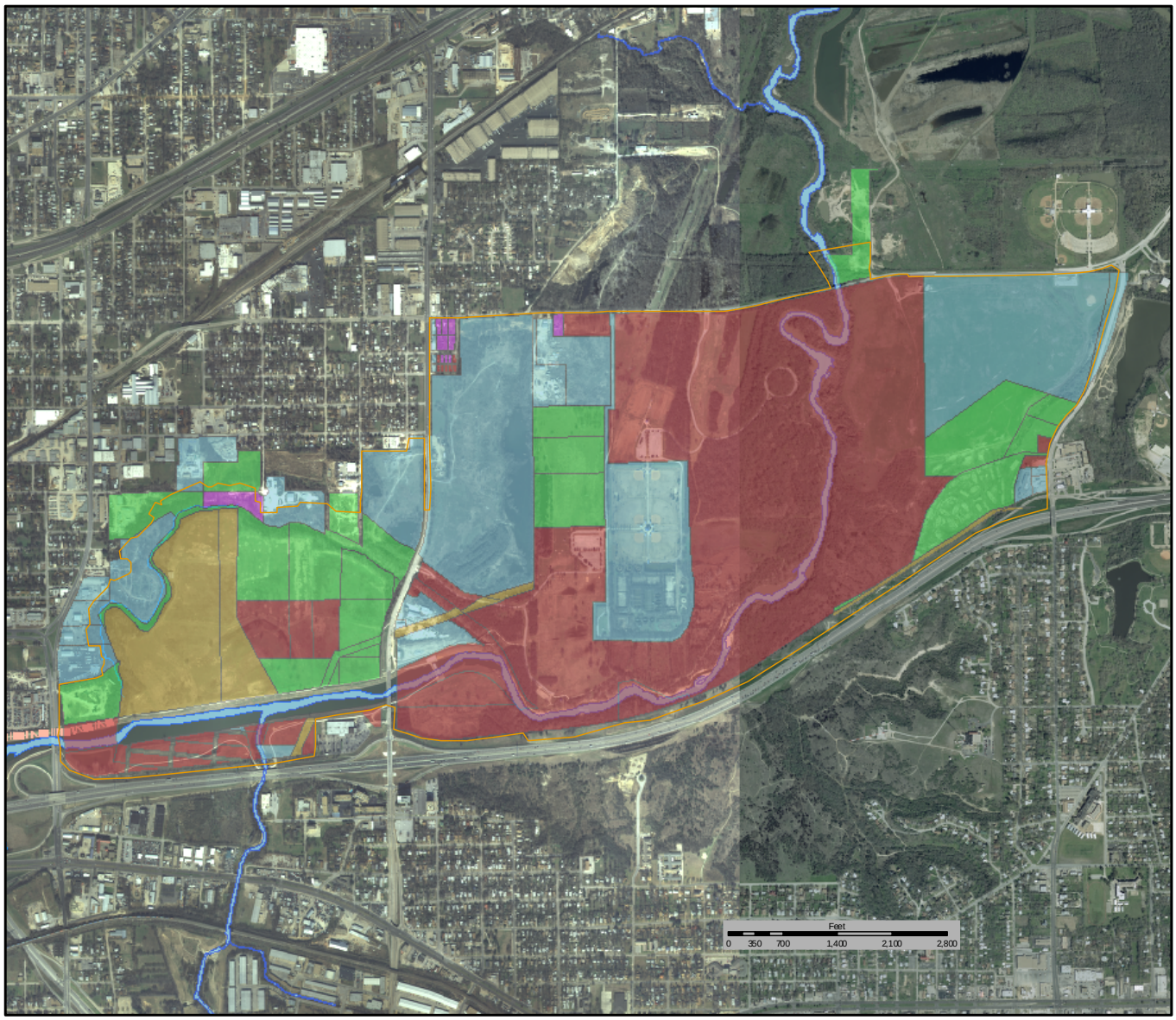


Figure 1
Central City Project
Land Use for
Riverside Oxbow Area

Legend

Riverside Oxbow Area

Streams

Existing Levees

Land Use Class

ACREAGE

COMMERCIAL/INDUSTRIAL

RESIDENTIAL

UTILITIES

VACANT PLATTED

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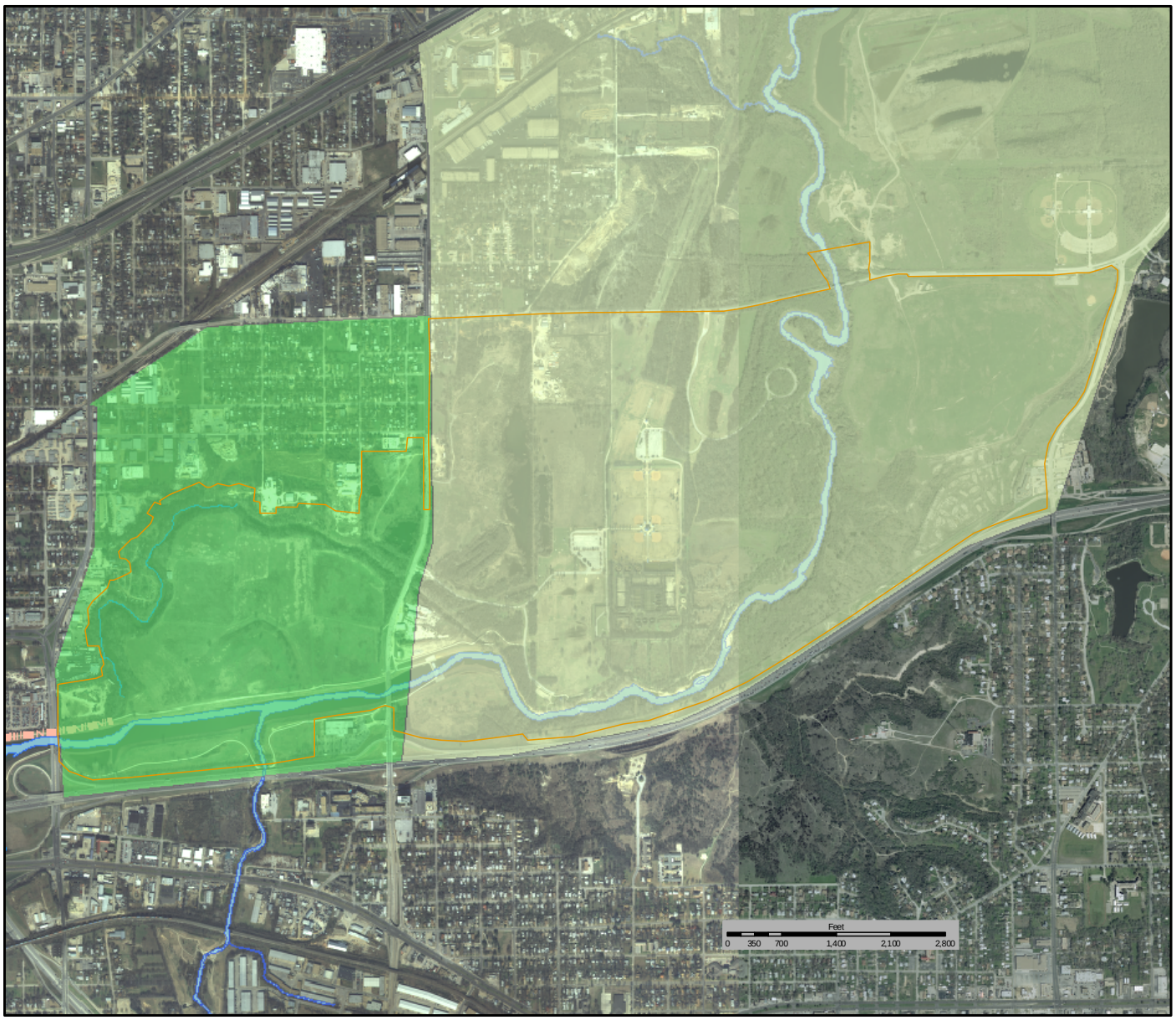

Figure 2
Central City Project
Census Blocks for Riverside Oxbow Area

Legend

Riverside Oxbow Area

Streams

Existing Levees

Census Block

1012.01.002

1012.02.006

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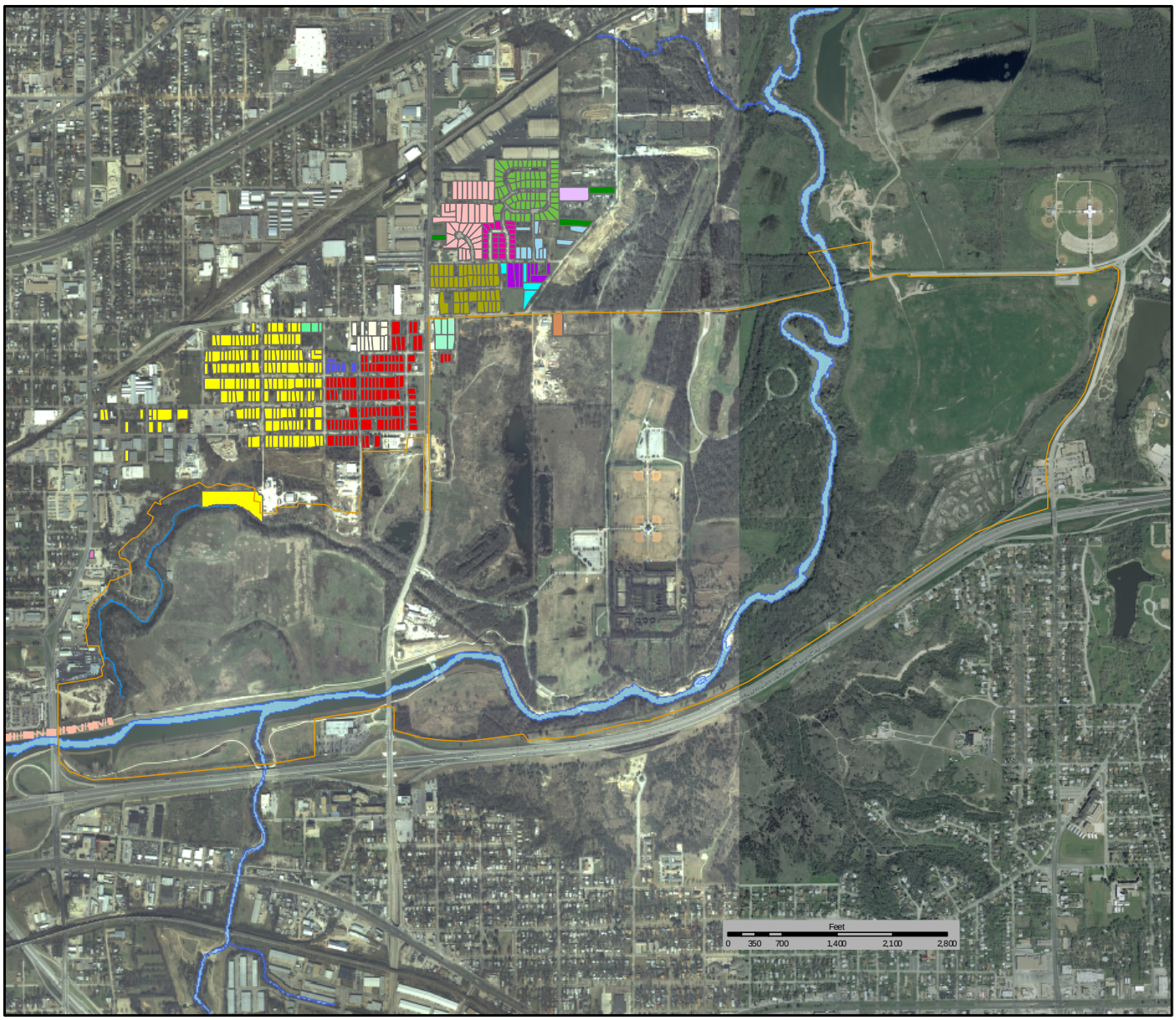

Figure 3
Central City Project
Potentially Impacted Subdivisions for Riverside Oxbow Area

Legend

- Riverside Oxbow Area
- Streams
- Existing Levees

Subdivision

- Baker, E L Subdivision
- Carver Place
- Davenport, Bert M Subdivision
- Eastview Addition
- Gilmore, G W Addition
- Kendall Subdivision
- King Oaks Addition
- Lynch, John Survey
- Page Co's East Side Addn
- Page's East Side
- Riverside Addition-Ft Worth
- Shutter Addition
- Tinsley Addition
- Tinsley, Lewis G Survey
- Waller, Benjamin E Survey
- Warren, Alex C Survey
- Woodrose Addition

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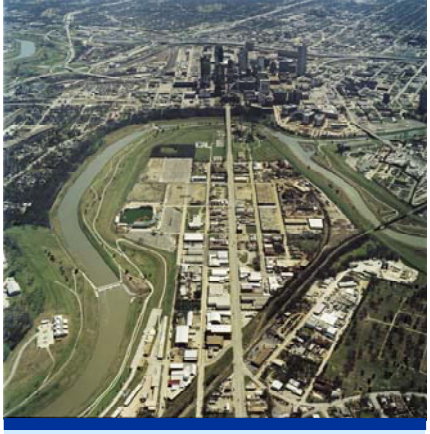
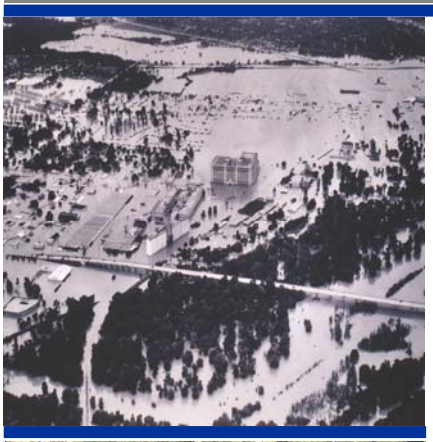


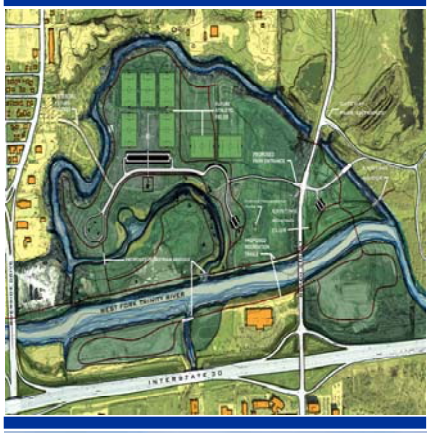
Fort Worth Central City Preliminary Design

Habitat Evaluations



Final Supplement No. 1
to the Final Environmental
Impact Statement

Appendix E - Attachment 1



March 2008

Rendering Image courtesy of CDM

CDM

TARRANT REGIONAL WATER DISTRICT

ATTACHMENT 1
to
APPENDIX E

Contents of this Workbook

Tab or Sheet Name	Description of Contents
AAHUs With vs Without Project	Summary of the habitat outputs of the Modified Project Alternative
WO Project AAHUs	Average Annual Habitat Units for the "Without Project" condition
WO Project Assumptions	Assumptions used in projecting the "Without Project" condition
WO Project Calculations	Calculations for the "Without Project" Condition
With Project AAHUs	Average Annual Habitat Units for the "With Modified Project" alternative
With Project Assumptions	Assumptions used in projecting the "With Modified Project" condition
With Project Calculations	Calculations for the "With Modified Project" Condition
RO AAHUs Updated to 2007	AAHUs for the Riverside Oxbow portion of the "No Action" Condition based on 2007 data
With RO Updated, GRASSLANDS	Realculations for Grasslands for the "No Action" Condition using 2007 field data
With RO Updated, WETLANDS	Recalculations for Wetlands for the "No Action" Condition using 2007 field data
With RO Updated, RIPARIAN	Recalculations for Riparian with the "No Action" Condition using 2007 field data
Site 17 With & WO	Average Annual Habitat Units for the "With" and "Without" Project c
Site 17 Assumps	Assumptions used in projecting the "With" and "Without" Project conditions for Site 17
Site 17 Calcs	Calculations for the "With" and "Without" Project conditions for Site 17

WITHOUT PROJECT VERSUS WITH PROJECT CONDITIONS
MODIFIED CENTRAL CITY PROJECT

Values are Average Annual Habitat Units (AAHUs)

	Riparian Woodland			Emergent Wetland			Upland Wooded			Grassland/Savannah		
Study Reach	Without Project	With Modified Project	Change due to Project	Without Project	With Modified Project	Change due to Project	Without Project	With Modified Project	Change due to Project	Without Project	With Modified Project	Change due to Project
Clear Fork West [1]	110.23	110.23	**0.00**	0	0	**0.00**	36.15	36.15	**0**	175.91	175.91	**0**
Clear Fork East [1]	0.00	0	**0.00**	0	0	**0.00**	17.1	17.1	**0**	32.75	32.75	**0**
North Main [1]	7.29	7.29	**0.00**	0.25	0.25	**0.00**	65.45	65.45	**0**	175.38	175.38	**0**
West Fork North [1]	3.94	3.94	**0.00**	0	0	**0.00**	24.53	24.53	**0**	97.51	97.51	**0**
West Fork South	2.10	4.14	**2.04**	0.25	0.25	**0.00**	51.78	51.78	**0**	208.24	205.87	**-2.37**
West Fork Riverbend [2]	13.00	13	**0.00**	1.12	1.12	**0.00**	41.26	41.26	**0**	57.07	57.07	**0**
West Fork Rockwood	37.31	44.48	**7.17**	0	0	**0.00**	3.08	3.08	**0**	122.44	116.49	**-5.95**
Oxbow North	19.31	42.31	**22.99**	0	0	**0.00**	2.29	2.29	**0**	18.01	21.51	**3.50**
Oxbow Central	1.37	17.76	**16.39**	0.14	0.14	**0.00**	0	0	**0**	41.57	41.58	**0.01**
Oxbow South	0.93	10.42	**9.50**	0	0	**0.00**	0	0	**0**	1.23	2.02	**0.79**
Gateway Central	0.70	1.74	**1.04**	0	0	**0.00**	0	0	**0**	0.46	11.11	**10.65**
Gateway South	16.24	25.23	**8.99**	0	0	**0.00**	0.09	0.09	**0**	1.83	0.40	**-1.43**
Gateway Beach	21.29	45.81	**24.52**	2.05	18.77	**16.71**	3.34	3.34	**0**	6.45	40.05	**33.60**
Gateway Park	42.71	48.16	**5.46**	0	0	**0.00**	1.23	1.23	**0**	7.79	11.22	**3.43**
Gateway East	73.71	93.52	**19.81**	0.24	31.45	**31.21**	0.78	0.73	**0**	0.92	0.05	**-0.87**
TOTALS	228.66	468.03	**117.91**	4.05	51.98	**47.92**	103.84	103.80	**0.00**	465.99	507.37	**41.38**

[1] These sites are included in the original Central City Project and no change is proposed with their inclusion in the Modified Project Alternative.

[2] West Fork Riverbend is included in the original Cetral City Project but is not proposed as a primary valley storage site with the Modified Project Alternative

WITHOUT PROJECT HABITAT CONDITIONS
MODIFIED CENTRAL CITY PROJECT

	Riparian Woodland				Emergent Wetland				Upland Woodland				Grassland/Savannah				Total Baseline Acres
SITE	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	
Clear Fork West	0.62	188	116.31	**110.23**													
Clear Fork East	0	0	0.00	**0.00**													
North Main	0.62	12	7.69	**7.29**													
West Fork North	0.66	6	4.16	**3.94**													
West Fork Riverbend	0.54	25	13.72	**13.00**													
West Fork South	0.30	7	2.22	**2.10**	0.19	3	0.59	**0.25**	0.19	127	24.11	**51.78**	0.35	650	227.47	**208.24**	787
West Fork Rockwood	0.52	76	37.31	**37.31**	0.00	0	0.00		0.51	7	3.77	**3.08**	0.45	297	133.74	**122.44**	380
Oxbow North	0.70	39	27.16	**19.31**	0.00	0	0.00		0.56	5	2.80	**2.29**	0.76	46	35.26	**18.01**	90
Oxbow Central	0.62	3	1.92	**1.37**	0.19	2	0.30	**0.14**	0.00	0	0.00		0.76	107	81.62	**41.57**	112
Oxbow South	0.62	2	1.30	**0.93**	0.00	0	0.00		0.00	0	0.00		0.10	24	2.41	**1.23**	26
Gateway Central	0.72	1	0.65	**0.70**	0.00	0	0.00		0.00	0	0.00		0.10	6	0.60	**0.46**	7
Gateway South	0.72	21	15.05	**16.24**	0.00	0	0.00		0.19	0	0.04	**0.09**	0.10	21	2.08	**1.83**	42
Gateway Beach	0.72	27	19.73	**21.29**	0.33	7	2.28	**2.05**	0.19	7	1.39	**3.34**	0.10	74	7.35	**6.45**	115
Gateway Park	0.72	55	39.03	**42.71**	0.00	0	0.00		0.19	3	0.51	**1.23**	0.10	87	8.70	**7.79**	145
Gateway East	0.72	92	66.13	**73.71**	0.38	10	3.91	**0.24**	0.33	2	0.53	**0.78**	0.10	6	0.59	**0.92**	110
		323				22				151				1318			1814
Notes:																	
1. Base acres are shown rounded to nearest unit, calculations were based on acres to the nearest one-tenth																	
2. Gateway Park and Gateway East include shrublands added to Riparian																	
3. Gateway East includes forbland in the grasslands analysis																	

WITHOUT PROJECT ASSUMPTIONS
MODIFIED CENTRAL CITY PROJECT

Determination of Baseline Conditions:

Acreages used in calculating Habitat Units (HU's) and Average Annual Habitat Units (AAHU's) were derived through Geographic Information System (GIS) interpretation of recent digital-orthophotography and color IR with field verification of habitat types by biologists with the Corps of Engineers, US Fish and Wildlife Service, and Texas Parks and Wildlife Department from August 2006 through July 2007. Species models used to determine baseline Habitat Suitability index (HSI) values were developed by that same team for the previous Central City and Riverside Oxbow studies.

Without Project Condition Assumptions for the LPP:

A 50 year period of analysis will be used to calculate AAHU's for the "Without Project" condition (and all subesequent "With Project" conditions).

It is assumed that the HSI for Riparian Woodlands within the valley storage sites in the Central City portion of the study area will decrease to 0.975 (i.e., 97.5%) of the baseline value by TY 10 (Target Year 10) and will continue to decrease in HSI value to 0.90 of the existing or baseline value by TY 50. Acreages of Riparian Woodlands in the original Central City study area are assumed to remain constant through the period of analysis. Within the Riverside Oxbow sites it is assumed that both acreages and HSIs will decrease to 0.8 at TY 10 and then rebound to 0.85 of baseline value by TY 50. In the Gateway Park sites, just east of the oxbow sites, it is assumed that both HSIs and acreages will improve to 1.03 and 1.06 of baseline values by TY 10 and TY 50, respectively. HSIs at Site 17 within the Gateway Park area, however, will go to 0.0 at TY 10 due to soils cleanup to be conducted by the City of Fort Worth during that time.

HSI's within Upland Woodlands, which would only be impacted within the original Central City reaches, will decrease in value to 0.95 of the baseline value by TY 10 and to 0.90 at TY50. Acreages of Upland Woodlands those sites containing Upland Woodland will decrease to 0.90 of baseline by TY 10 and to 0.80 by TY50.

Emergent wetlands within sites the original Central City study area sites will decrease in both value and acreage to 0.50 of the baseline values by TY 10 and to 0.0 HSI and 0.0 acreage by TY 50. Emergent wetlands within the Riverside Oxbow reach will decrease to 0.95 of the baseline HSI value by TY 10 and 0.0 for HSI and acreage fy TY 50. Within the Gateway Park reach the HSI will go to 0.93 of its baseline value by TY 10 and to 0.84 of the acreage and baseline value by TY 50.

Grassland and Grassland Savannah habitat types within potential valley storage in the Central City reaches will retain baseline HSI values through the period of analysis. Acreages of grasslands within that reach will decrease to 0.95 of the baseline through TY 10 and then to 0.85 of the baseline acreage by TY 50. Acrages of grasslands at the Riverside Oxbow sites will go to 0.87 of baseline at TY 10 and to 0.29 at TY 50. HSIs of grasslands in the Riverside Oxbow reach will go to 0.90 at TY 10 and to 0.45 at TY 50. remain constant through the period of analysis. Grassland HSI's on sites 10, 12, 14a, and 14b will go to 0.78 of baseline by TY 10 and then to 0.13 of baseline by TY 50. Grassland HSI's on sites within the Gateway Park reach will go to 0.96 of the baseline value through TY 10 and then will decrease to 0.85 of the baseline value by TY 50. HSIs in that reach will not change through TY 10 but will then go to 0.88 of the baseline by TY 50.

No terrestrial habitat value will be assigned to open water and disturbed areas such as roads, gas well pads, debris disposal areas, etc. Acreage declines in woodlands, wetlands, and grasslands will be reflected in comparative increases in acreage of disturbed areas.

Calculations used in these Habitat Evaluations are based upon the US Fish and Wildlife Service's Habitat Evaluation Proceedures (HEP) published in Ecological Services Manual example below:

EXAMPLE AAHU CALCULATIONS (From USFWS's ESM 102)

*Input data in the bolded areas, see formulas by clicking cell

100 year Pro	Target Year	0	1	20	100	Cumulative Hu's	AAHU's
Forest (witho	Year Interval	0	1	19	80		
	HSI	**0.75**	**0.75**	**0.6**	**0.6**		
	ACRES	**1000**	**1000**	**900**	**600**		
	Target Year H	750	750	540	360		
	Interval HU's		750.00	12207.50	36000.00	48957.50	489.58

100 year Pro	Target Year's	0	1	20	100	Cumulative Hu's	AAHU's
Forest (with)	Year Interval	0	1	19	80		
	HSI	**0.75**	**0.7**	**0.2**	**0.2**		
	ACRES	**1000**	**500**	**500**	**500**		
	Target Year H	750	350	100	100		
	Interval HU's		545.83	4275.00	8000.00	12820.83	128.21

Net AAHU C	**-361.37**

WITHOUT PROJECT AAHU CALCULATIONS

Clear Fork West

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.60	0.56		
	ACRES	187.6	187.6	187.6	187.6		
	Target Year HU's	116.31	116.31	113.40	104.68		
	Interval HU's		116.31	1033.72	4361.70	5511.73	110.23

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	79.1	79.1	71.19	63.28		
	Target Year HU's	44.30	44.30	37.87	31.89		
	Interval HU's		44.30	369.43	1393.85	1807.57	36.15

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.48	0.48	0.48	0.48		
	ACRES	400.3	400.3	380.29	340.26		
	Target Year HU's	192.14	192.14	182.54	163.32		
	Interval HU's		192.14	1686.06	6917.18	8795.39	175.91

Clear Fork East

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.00	0.00		
	ACRES	0	0	0	0		
	Target Year HU's	0.00	0.00	0.00	0.00		
	Interval HU's		0.00	0.00	0.00	0.00	0.00

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.5	0.5	0.48	0.45		
	ACRES	41.9	41.9	37.71	33.52		
	Target Year HU's	20.95	20.95	17.91	15.08		
	Interval HU's		20.95	174.72	659.23	854.90	17.10

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.35	0.35	0.35	0.35		
	ACRES	102.2	102.2	97.09	86.87		
	Target Year HU's	35.77	35.77	33.98	30.40		
	Interval HU's		35.77	313.88	1287.72	1637.37	32.75

North Main

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.60	0.56		
	ACRES	12.4	12.4	12.4	12.4		
	Target Year HU's	7.69	7.69	7.50	6.92		
	Interval HU's		7.69	68.33	288.30	364.32	7.29

Emergent Wetland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.3	0.3	0.15	0.00		
	ACRES	2.9	2.9	2.90	0.00		
	Target Year HU's	0.87	0.87	0.44	0.00		
	Interval HU's		0.87	5.87	5.80	12.54	0.25

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	143.2	143.2	128.88	114.56		
	Target Year HU's	80.19	80.19	68.56	57.74		
	Interval HU's		80.19	668.80	2523.37	3272.37	65.45

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.48	0.48	0.48	0.48		
	ACRES	399.1	399.1	379.15	339.24		
	Target Year HU's	191.57	191.57	181.99	162.83		
	Interval HU's		191.57	1681.01	6896.45	8769.03	175.38

West Fork North

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.66	0.66	0.64	0.59		
	ACRES	6.3	6.3	6.3	6.3		
	Target Year HU's	4.16	4.16	4.05	3.74		
	Interval HU's		4.16	36.95	155.93	197.04	3.94

Emergent Wetland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.00	0.00		
	ACRES	0	0	0.00	0.00		
	Target Year HU's	0.00	0.00	0.00	0.00		
	Interval HU's		0.00	0.00	0.00	0.00	0.00

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.41	0.41	0.39	0.37		
	ACRES	73.3	73.3	65.97	58.64		
	Target Year HU's	30.05	30.05	25.70	21.64		
	Interval HU's		30.05	250.64	945.67	1226.36	24.53

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.35	0.35	0.35	0.35		
	ACRES	304.3	304.3	289.09	258.66		
	Target Year HU's	106.51	106.51	101.18	90.53		
	Interval HU's		106.51	934.58	3834.18	4875.27	97.51

West Fork South

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.3	0.3	0.29	0.27		
	ACRES	7.4	7.4	7.4	7.4		
	Target Year HU's	2.22	2.22	2.16	2.00		
	Interval HU's		2.22	19.73	83.25	105.20	2.10

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.5	0.5	0.48	0.45		
	ACRES	126.9	126.9	114.21	101.52		
	Target Year HU's	63.45	63.45	54.25	45.68		
	Interval HU's		63.45	529.17	1996.56	2589.18	51.78

Emergent Wetland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.19	0.19	0.10	0.00		
	ACRES	3.1	3.1	3.10	0.00		
	Target Year HU's	0.59	0.59	0.29	0.00		
	Interval HU's		0.59	3.98	3.93	8.49	0.17

Grassland/Savannah

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.35	0.35	0.35	0.35		
	ACRES		649.9	649.9	617.41	552.42		
	Target Year HU's		227.47	227.47	216.09	193.35		
	Interval HU's			227.47	1996.01	8188.74	10412.21	208.24

West Fork Riverbend

Riparian Woodland

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.54	0.54	0.53	0.49		
	ACRES		25.4	25.4	25.4	25.4		
	Target Year HU's		13.72	13.72	13.37	12.34		
	Interval HU's			13.72	121.90	514.35	649.97	13.00

Emergent Wetland

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.44	0.44	0.22	0.00		
	ACRES		8.8	8.8	8.80	0.00		
	Target Year HU's		3.87	3.87	1.94	0.00		
	Interval HU's			3.87	26.14	25.81	55.82	1.12

Upland Woodland

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.8	0.8	0.76	0.72		
	ACRES		63.2	63.2	56.88	50.56		
	Target Year HU's		50.56	50.56	43.23	36.40		
	Interval HU's			50.56	421.67	1590.95	2063.19	41.26

Grassland/Savannah

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.35	0.35	0.35	0.35		
	ACRES		178.1	178.1	169.20	151.39		
	Target Year HU's		62.34	62.34	59.22	52.98		
	Interval HU's			62.34	546.99	2244.06	2853.38	57.07

West Fork Rockwood

Riparian Woodland

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.52	0.52	0.51	0.47		
	ACRES		75.7	75.7	75.7	75.7		
	Target Year HU's		39.36	39.36	38.38	35.43		
	Interval HU's			39.36	349.85	1476.15	1865.36	37.31

Upland Woodland

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.51	0.51	0.48	0.46		
	ACRES		7.4	7.4	6.66	5.92		
	Target Year HU's		3.77	3.77	3.23	2.72		
	Interval HU's			3.77	31.48	118.76	154.00	3.08

Grassland/Savannah

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.45	0.45	0.45	0.45		
	ACRES		297.2	297.2	282.34	252.62		
	Target Year HU's		133.74	133.74	127.05	113.68		
	Interval HU's			133.74	1173.57	4814.64	6121.95	122.44

Oxbow North

Riparian Woodland

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.7	0.7	0.56	0.60		
	ACRES		38.8	38.8	31.04	32.98		
	Target Year HU's		27.16	27.16	17.38	19.62		
	Interval HU's			27.16	198.81	739.66	965.63	19.31

Upland Woodland

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.56	0.56	0.53	0.50		
	ACRES		5.00	5.00	4.50	4.00		
	Target Year HU's		2.80	2.80	2.39	2.02		
	Interval HU's			2.80	23.35	88.11	114.26	2.29

Grassland/Savannah

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.76	0.76	0.68	0.34		
	ACRES		46.4	46.4	40.37	13.46		
	Target Year HU's		35.26	35.26	27.61	4.60		
	Interval HU's			35.26	282.25	582.91	900.43	18.01

Oxbow Central

Riparian Woodland

50 year Project Life		TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval		0	1	9	40		
	HSI		0.62	0.62	0.50	0.53		
	ACRES		3.1	3.1	2.48	2.64		
	Target Year HU's		1.92	1.92	1.23	1.39		
	Interval HU's			1.92	14.07	52.34	68.33	1.37

Emergent Wetland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's

	Year Interval	0	1	9	40		
	HSI	0.19	0.19	0.18	0.00		
	ACRES	1.6	1.6	1.60	0.00		
	Target Year HU's	0.30	0.30	0.29	0.00		
	Interval HU's		0.30	2.67	3.85	6.82	0.14

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.76	0.76	0.68	0.34		
ACRES		107.1	107.1	93.18	31.06		
Target Year HU's		81.40	81.40	63.73	10.62		
Interval HU's			81.40	651.49	1345.48	2078.37	41.57

Oxbow South

Riparian Woodland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.62	0.62	0.50	0.53		
ACRES		2.1	2.1	1.68	1.79		
Target Year HU's		1.30	1.30	0.83	0.94		
Interval HU's			1.30	9.53	35.46	46.29	0.93

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.1	0.1	0.09	0.05		
ACRES		24.1	24.1	20.97	6.99		
Target Year HU's		2.41	2.41	1.89	0.31		
Interval HU's			2.41	19.29	39.84	61.54	1.23

Gateway Central

Riparian Woodland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.72	0.72	0.74	0.76		
ACRES		0.9	0.9	0.93	0.95		
Target Year HU's		0.65	0.65	0.69	0.73		
Interval HU's			0.65	6.01	28.31	34.96	0.70

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.1	0.1	0.10	0.09		
ACRES		5.2	5.2	5.20	4.58		
Target Year HU's		0.52	0.52	0.50	0.39		
Interval HU's			0.52	4.59	17.72	22.82	0.46

Gateway South

Riparian Woodland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**

Year Interval	0	1	9	40			
HSI	0.72	0.72	0.74	0.76			
ACRES	20.9	20.9	21.53	22.15			
Target Year HU's	15.05	15.05	15.96	16.91			
Interval HU's		15.05	139.54	657.36	811.94	16.24	

Upland Woodland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.56	0.56	0.53	0.50		
ACRES		0.20	0.20	0.18	0.16		
Target Year HU's		0.11	0.11	0.10	0.08		
Interval HU's			0.11	0.93	3.52	4.57	0.09

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.1	0.1	0.10	0.09		
ACRES		20.8	20.8	20.80	18.30		
Target Year HU's		2.08	2.08	2.00	1.56		
Interval HU's			2.08	18.35	70.87	91.30	1.83

Gateway Beach

Riparian Woodland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.72	0.72	0.74	0.76		
ACRES		27.4	27.4	28.22	29.04		
Target Year HU's		19.73	19.73	20.93	22.17		
Interval HU's			19.73	182.93	861.80	1064.46	21.29

Upland Woodland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.56	0.56	0.53	0.50		
ACRES		7.30	7.30	6.57	5.84		
Target Year HU's		4.09	4.09	3.50	2.94		
Interval HU's			4.09	34.09	128.64	166.82	3.34

Emergent Wetland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.33	0.33	0.31	0.28		
ACRES		6.9	6.9	6.90	6.90		
Target Year HU's		2.28	2.28	2.12	2.28		
Interval HU's			2.28	19.78	80.61	102.66	2.05

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		

	HSI	0.1	0.1	0.10	0.09		
	ACRES	73.5	73.5	73.50	64.68		
	Target Year HU's	7.35	7.35	7.06	5.50		
	Interval HU's		7.35	64.83	250.43	322.61	6.45

Gateway Park

Riparian Woodland	Not in site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.72	0.72	0.74	0.76		
	ACRES		54.21	54.21	55.84	57.46		
	Target Year HU's		39.03	39.03	41.41	43.86		
	Interval HU's			39.03	361.92	1705.04	2105.99	42.12

Riparian Woodland	In Site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.4	0.4	0.00	0.00		
	ACRES		0.82	0.82	0.00	0.00		
	Target Year HU's		0.33	0.33	0.00	0.00		
	Interval HU's			0.33	0.98	0.00	1.31	0.03

Emergent Wetland								
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.45	0.45	0.00	0.00		
	ACRES		0.04	0.04	0.04	0.03		
	Target Year HU's		0.02	0.02	0.00	0.02		
	Interval HU's			0.02	0.08	0.00	0.10	0.00

Upland Woodland								
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.56	0.56	0.53	0.50		
	ACRES		2.70	2.70	2.43	2.16		
	Target Year HU's		1.51	1.51	1.29	1.09		
	Interval HU's			1.51	12.61	47.58	61.70	1.23

Grassland/Savannah	Not in Site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.1	0.1	0.10	0.09		
	ACRES		86.7	86.7	86.67	76.27		
	Target Year HU's		8.67	8.67	8.32	6.48		
	Interval HU's			8.67	76.44	295.30	380.41	7.61

Grassland/Savannah	In Site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
becomes deep water pond	**HSI**		0.1	0.1	0.00	0.00		
or turf grass	**ACRES**		16.1	16.1	16.12	14.19		

	Target Year HU's	1.61	1.61	0.00	0.00		
	Interval HU's		1.61	7.25	0.00	8.87	0.18

Shrubland	Not in Site 17						
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
tends toward riparian	**HSI**	0.77	0.77	0.79	0.82		
	ACRES	0.7	0.7	0.69	0.71		
	Target Year HU's	0.52	0.54	0.55	0.58		
	Interval HU's		0.53	4.89	22.54	27.95	0.56

Gateway East

Riparian Woodland	Not in Site 17						
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.72	0.72	0.74	0.76		
	ACRES	91.85	91.85	94.61	97.36		
	Target Year HU's	66.13	66.13	70.16	74.31		
	Interval HU's		66.13	613.22	2888.91	3568.26	71.37

Riparian Woodland	In Site 17						
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
becomes turf or	**HSI**	0.39	0.39	0.00	0.00		
deep water	**ACRES**	14.95	14.95	0.00	0.00		
	Target Year HU's	5.83	5.83	0.00	0.00		
	Interval HU's		5.83	17.49	0.00	23.32	0.47

Shrubland	Not in Site 17						
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
becomes turf or	**HSI**	0.77	0.77	0.79	0.82		
deep water	**ACRES**	1.27	1.27	1.31	1.35		
	Target Year HU's	0.98	0.98	1.04	1.10		
	Interval HU's		0.98	9.07	42.72	52.76	1.06

Shrubland	In Site 17						
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
becomes turf or	**HSI**	0.77	0.77	0.00	0.00		
deep water	**ACRES**	2.76	14.95	0.00	0.00		
	Target Year HU's	2.13	11.51	0.00	0.00		
	Interval HU's		6.82	34.53	0.00	41.35	0.83

Upland Woodland							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	1.70	1.70	1.53	1.36		
	Target Year HU's	0.95	0.95	0.81	0.69		

	Interval HU's			0.95	7.94	29.96	38.85	0.78

Emergent Wetland	Not in Site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.45	0.45	0.00	0.00		
adversely affected by	**ACRES**		4.36	4.36	4.36	3.66		
excavation	Target Year HU's		1.96	1.96	0.00	1.65		
	Interval HU's			1.96	8.83	0.00	10.79	0.22

Emergent Wetland	In Site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.45	0.45	0.00	0.00		
becomes deep water	**ACRES**		5.9	0	0.00	0.00		
	Target Year HU's		2.66	0.00	0.00	0.00		
	Interval HU's			1.33	0.00	0.00	1.33	0.03

Grassland/Savannah	Not in Site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.1	0	0.10	0.09		
	ACRES		5.9	5.9	5.93	5.22		
	Target Year HU's		0.59	0.00	0.57	0.44		
	Interval HU's			0.30	2.56	20.20	23.06	0.46

Grassland/Savannah	In Site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.1	0	0.10	0.09		
Becomes deep water	**ACRES**		0.1	0.0	0.00	0.00		
	Target Year HU's		0.01	0.00	0.00	0.00		
	Interval HU's			0.00	0.00	0.00	0.00	0.00

Forbland	In Site 17							
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.66	0.66	0.00	0.00		
Becomes deep water	**ACRES**		8.6	8.6	0.00	0.00		
	Target Year HU's		5.68	5.68	0.00	0.00		
	Interval HU's			5.68	17.03	0.00	22.70	0.45

Site 17

Riparian Woodland								
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.39	0.9	0.00	0.00		
	ACRES		16.7	16.7	0.00	0.00		
	Target Year HU's		6.51	15.03	0.00	0.00		

	Interval HU's		10.77	45.09	0.00	55.86	1.12

Upland Woodland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.56	0.56	0.53	0.50		
ACRES		1.60	1.60	1.44	1.28		
Target Year HU's		0.90	0.90	0.77	0.65		
Interval HU's			0.90	7.47	28.19	36.56	0.73

Emergent Wetland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.45	0.45	0.00	0.00		
ACRES		8.8	8.8	0.00	0.00		
Target Year HU's		3.96	3.96	0.00	0.00		
Interval HU's			3.96	11.88	0.00	15.84	0.32

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.1	0.1	0.10	0.10		
ACRES		17.2	17.2	42.70	42.70		
Target Year HU's		1.72	1.72	4.10	4.27		
Interval HU's			1.72	26.34	167.38	195.44	3.91

WITH PROJECT HABITAT CONDITIONS
MODIFIED CENTRAL CITY PROJECT

	Riparian Woodland				Emergent Wetland				Upland Woodland				Grassland/Savannah				Total Baseline Acres
SITE	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	
West Fork South	0.30	1	0.42	**4.14**	0.19	3	0.59	**0.25**	0.19	127	24.11	**51.78**	0.35	650	227.47	**205.87**	781
West Fork Rockwood	0.52	75	39.21	**44.48**	0.00	0	0.00		0.51	7	3.77	**3.08**	0.45	297	133.74	**116.49**	380
Oxbow North	0.70	39	27.16	**42.31**	0.00	0	0.00		0.56	5	2.80	**2.29**	0.76	46	35.26	**21.51**	90
Oxbow Central	0.62	3	1.86	**17.76**	0.19	2	0.30	**0.14**	0.00	0	0.00		0.76	107	81.62	**41.58**	112
Oxbow South	0.62	6	4.00	**10.42**	0.00	0	0.00		0.00	0	0.00		0.10	24	2.41	**2.02**	31
Gateway Central	0.72	2	1.53	**1.74**	0.00	0	0.00		0.00	0	0.00		0.10	6	0.60	**11.11**	8
Gateway South	0.72	24	17.59	**25.23**	0.00	0	0.00		0.56	0.2	0.11	**0.09**	0.10	21	2.08	**0.40**	45
Gateway Beach	0.72	26	18.51	**45.81**	0.33	7	2.28	**18.77**	0.56	7	4.09	**3.34**	0.10	74	7.35	**40.05**	113
Gateway Park	0.72	55	39.60	**48.16**	0.00	0	0.00		0.56	3	1.51	**1.23**	0.10	87	8.70	**11.22**	145
Gateway East	0.72	107	76.90	**93.52**	0.38	10	3.91	**31.45**	0.56	2	0.90	**0.73**	0.10	6	0.59	**0.05**	125
		339				22				151				1318			1830

With Project Assumptions for the LPP
Same assumptions were also used for re-assessment of Riverside Oxbow 2005 project reported habitat measures to reflect current planning conditions

Adverse impacts to significant resource catagories such as riparian woodlands and emergent wetlands will be avoided and minimized to the maximum extent possible by design and configuration of the potential hydraulic valley storage sites. Every effort will be made to utilize only those lower valued or more renewable resource catagories such as grasslands and disturbed areas to achieve the required valley storage and then to restore those excavated sites to the higher resource categories of riparian woodland and emergent wetland.

Any acreages other than Riparian Woodland within a given reach that are not directly affected by the project's valley storage sites or other project features will retain the same acreage and HSI values as they would have for the Without Project condition.

Differing sets of assumptions will be used for the "with project" condition for restoration of riparian woodlands, emergent wetlands, and stream aquatic habitat that would be directly affected depending upon existing value, location of the site, and management intensity. These assumptions will vary by site as follows.

West Fork South : Riparian woodlands that will be created from the excavated valley storage area will achieve an HSI of 0.25 by TY 10 and 0.8 by TY 50. HSI of existing riparian woodlands will be increased to values of 0.5 and 0.85 by TY 10 and TY 50, respectively. Restoration of 3,568 linear feet of channel, including 900 linear feet of riffle, will result in a gain of 1.52 AAHUs of stream aquatic habitat through the project life.

West Fork Rockwood : For those riparian woodlands that will be created from the excavated valley storage area it is assumed that an HSI of 0.25 will be reached by TY 10 and that the HSI will reach 0.8 by TY 50. Existing Riparian Woodland areas that are not impacted by construction will go to 0.975 of their current HSI at TY 10 through the project life. 5.9 acres of riparian woodland will be impacted begining at TY 1 but will undergo riparian restoration as described above (accounting will be as mitigation). Restoration of aquatic oxbow habitat will encoumpass 5.1 acres of previously severed stream channel begining at TY 1 with AAHUs of 4.3 through the project life.

Oxbow North : (Right descending bank) - Developed riparian woodland will achieve an HSI of 0.25 by TY 10 and 0.8 by TY 50. Improved riparian woodland currently valued at an HSI of 0.7 will increase to 0.8 at TY 10 and to 0.95 at TY 50. Native grassland HSIs will go to 0.5 at TY 1 and to 1.0 by TY 10 through the remainder of the project life. Areas developed as "high density riparian forest" with restored topsoil will achieve an HSI of 0.2 by TY 10 and 0.6 by TY 50. (Left descending bank and additions to both banks) - HSIs for all habitat types in this area will be the same as the right descending bank except that improved riparian woodland currently valued at an HSI of 0.7 will increase to 0.8 at TY 10 and to 0.95 at TY 50. Existing graslands in the Oxbow North Reach of grasslands not directly affected by the project HSIs will go to 0.9 of the baseline by TY 10 and to 0.45 of the baseline by TY 50 and acreages will drop to 0.87 and to 0.29 of baseline during those same intervals.

Oxbow Central : Areas developed as "high density riparian forest" with restored topsoil will achieve an HSI of 0.2 by TY 10 and 0.6 by TY 50. Acreages and HSI's of preserved riparian forest will drop to 0.8 of their baseline values at TY 10 but will rebound to 0.85 of that value by TY 50. Created or developed low density forest (10% or less canopy, i.e., savannah) will achieve a 0.5 grassland HSI by TY 1 and then 1.0 at TY 10 through the project life. Native grassland will achieve those same values. Turf grasses will retain an HSI of 0.1 from TY 1 through

affected by the project will go to 0.9 of the baseline by TY 10 and to 0.45 of the baseline by TY 50 and acreages will drop to 0.87 and to 0.29 of existing values at those target years. Restoration of the Sycamore Creek aquatic and riparian system will result in riparian HSI values of 0.4 at TY 1, 0.85 at TY 10 through TY 50 on the 2.78 acres used for that purpose.

Oxbow South : Areas developed as "high density riparian forest" with restored topsoil will achieve an HSI of 0.2 by TY 10 and 0.6 by TY 50. Improved riparian woodland will achieve an HSI of 0.8 by TY 10 and an HSI of 0.9 by TY 50. Turf grasses will retain an HSI of 0.1 from TY 1 through the project life. Native grasslands created as a buffer within the valley storage site will achieve a 0.5 grassland HSI by TY 1 and then 1.0 at TY 10 through the project life. HSIs of "preserved" native grasslands not directly affected by the project will go to 0.9 of the baseline by TY 10 and to 0.45 of the baseline by TY 50 and acreages will drop to 0.87 and to 0.29 of existing values at those target years.

Gateway Center : Improved existing riparian woodland will achieve an HSI of 0.8 by TY 10 and an HSI of 0.9 by TY 50. Turf grasses will retain an HSI of 0.1 from TY 1 through the project life. Created or developed low density forest (10% or less canopy, i.e., savannah) will achieve a 0.5 grassland HSI by TY 1 and then 1.0 at TY 10 through the project life. Turf grasses will retain an HSI of 0.1 from TY 1 through the project life. Existing grasslands will be maintained but acreages will be reduced by 0.96 at TY 10 and by 0.85 at TY 50, and HSI will remain constant through TY 10 but will be reduced by 0.88 by TY 50.

Gateway Beach : Improved existing riparian woodland will achieve an HSI of 0.85 by TY 10 and an HSI of 0.95 by TY 50 due to association with developed and improved wetlands. Developed woodlands although on excavated sites will achieve 0.85 hsi by TY 50 due to proximity to wetlands and adjacent riparian forest in this site. Created or developed low density forest (10% or less canopy, i.e., savannah) will achieve a 0.5 grassland HSI by TY 1 and then 1.0 at TY 10 through the project life. Developed scattered trees (5% canopy savannah) will achieve a 0.5 grassland HSI by TY 1 and then 1.0 at TY 10 through the project life. Turf grasses will retain an HSI of 0.1 from TY 1 through the project life. Existing grasslands will be maintained but acreages will be reduced by 0.96 at TY 10 and by 0.85 at TY 50, and HSI will remain constant through TY 10 but will be reduced by 0.88 by TY 50.

Gateway South : Areas developed as "high density riparian forest" with restored topsoil will achieve an HSI of 0.2 by TY 10 and 0.6 by TY 50. Improved riparian woodland will achieve an HSI of 0.8 by TY 10 and an HSI of 0.9 by TY 50. Turf grasses will retain an HSI of 0.1 from TY 1 through the project life.

Gateway Park : Existing riparian forest, either inside or outside the project footprint, with no management will result in no additional loss of acreage and will result in increases in HSI by 1.03 at TY 10 and by 1.06 at TY 50. Improved riparian woodland will achieve an HSI of 0.85 by TY 10 and an HSI of 0.95 by TY 50 due to incorporation of extensive emergent wetland complex and adjacent riparian woodland management. Developed scattered trees (5% canopy savannah) will achieve a 0.5 grassland HSI by TY 1 and then 1.0 at TY 10 through the project life. Turf grasses will retain an HSI of 0.1 from TY 1 through the project life. Existing grasslands will be maintained but acreages will be reduced by 0.96 at TY 10 and by 0.85 at TY 50, and HSI will remain constant through TY 10 but will be reduced by 0.88 by TY 50.

Gateway East : Improved riparian woodland will achieve an HSI of 0.85by TY 10 and an HSI of 0.95 by TY 50 due to connection to wetlands and adjacent managed forests.. Existing riparian forest, either inside or outside the project footprint, with no management will result in no additional loss of acreage and will result in increases in HSI by 1.03 at TY 10 and by 1.06 at TY 50.

Site 17 (a subset of Gateway Park and Gateway East) : All excavated areas within Site 17 will be

WITH MODIFIED PROJECT AAHU CALCULATIONS

Clear Fork West

This site was included in the Authorized Central City plan

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.60	0.56		
	ACRES	187.6	187.6	187.6	187.6		
	Target Year HU's	116.31	116.31	113.40	104.68		
	Interval HU's		116.31	1033.72	4361.70	5511.73	110.23

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	79.1	79.1	71.19	63.28		
	Target Year HU's	44.30	44.30	37.87	31.89		
	Interval HU's		44.30	369.43	1393.85	1807.57	36.15

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.48	0.48	0.48	0.48		
	ACRES	400.3	400.3	380.29	340.26		
	Target Year HU's	192.14	192.14	182.54	163.32		
	Interval HU's		192.14	1686.06	6917.18	8795.39	175.91

Clear Fork East

This site was included in the Authorized Central City plan

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.00	0.00		
	ACRES	0	0	0	0		
	Target Year HU's	0.00	0.00	0.00	0.00		
	Interval HU's		0.00	0.00	0.00	0.00	0.00

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.5	0.5	0.48	0.45		
	ACRES	41.9	41.9	37.71	33.52		
	Target Year HU's	20.95	20.95	17.91	15.08		
	Interval HU's		20.95	174.72	659.23	854.90	17.10

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.35	0.35	0.35	0.35		
	ACRES	102.2	102.2	97.09	86.87		
	Target Year HU's	35.77	35.77	33.98	30.40		
	Interval HU's		35.77	313.88	1287.72	1637.37	32.75

North Main

This site was included in the Authorized Central City plan

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.60	0.56		
	ACRES	12.4	12.4	12.4	12.4		
	Target Year HU's	7.69	7.69	7.50	6.92		
	Interval HU's		7.69	68.33	288.30	364.32	7.29

Emergent Wetland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.3	0.3	0.15	0.00		
	ACRES	2.9	2.9	2.90	0.00		
	Target Year HU's	0.87	0.87	0.44	0.00		
	Interval HU's		0.87	5.87	5.80	12.54	0.25

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	143.2	143.2	128.88	114.56		
	Target Year HU's	80.19	80.19	68.56	57.74		
	Interval HU's		80.19	668.80	2523.37	3272.37	65.45

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.48	0.48	0.48	0.48		
	ACRES	399.1	399.1	379.15	339.24		
	Target Year HU's	191.57	191.57	181.99	162.83		
	Interval HU's		191.57	1681.01	6896.45	8769.03	175.38

West Fork North

This site was included in the Authorized Central City plan

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.66	0.66	0.64	0.59		
	ACRES	6.3	6.3	6.3	6.3		
	Target Year HU's	4.16	4.16	4.05	3.74		
	Interval HU's		4.16	36.95	155.93	197.04	3.94

Emergent Wetland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.00	0.00		
	ACRES	0	0	0.00	0.00		
	Target Year HU's	0.00	0.00	0.00	0.00		
	Interval HU's		0.00	0.00	0.00	0.00	0.00

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.41	0.41	0.39	0.37		
	ACRES	73.3	73.3	65.97	58.64		
	Target Year HU's	30.05	30.05	25.70	21.64		
	Interval HU's		30.05	250.64	945.67	1226.36	24.53

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.35	0.35	0.35	0.35		
	ACRES	304.3	304.3	289.09	258.66		
	Target Year HU's	106.51	106.51	101.18	90.53		
	Interval HU's		106.51	934.58	3834.18	4875.27	97.51

West Fork South (Ham Branch)

This site was included in the Authorized Central City plan

Riparian Woodland (Developed within Ham Branch Valley Storage)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	1.4	1.4	1.4		
	Target Year HU's	0.00	0.00	0.35	1.12		
	Interval HU's		0.00	1.58	29.40	30.98	0.62

Riparian Woodland (Existing within reach)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.3	0.3	0.50	0.85		
	ACRES	7.4	7.4	7.4	7.4		
	Target Year HU's	2.22	2.22	3.70	6.29		
	Interval HU's		2.22	26.64	199.80	228.66	4.57

Upland Woodland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.5	0.5	0.48	0.45		
	ACRES	126.9	126.9	114.21	101.52		
	Target Year HU's	63.45	63.45	54.25	45.68		
	Interval HU's		63.45	529.17	1996.56	2589.18	51.78

Emergent Wetland

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.3	0.3	0.15	0.00		
	ACRES	2.9	2.9	2.90	0.00		
	Target Year HU's	0.87	0.87	0.44	0.00		
	Interval HU's		0.87	5.87	5.80	12.54	0.25

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.35	0.35	0.35	0.35		
	ACRES	649.9	642.4	610.28	546.04		
	Target Year HU's	227.47	224.84	213.60	191.11		
	Interval HU's		226.15	1972.97	8094.24	10293.36	205.87

West Fork Riverbend

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.54	0.54	0.53	0.49		
	ACRES	25.4	25.4	25.4	25.4		
	Target Year HU's	13.72	13.72	13.37	12.34		
	Interval HU's		13.72	121.90	514.35	649.97	13.00

Emergent Wetland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.44	0.44	0.22	0.00		
	ACRES	8.8	8.8	8.80	0.00		
	Target Year HU's	3.87	3.87	1.94	0.00		
	Interval HU's		3.87	26.14	25.81	55.82	1.12

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.8	0.8	0.76	0.72		
	ACRES	63.2	63.2	56.88	50.56		
	Target Year HU's	50.56	50.56	43.23	36.40		
	Interval HU's		50.56	421.67	1590.95	2063.19	41.26

Grassland/Savannah

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.35	0.35	0.35	0.35		
	ACRES	178.1	178.1	169.20	151.39		
	Target Year HU's	62.34	62.34	59.22	52.98		
	Interval HU's		62.34	546.99	2244.06	2853.38	57.07

West Fork Rockwood

Riparian Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	20.51	20.51	20.51		
	Target Year HU's	0.00	0.00	5.13	16.41		
	Interval HU's		0.00	23.07	430.71	453.78	9.08

Riparian Woodland (Lost existing riparian woodland)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.52	0.52	0.51	0.51		
	ACRES	5.9	0.00	0.00	0.00		
	Target Year HU's	3.07	0.00	0.00	0.00		
	Interval HU's		1.53	0.00	0.00	1.53	0.03

Riparian Woodland (Existing within reach)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.52	0.52	0.51	0.51		
	ACRES	75.7	75.7	75.70	75.70		
	Target Year HU's	39.36	39.36	38.38	38.38		
	Interval HU's		39.36	349.85	1535.20	1924.41	38.49

Upland Woodland							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.51	0.51	0.48	0.46		
	ACRES	7.4	7.4	6.66	5.92		
	Target Year HU's	3.77	3.77	3.23	2.72		
	Interval HU's		3.77	31.48	118.76	154.00	3.08

Grassland/Savannah							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.45	0.45	0.45	0.45		
	ACRES	297.2	282.59	268.46	240.20		
	Target Year HU's	133.74	127.17	120.81	108.09		
	Interval HU's		130.45	1115.88	4577.96	5824.29	116.49

Oxbow North

Riparian Woodland (Right bank looking downstream - developed)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	6.77	6.77	6.77		
	Target Year HU's	0.00	0.00	1.69	5.42		
	Interval HU's		0.00	7.62	142.17	149.79	3.00

Riparian Woodland (Right bank looking downstream - Improved within reach)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.7	0.7	0.80	0.92		
	ACRES	1.11	1.11	1.11	1.11		
	Target Year HU's	0.78	0.78	0.89	1.02		
	Interval HU's		0.78	7.49	38.18	46.45	0.93

Riparian Woodland (Right bank - Developed high density on restored deeply disturbed top soils)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.20	0.60		
	ACRES	0	8.55	8.55	8.55		
	Target Year HU's	0.00	0.00	1.71	5.13		
	Interval HU's		0.00	7.70	136.80	144.50	2.89

Riparian Woodland (Left bank - developed)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	9.62	9.62	9.62		
	Target Year HU's	0.00	0.00	2.41	7.70		
	Interval HU's		0.00	10.82	202.02	212.84	4.26

Riparian Woodland (- Improved within reach)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.7	0.7	0.80	0.95		
	ACRES	36.79	36.79	36.79	36.79		
	Target Year HU's	25.75	25.75	29.43	34.95		
	Interval HU's		25.75	248.33	1287.65	1561.74	31.23

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	5.00	5.00	4.50	4.00		
	Target Year HU's	2.80	2.80	2.39	2.02		
	Interval HU's		2.80	23.35	88.11	114.26	2.29

Grassland/Savannah (Existing native grassland)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.76	0.5	1.00	1.00		
	ACRES	46.4	21.46	21.46	21.46		
	Target Year HU's	35.26	10.73	21.46	21.46		
	Interval HU's		21.92	144.86	858.40	1025.17	20.50

Grassland/Savannah (Turf grasses)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.10	0.10		
	ACRES	0	11.31	11.31	11.31		
	Target Year HU's	0.00	0.00	1.13	1.13		
	Interval HU's		0.00	5.09	45.24	50.33	1.01

Oxbow Central

Riparian Woodland (Developed high density on restored deeply disturbed top soils)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.20	0.60		
	ACRES	0	45.2	45.20	45.20		
	Target Year HU's	0.00	0.00	9.04	27.12		
	Interval HU's		0.00	40.68	723.20	763.88	15.28

Riparian Woodland (Preserve Existing)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.50	0.53		
	ACRES	0.61	0.61	0.49	0.52		
	Target Year HU's	0.38	0.38	0.24	0.27		
	Interval HU's		0.38	2.77	10.30	13.45	0.27

Riparian Woodland (Restored Perched Sycamore Creek Channel)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.4	0.85	0.85		
	ACRES	0	2.78	2.78	2.78		
	Target Year HU's	0.00	1.11	2.36	2.36		
	Interval HU's		0.37	15.64	94.52	110.53	2.21

Emergent Wetland								
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.19	0.19	0.18	0.00		
	ACRES		1.6	1.6	1.60	0.00		
	Target Year HU's		0.30	0.30	0.29	0.00		
	Interval HU's			0.30	2.67	3.85	6.82	0.14

Grassland/Savannah (Developed low density forest (10%) canopy - Savannah)								
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0	0.5	1.00	1.00		
	ACRES		0	21.49	21.49	21.49		
	Target Year HU's		0.00	10.75	21.49	21.49		
	Interval HU's			3.58	145.06	859.60	1008.24	20.16

Grassland/Savannah (Native Grasslands)								
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0	0.5	1.00	1.00		
	ACRES		0	0.46	0.46	0.46		
	Target Year HU's		0.00	0.23	0.46	0.46		
	Interval HU's			0.08	3.11	18.40	21.58	0.43

Grassland/Savannah (Turf grasses)								
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0.1	0	0.10	0.10		
	ACRES		37.22	0	37.22	37.22		
	Target Year HU's		3.72	0.00	3.72	3.72		
	Interval HU's			1.24	11.17	148.88	161.29	3.23

Oxbow South

Riparian Woodland (Developed high density on restored deeply disturbed top soils)								
50 year Project Life		TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval		0	1	9	40		
	HSI		0	0	0.20	0.60		
	ACRES		0	15.18	15.18	15.18		
	Target Year HU's		0.00	0.00	3.04	9.11		
	Interval HU's			0.00	13.66	242.88	256.54	5.13

Riparian Woodland (Improved riparian forest)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.80	0.90		
	ACRES	6.45	6.45	6.45	6.45		
	Target Year HU's	4.00	4.00	5.16	5.81		
	Interval HU's		4.00	41.22	219.30	264.51	5.29

Grassland/Savannah (Native Grasslands)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	0	1.54	1.54	1.54		
	Target Year HU's	0.00	0.77	1.54	1.54		
	Interval HU's		0.26	10.40	61.60	72.25	1.45

Grassland/Savannah (Turf grasses)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.10	0.10		
	ACRES	0	3.28	3.28	3.28		
	Target Year HU's	0.00	0.00	0.33	0.33		
	Interval HU's		0.00	1.48	13.12	14.60	0.29

Grassland/Savannah (Preserve existing grasslands)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.1	0.1	0.09	0.05		
	ACRES	5.56	5.56	4.84	1.61		
	Target Year HU's	0.56	0.56	0.44	0.07		
	Interval HU's		0.56	4.45	9.19	14.20	0.28

Gateway Central

Riparian Woodland (Improved riparian forest)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.80	0.90		
	ACRES	2.12	2.12	2.12	2.12		
	Target Year HU's	1.31	1.31	1.70	1.91		
	Interval HU's		1.31	13.55	72.08	86.94	1.74

Grassland/Savannah (Developed low density forest (10%) canopy - Savannah)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	0	11.32	11.32	11.32		
	Target Year HU's	0.00	5.66	11.32	11.32		
	Interval HU's		1.89	76.41	452.80	531.10	10.62

Grassland/Savannah (Preserve existing grasslands)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.1	0.1	0.10	0.09		
	ACRES	5.5	5.5	5.28	4.68		
	Target Year HU's	0.55	0.55	0.53	0.42		
	Interval HU's		0.55	4.85	18.93	24.34	0.49

Gateway South

Riparian Woodland (Developed high density on restored deeply disturbed top soils)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.20	0.60		
	ACRES	0	14.57	14.57	14.57		
	Target Year HU's	0.00	0.00	2.91	8.74		
	Interval HU's		0.00	13.11	233.12	246.23	4.92

Riparian Woodland (Improved riparian forest)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.72	0.72	0.80	0.90		
	ACRES	24.43	24.43	24.43	24.43		
	Target Year HU's	17.59	17.59	19.54	21.99		
	Interval HU's		17.59	167.10	830.62	1015.31	20.31

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	0.20	0.20	0.18	0.16		
	Target Year HU's	0.11	0.11	0.10	0.08		
	Interval HU's		0.11	0.93	3.52	4.57	0.09

Grassland/Savannah (Turf grasses)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.10	0.10		
	ACRES	0	4.52	4.52	4.52		
	Target Year HU's	0.00	0.00	0.45	0.45		
	Interval HU's		0.00	2.03	18.08	20.11	0.40

Gateway Beach

Riparian Woodland (Improved riparian forest)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.72	0.72	0.85	0.95		
	ACRES	25.71	25.71	25.71	25.71		
	Target Year HU's	18.51	18.51	21.85	24.42		
	Interval HU's		18.51	181.64	925.56	1125.71	22.51

Riparian Woodland (Improve riparian forests)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.72	0.72	0.85	0.95		
	ACRES	8.9	8.9	9.17	9.43		
	Target Year HU's	6.41	6.41	7.79	8.96		
	Interval HU's		6.41	63.85	334.91	405.16	8.10

Riparian Woodland (Developed high density on restored deeply disturbed top soils)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.30	0.85		
	ACRES	0	31.2	31.20	31.20		
	Target Year HU's	0.00	0.00	9.36	26.52		
	Interval HU's		0.00	42.12	717.60	759.72	15.19

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	7.30	7.30	6.57	5.84		
	Target Year HU's	4.09	4.09	3.50	2.94		
	Interval HU's		4.09	34.09	128.64	166.82	3.34

Emergent Wetland (Develop wetlands per restoration plan)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.95	0.95		
	ACRES	0	15	15.00	15.00		
	Target Year HU's	0.00	0.00	14.25	0.00		
	Interval HU's		0.00	64.13	570.00	634.13	12.68

Emergent Wetland(incorporate and mange with developed wetland)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.33	0.33	0.95	0.95		
	ACRES	6.9	6.9	6.90	6.90		
	Target Year HU's	2.28	2.28	6.56	2.28		
	Interval HU's		2.28	39.74	262.20	304.22	6.08

Grassland/Savannah (Developed low density forest (10%) canopy - Savannah)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	0	27.44	27.44	27.44		
	Target Year HU's	0.00	13.72	27.44	27.44		
	Interval HU's		4.57	185.22	1097.60	1287.39	25.75

Grassland/Savannah (Developed scattered trees (5%) canopy - Savannah)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	0	8.45	8.45	8.45		
	Target Year HU's	0.00	4.23	8.45	8.45		
	Interval HU's		1.41	57.04	338.00	396.45	7.93

Grassland/Savannah (Turf grasses)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.10	0.10		
	ACRES	0	41.02	41.02	41.02		
	Target Year HU's	0.00	0.00	4.10	4.10		
	Interval HU's		0.00	18.46	164.08	182.54	3.65

Grassland/Savannah (Maintain existing grasslands)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.1	0.1	0.10	0.09		
	ACRES	8.09	8.09	7.77	6.88		
	Target Year HU's	0.81	0.81	0.78	0.62		
	Interval HU's		0.81	7.14	27.85	35.80	0.72

Gateway Park

Riparian Woodland (Improved riparian forest)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.72	0.72	0.85	0.95		
	ACRES	55	55	55.00	55.00		
	Target Year HU's	39.60	39.60	46.75	52.25		
	Interval HU's		39.60	388.58	1980.00	2408.18	48.16

Upland Woodland							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	2.70	2.70	2.43	2.16		
	Target Year HU's	1.51	1.51	1.29	1.09		
	Interval HU's		1.51	12.61	47.58	61.70	1.23

Grassland/Savannah (Developed scattered trees (5%) canopy - Savannah)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	0	2.71	2.71	2.71		
	Target Year HU's	0.00	1.36	2.71	2.71		
	Interval HU's		0.45	18.29	108.40	127.14	2.54

Grassland/Savannah (Turf grasses)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.10	0.10		
	ACRES	0	27.27	27.27	27.27		
	Target Year HU's	0.00	0.00	2.73	2.73		
	Interval HU's		0.00	12.27	109.08	121.35	2.43

Grassland/Savannah Maintain existing grasslands)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.1	0.1	0.10	0.09		
	ACRES	70.67	70.67	67.84	60.07		
	Target Year HU's	7.07	7.07	6.78	5.41		
	Interval HU's		7.07	62.33	243.29	312.69	6.25

Gateway East

*Some acres and/or HU's by TY are calculated based on WO Project Assumptions

Riparian Woodland (Improved riparian forest)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.72	0.72	0.85	0.95		
	ACRES	106.8	106.8	106.80	106.80		
	Target Year HU's	76.90	76.90	90.78	101.46		
	Interval HU's		76.90	754.54	3844.80	4676.24	93.52

Upland Woodland

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.56	0.56	0.53	0.50		
	ACRES	1.60	1.60	1.44	1.28		
	Target Year HU's	0.90	0.90	0.77	0.65		
	Interval HU's		0.90	7.47	28.19	36.56	0.73

Emergent Wetland Develop wetland complex

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.95	0.95		
	ACRES	37.2	37.2	37.20	37.20		
	Target Year HU's	0.00	0.00	35.34	0.00		
	Interval HU's		0.00	159.03	1413.60	1572.63	31.45

Grassland/Savannah (Turf grasses)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.1	0	0.10	0.10		
	ACRES	0.11	0.11	0.11	0.11		
	Target Year HU's	0.01	0.00	0.01	0.01		
	Interval HU's		0.01	0.05	0.44	0.50	0.01

Grassland/Savannah Maintain existing grasslands)

50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
Year Interval		0	1	9	40		
HSI		0.1	0.1	0.10	0.09		
ACRES		0.49	0.49	0.47	0.42		
Target Year HU's		0.05	0.05	0.05	0.04		
Interval HU's			0.05	0.43	1.69	2.17	0.04

RIVERSIDE OXBOW as part of the "NO ACTION" CONDITION
RE-ASSESSED FOR 2007 CONDITIONS

Values are Average Annual Habitat Units (AAHUs)												
10/23/2007	Riparian Woodland			Emergent Wetland			Upland Wooded			Grassland/Savannah		
Study Reach	Without Project	With Updated RO	Updated RO Outputs	Without Project	With Updated RO	Updated RO Outputs	Without Project	With Updated RO	Updated RO Outputs	Without Project	With Updated RO	Updated RO Outputs
Clear Fork West [1]	110.23	110.23	**0.00**	0	0	**0.00**	36.15	36.15	**0**	175.91	175.91	**0**
Clear Fork East [1]	0.00	0	**0.00**	0	0	**0.00**	17.1	17.1	**0**	32.75	32.75	**0**
North Main [1]	7.29	7.29	**0.00**	0.25	0.25	**0.00**	65.45	65.45	**0**	175.38	175.38	**0**
West Fork North [1]	3.94	3.94	**0.00**	0	0	**0.00**	24.53	24.53	**0**	97.51	97.51	**0**
West Fork South	2.10	4.14	**2.04**	0.25	0.25	**0.00**	51.78	51.78	**0**	208.24	205.87	**-2.37**
West Fork Riverbend [2]	13.00	13	**0.00**	1.12	1.12	**0.00**	41.26	41.26	**0**	57.07	57.07	**0**
West Fork Rockwood	37.31	44.48	**7.17**	0	0	**0.00**	3.08	3.08	**0**	122.44	116.49	**-5.95**
Oxbow North	19.31	39.56	**20.25**	0	2.68	**2.68**	2.29	2.29	**0**	18.01	45.50	**27.49**
Oxbow Central	1.37	0.00	**-1.37**	0.14	10.40	**10.26**	0	0	**0**	41.57	67.30	**25.74**
Oxbow South	0.93	2.61	**1.68**	0	0.00	**0.00**	0	0	**0**	1.23	14.85	**13.62**
Gateway Central	0.70	8.62	**7.92**	0	0	**0.00**	0	0	**0**	0.46	13.63	**13.17**
Gateway South	16.24	23.67	**7.44**	0	0.96	**0.96**	0.09	0.09	**0**	1.83	1.22	**-0.60**
Gateway Beach	21.29	33.55	**12.26**	2.05	8.46	**6.40**	3.34	3.34	**0**	6.45	0.00	**-6.45**
Gateway Park	42.71	42.71	**0.00**	0	0	**0.00**	1.23	1.23	**0**	7.79	0.00	**-7.79**
Gateway East	73.71	88.86	**15.15**	0.24	22.66	**22.42**	0.78	0.73	**0**	0.92	0.00	**-0.92**
TOTALS	228.66	422.66	**72.54**	4.05	46.77	**42.72**	103.84	103.80	**0.00**	465.99	521.93	**55.94**

[1] These sites are included in the Authorized Central City Project and no change is proposed with their inclusion in the Modified Project Alternative.

[2] West Fork Riverbend is included in the Authorized Cetral City Project but is not proposed as a primary valley storage site with the Modified Project Alternative

No Action Alternative
Updated Riverside Oxbow
Grassland and Savannah

Reevaluation of Addendum report based Riverside Oxbow Grassland and Grassland Savannah using 2007 data

Oxbow North

Grassland/Savannah Native Grass Buffer

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	36.4	36.4	36.40	36.40		
	Target Year H	0.00	18.20	36.40	36.40		
	Interval HU's		9.10	245.70	1456.00	1710.80	34.22

Grassland/Savannah (low density forest (10%) canopy- Savannah)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	12	12	12.00	12.00		
	Target Year H	0.00	6.00	12.00	12.00		
	Interval HU's		3.00	81.00	480.00	564.00	11.28

Oxbow Central

Grassland/Savannah (Developed low density forest (10%) canopy - Savannah)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	71.6	71.6	71.60	71.60		
	Target Year H	0.00	35.80	71.60	71.60		
	Interval HU's		17.90	483.30	2864.00	3365.20	67.30

Oxbow South

Grassland/Savannah (Native Grasslands)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	0.9	0.9	0.90	0.90		
	Target Year H	0.00	0.45	0.90	0.90		
	Interval HU's		0.23	6.08	36.00	42.30	0.85

Grassland/Savannah (low density forest (10%) canopy- Savannah							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	14.9	14.9	14.90	14.90		
	Target Year H	0.00	7.45	14.90	14.90		
	Interval HU's		3.73	100.58	596.00	700.30	14.01

Gateway Central

Grassland/Savannah (Native grass buffer)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	3.2	3.2	3.20	3.20		
	Target Year H	0.00	1.60	3.20	3.20		
	Interval HU's		0.80	21.60	128.00	150.40	3.01

Grassland/Savannah (Developed low density forest (10%) canopy - Savannah)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	0	11.32	11.32	11.32		
	Target Year H	0.00	5.66	11.32	11.32		
	Interval HU's		1.89	76.41	452.80	531.10	10.62

Gateway South

Grassland/Savannah (Native Grass Buffer)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0.5	1.00	1.00		
	ACRES	1.3	1.3	1.30	1.30		
	Target Year H	0.00	0.65	1.30	1.30		
	Interval HU's		0.33	8.78	52.00	61.10	1.22

Gateway Beach No grassland development in SEC Army approved plan for this reach

Gateway Park No grasslands in approved plan for RO 2005 version

Gateway East No grasslands in approved RO within this reach

No Action Alternative
Updated Riverside Oxbow
Emergent Wetlands

Reevaluation of Addendum report based Riverside Emergent Wetlands using 2007 data

Oxbow North

Emergent Wetland (This is actually a pond habitat not wetland)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.45	0.45		
	ACRES	0	6.7	6.70	6.70		
	Target Year H	0.00	0.00	3.02	0.00		
	Interval HU's		0.00	13.57	120.60	134.17	2.68

Oxbow Central

Emergent Wetland (Develop wetlands per restoration plan)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.95	0.95		
	ACRES	0	12.3	12.30	12.30		
	Target Year H	0.00	0.00	11.69	0.00		
	Interval HU's		0.00	52.58	467.40	519.98	10.40

Oxbow South

Emergent Wetland (Develop wetlands per restoration plan)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.95	0.95		
	ACRES	0	0	0.00	0.00		
	Target Year H	0.00	0.00	0.00	0.00		
	Interval HU's		0.00	0.00	0.00	0.00	0.00

Gateway South

Emergent Wetland (Develop wetlands per restoration plan)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.95	0.95		
	ACRES	0	1.13	1.13	1.13		
	Target Year H	0.00	0.00	1.07	0.00		
	Interval HU's		0.00	4.83	42.94	47.77	0.96

No Action Alternative
Updated Riverside Oxbow
Emergent Wetlands

Gateway Beach

Emergent Wetland (Develop wetlands per restoration plan)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.95	0.95		
	ACRES	0	10	10.00	10.00		
	Target Year H	0.00	0.00	9.50	0.00		
	Interval HU's		0.00	42.75	380.00	422.75	8.46

Gateway East

Emergent Wetland (Develop wetlands per restoration plan)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.95	0.95		
	ACRES	0	26.8	26.80	26.80		
	Target Year H	0.00	0.00	25.46	0.00		
	Interval HU's		0.00	114.57	1018.40	1132.97	22.66

No Action Alternative
Updated Riverside Oxbow
Riparian Woodlands

Reevaluation of Addendum report based Riverside Oxbow riparian forest using 2007 data With Project

Total Acres at TY 50

Oxbow North

Riparian Woodland (developed) — 39.56

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	20	20	20		
	Target Year HU's	0.00	0.00	5.00	16.00		
	Interval HU's		0.00	22.50	420.00	442.50	8.85

Riparian Woodland (Improved within reach)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.7	0.7	0.80	0.95		
	ACRES	20.33	20.33	20.33	20.33		
	Target Year HU's	14.23	14.23	16.26	19.31		
	Interval HU's		14.23	137.23	711.55	863.01	17.26

Riparian Woodland (preserved)

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0.7	0.7	0.72	0.74		
	ACRES	18.5	18.5	18.50	18.50		
	Target Year HU's	12.95	12.95	13.34	13.73		
	Interval HU's		12.95	118.30	541.31	672.56	13.45

Oxbow Central

Riparian Woodland (Developed) — 0.00

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.00	0.00		
	ACRES	0	0	0.00	0.00		
	Target Year HU's	0.00	0.00	0.00	0.00		
	Interval HU's		0.00	0.00	0.00	0.00	0.00

Oxbow South

Riparian Woodland (Developed) — 2.61

50 year Project Life	TY	0	1	10	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	2	2.00	2.00		
	Target Year HU's	0.00	0.00	0.50	1.60		
	Interval HU's		0.00	2.25	42.00	44.25	0.89

No Action Alternative
Updated Riverside Oxbow
Riparian Woodlands

Riparian Woodland (Improved riparian forest)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.80	0.90		
	ACRES	2.1	2.1	2.10	2.10		
	Target Year HU's	1.30	1.30	1.68	1.89		
	Interval HU's		1.30	13.42	71.40	86.12	1.72

Gateway Central

8.62

Riparian Woodland (Improved riparian forest)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.62	0.62	0.80	0.90		
	ACRES	9.7	9.7	9.70	9.70		
	Target Year HU's	6.01	6.01	7.76	8.73		
	Interval HU's		6.01	61.98	329.80	397.80	7.96

Riparian Woodland (developed riparian forest)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	1.5	1.50	1.50		
	Target Year HU's	0.00	0.00	0.38	1.20		
	Interval HU's		0.00	1.69	31.50	33.19	0.66

Gateway South

23.67

Riparian Woodland (developed)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	13.3	13.30	13.30		
	Target Year HU's	0.00	0.00	3.33	10.64		
	Interval HU's		0.00	14.96	279.30	294.26	5.89

Riparian Woodland (Improved riparian forest)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.72	0.72	0.85	0.95		
	ACRES	15.7	15.7	15.70	15.70		
	Target Year HU's	11.30	11.30	13.35	14.92		
	Interval HU's		11.30	110.92	565.20	687.42	13.75

No Action Alternative
Updated Riverside Oxbow
Riparian Woodlands

Riparian Woodland (Preserved riparian forest)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0.72	0.72	0.74	0.76		
	ACRES	5.2	5.2	5.36	5.51		
	Target Year HU's	3.74	3.74	3.97	4.21		
	Interval HU's		3.74	34.72	163.55	202.01	4.04

Gateway Beach

Riparian Woodland (Improved riparian forest)								33.55
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**	
	Year Interval	0	1	9	40			
	HSI	0.72	0.72	0.85	0.95			
	ACRES	27.4	27.4	27.40	27.40			
	Target Year HU's	19.73	19.73	23.29	26.03			
	Interval HU's		19.73	193.58	986.40	1199.71	23.99	

Riparian Woodland Forest Development							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	0	21.6	21.6	21.6		
	Target Year HU's	0.00	0.00	5.40	17.28		
	Interval HU's		0.00	24.30	453.60	477.90	9.56

Gateway Park

Riparian Woodland (Improved riparian forest)								0.00
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**	
	Year Interval	0	1	9	40			
	HSI	0	0	0.00	0.00			
	ACRES	0	0	0.00	0.00			
	Target Year HU's	0.00	0.00	0.00	0.00			
	Interval HU's		0.00	0.00	0.00	0.00	0.00	

Gateway East

*Some acres and/or HU's by TY are calculated based on WO Project Assumptions

Riparian Woodland (Improved riparian forest)								88.86
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**	
	Year Interval	0	1	9	40			
	HSI	0.72	0.72	0.85	0.95			
	ACRES	97.1	106.8	97.10	97.10			
	Target Year HU's	69.91	76.90	82.54	92.25			
	Interval HU's		73.40	719.33	3495.60	4288.34	85.77	

No Action Alternative
Updated Riverside Oxbow
Riparian Woodlands

Riparian Woodland (develop riparian forest)							
50 year Project Life	TY	0	1	10	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	40		
	HSI	0	0	0.25	0.80		
	ACRES	7	7	7.00	7.00		
	Target Year HU's	0.00	0.00	1.75	5.60		
	Interval HU's		0.00	7.88	147.00	154.88	3.10

HABITAT CONDITIONS FOR HYDRAULIC STORAGE SITE 17
MODIFIED CENTRAL CITY PROJECT

				WITHOUT PROJECT CONDITIONS														
	Riparian Woodland				Shrubland				Forbland				Emergent Wetland				Total Baseline Acres	Total AAHU's
Lagoon Number	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU		
L1		0	0.00			0	0.00		0.66	2	1.17	**0.61**		0	0.00		2	**0.61**
L2	0.22	1	0.12	**0.01**		0	0.00		0.66	1	0.93	**0.65**		0	0.00		2	**0.66**
L3		0	0.00		0.77	3	2.12	**0.17**		0	0.00	**0.75**		0	0.00		3	**0.92**
L4	0.31	2	0.68	**0.05**		0	0.00			0	0.00	**0.59**		0	0.00		2	**0.64**
L5	0.40	1	0.50	**0.04**		0	0.00			0	0.00	**0.34**		0	0.00		1	**0.38**
L6	0.47	2	0.77	**0.06**		0	0.00			0	0.00	**0.44**		0	0.00		2	**0.50**
L7	0.33	2	0.73	**0.06**		0	0.00			0	0.00	**0.60**		0	0.00		2	**0.66**
L8	0.35	3	1.12	**0.09**		0	0.00		0.65	5	3.50	**5.37**	0.45	9	4.00	**0.32**	17	**5.78**
Levee/Other	0.40	6	2.28	**0.78**		0	0.00			0	0.00	**1.54**		0	0.00		6	**2.32**
Totals	0.38	17	6.19	1.09	0.77	3	2.12	0.17	0.66	9	5.61	10.89	0.45	9	4.00	0.32	37	**12.47**

Note for "Without Project" Condition: Total Baseline HSIs for the "Without Project" conditions are proportioned averages by habitat type. It is assumed that due to the City's clean-up of the Lagoons, all acreages will convert to forbland beginning at TY 10. There are currently about 2 acres of disturberd lands within the baseline study area

				WITH MODIFIED CENTRAL CITY PROJECT CONDITIONS														
	Riparian Woodland				Shrubland				Forbland				Emergent Wetland				Total Baseline Acres	Total AAHU's
	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU	Base HSI	Base Acres	Baseline HU	AAHU		
Excavated	0.00	0	0.00		0.00	0.00	0.00		0.05	33	1.66	**0.00**	0.45	33.22	14.95	**24.74**	66	**24.74**
Levee/Other	0.40	6	2.28	**0.18**		0.00	0.00			0	0.00	**1.54**	0.00	0.00	0.00	**0.00**	6	**1.72**
Totals	0.40	6	2.28	0.18		0.00	0.00	0.00	0.05	33	1.66	1.54		33.22	14.95	24.74	72	**26.46**

Note for "With LPP" Condition: The City of Fort Worth's soil remediation is anticipated to be completed by TY 10. the "Without Project" TY 10 conditions are therefore considered to be the baseline values for the "With LPP" condition. See Site 17 AAHU Calculation sheets for details by Target Year.

ASSUMPTIONS FOR SITE 17
MODIFIED CENTRAL CITY PROJECT

A 50 year period of analysis will be used to calculate AAHU's for the "Without Project" condition (and any subesequent "With Project" conditions).

Without Project Condition Assumptions:

Lagoons 1 through 8 within Site 17 will undergo soil clean-up or remediation by the City of Fort Worth for PCBs and/or metals during the next 10 years. Revegetation by the City will consist primarily of establishment of grasses and forbs to stabilize new soils within the remediated areas.

Beginning at Target Year 10 It is assumed that the HSI for all habitat types in the lagoons within Site 17 will begin moving toward the Forbland habitat values with an HSI of 0.05 at TY 10, HSI of 0.5 at TY20, and the full HSI value for forbland of 0.66 by TY 50.

Acreages of all other habitat types (Riparian Woodland, Shrubland, and Emergent Wetland) will be accounted as Forbland habitat beginning at TY 10 and will remain as Forbland acreage through the 50 year period of analysis.

With Project Condition (LLP) Asumptions:

All area excavated for valley storage as part of the LPP within Site 17 will be established as emergnt wetlands. Acreage of established wetlands will remain constant through the period of analysis. HSI values of established wetlands will go to 0.75 at TY 10 and will achieve a value of 1.0 at TY 50.

Site 17 - AAHU Calculations

WITHOUT PROJECT

Lagoon 1

Forbland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.66	0.66	0.05	0.50	0.66		
	ACRES	1.78	1.78	1.78	1.78	1.78		
	Target Year HU's	1.17	1.17	0.09	0.89	1.17		
	Interval HU's		1.17	5.69	4.90	18.96	30.71	0.61

Lagoon 2

Riparian Woodland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.22	0.22	0.00	0.00	0.00		
	ACRES	0.55	0.55	0.00	0.00	0.00		
	Target Year HU's	0.12	0.12	0.00	0.00	0.00		
	Interval HU's		0.12	0.36	0.00	0.00	0.48	0.01

Forbland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.66	0.66	0.05	0.50	0.66		
	ACRES	1.41	1.41	1.96	1.96	1.96		
	Target Year HU's	0.93	0.93	0.10	0.98	1.29		
	Interval HU's		0.93	5.13	5.39	20.87	32.33	0.65

Lagoon 3

Shrubland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.77	0.77	0.00	0.00	0.00		
	ACRES	2.75	2.75	0.00	0.00	0.00		
	Target Year HU's	2.12	2.12	0.00	0.00	0.00		
	Interval HU's		2.12	6.35	0.00	0.00	8.47	0.17

Forbland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.00	0.00	0.05	0.50	0.66		
	ACRES	0.00	0.00	2.75	2.75	2.75		
	Target Year HU's	0.00	0.00	0.14	1.38	1.82		
	Interval HU's		0.00	0.41	7.56	29.29	37.26	0.75

Lagoon 4

Riparian Woodland								
50 year Project Life	TY	0	1	10	20	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	10	30		
	HSI	0.31	0.31	0.00	0.00	0.00		
	ACRES	2.18	2.18	0.00	0.00	0.00		
	Target Year HU's	0.68	0.68	0.00	0.00	0.00		
	Interval HU's		0.68	2.03	0.00	0.00	2.70	0.05

Forbland								
50 year Project Life	TY	0	1	10	20	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	10	30		
	HSI	0	0	0.05	0.50	0.66		
	ACRES	0	0	2.18	2.18	2.18		
	Target Year HU's	0.00	0.00	0.11	1.09	1.44		
	Interval HU's		0.00	0.33	6.00	23.22	29.54	0.59

Lagoon 5

Riparian Woodland								
50 year Project Life	TY	0	1	10	20	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	10	30		
	HSI	0.4	0.4	0.00	0.00	0.00		
	ACRES	1.25	1.25	0.00	0.00	0.00		
	Target Year HU's	0.50	0.50	0.00	0.00	0.00		
	Interval HU's		0.50	1.50	0.00	0.00	2.00	0.04

Forbland								
50 year Project Life	TY	0	1	10	20	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	10	30		
	HSI	0	0	0.05	0.50	0.66		
	ACRES	0	0	1.25	1.25	1.25		
	Target Year HU's	0.00	0.00	0.06	0.63	0.83		
	Interval HU's		0.00	0.19	3.44	13.31	16.94	0.34

Lagoon 6

Riparian Woodland								
50 year Project Life	TY	0	1	10	20	50	**Cumulative Hu's**	**AAHU's**
	Year Interval	0	1	9	10	30		
	HSI	0.47	0.47	0.00	0.00	0.00		
	ACRES	1.63	1.63	0.00	0.00	0.00		
	Target Year HU's	0.77	0.77	0.00	0.00	0.00		
	Interval HU's		0.77	2.30	0.00	0.00	3.06	0.06

Forbland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0	0	0.05	0.50	0.66		
	ACRES	0	0	1.63	1.63	1.63		
	Target Year HU's	0.00	0.00	0.08	0.82	1.08		
	Interval HU's		0.00	0.24	4.48	17.36	22.09	0.44

Lagoon 7

Riparian Woodland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.33	0.33	0.00	0.00	0.00		
	ACRES	2.22	2.22	0.00	0.00	0.00		
	Target Year HU's	0.73	0.73	0.00	0.00	0.00		
	Interval HU's		0.73	2.20	0.00	0.00	2.93	0.06

Forbland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.00	0.00	0.05	0.50	0.66		
	ACRES	0.00	0.00	2.22	2.22	2.22		
	Target Year HU's	0.00	0.00	0.11	1.11	1.47		
	Interval HU's		0.00	0.33	6.11	23.64	30.08	0.60

Lagoon 8

Riparian Woodland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.35	0.35	0.00	0.00	0.00		
	ACRES	3.2	3.2	0.00	0.00	0.00		
	Target Year HU's	1.12	1.12	0.00	0.00	0.00		
	Interval HU's		1.12	3.36	0.00	0.00	4.48	0.09

Forbland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.65	0.65	0.05	0.50	0.66		
	ACRES	5.39	5.39	17.48	17.48	17.48		
	Target Year HU's	3.50	3.50	0.87	8.74	11.54		
	Interval HU's		3.50	30.58	48.07	186.16	268.32	5.37

Emergent Wetland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.45	0.45	0.00	0.00	0.00		
	ACRES	8.89	8.89	0.00	0.00	0.00		
	Target Year HU's	4.00	4.00	0.00	0.00	0.00		
	Interval HU's		4.00	12.00	0.00	0.00	16.00	0.32

Levees & Other

Riparian Woodland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.40	0.40	0.00	0.00	0.24		
	ACRES	5.69	5.69	0.00	0.00	12.50		
	Target Year HU's	2.28	2.28	0.00	0.00	3.00		
	Interval HU's		2.28	6.83	0.00	30.00	39.10	0.78

Forbland

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.00	0.00	0.05	0.50	0.66		
	ACRES	0.00	0.00	5.69	5.69	5.69		
	Target Year HU's	0.00	0.00	0.28	2.85	3.76		
	Interval HU's		0.00	0.85	15.65	60.60	77.10	1.54

WITH LOCALLY PREFERRED PROJECT

Emergent Wetland

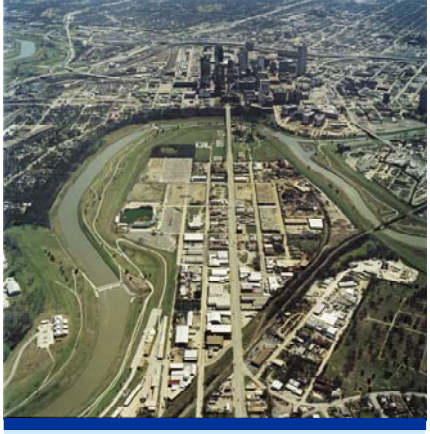
50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.45	0.00	0.75	0.75	1.00		
	ACRES	8.89	33.22	33.22	33.22	33.22		
	Target Year HU's	4.00	0.00	24.92	24.92	33.22		
	Interval HU's		3.83	112.12	249.15	872.03	1237.12	24.74

Levees & Other (Riparian Woodland)

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.40	0.40	0.00	0.00	0.00		
	ACRES	5.69	5.69	0.00	0.00	0.00		
	Target Year HU's	2.28	2.28	0.00	0.00	0.00		
	Interval HU's		2.28	6.83	0.00	0.00	9.10	0.18

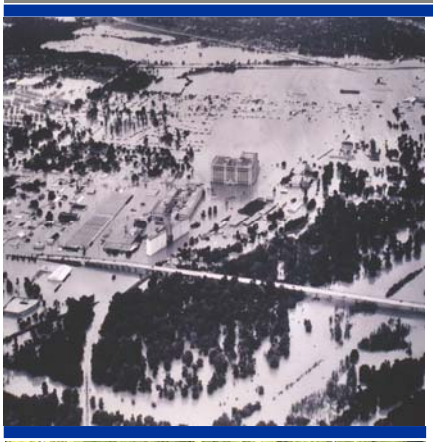
Levees & Other (Forbland)

50 year Project Life	TY	0	1	10	20	50	Cumulative Hu's	AAHU's
	Year Interval	0	1	9	10	30		
	HSI	0.00	0.00	0.05	0.50	0.66		
	ACRES	0.00	0.00	5.69	5.69	5.69		
	Target Year HU's	0.00	0.00	0.28	2.85	3.76		
	Interval HU's		0.00	0.85	15.65	60.60	77.10	1.54



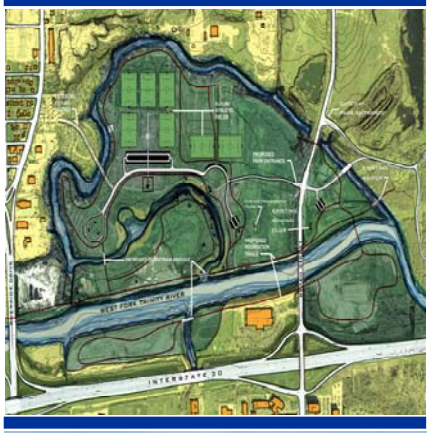
Fort Worth Central City Preliminary Design

Habitat Evaluations



Final Supplement No. 1
to the Final Environmental
Impact Statement

Appendix E



March 2008

Rendering Image courtesy of CDM

CDM

TARRANT REGIONAL WATER DISTRICT

Appendix E
Habitat Evaluations

BACKGROUND

Initial project planning for the Authorized Central City Project followed traditional Corps of Engineers plan formulation guidance and resulted in a formulation of a National Ecosystem Restoration Plan and a Flood Damage Reduction plan. A local plan was concurrently developed that emphasized flood damage reduction through relocation of features of the existing federal project. The local plan, as generally described in the April 2003 Trinity River Vision Master plan, was authorized by Congress prior to completion of the Corps project report. That Authorization includes limitations to total and Federal costs and requires determinations of environmental acceptability and technical soundness. Ecosystem improvements were incorporated into the Authorized "Community Based Alternative". Within the Rockwood study reach, two severed oxbows were configured and designed to achieve ecosystem restoration outputs. The largest valley storage site proposed for the Authorized Central City Project is the Riverbend site. A majority of adverse impacts of the Authorized Central City Project to riparian, wetland, and upland forest resources would be the result of increasing the valley storage capacity at the Riverbend site. Extensive riparian woodland and emergent wetland improvements were designed into the Riverbend site, however, much of those improvements are required to mitigate the adverse impacts of site development on significant habitat resources. Habitat mitigation is also required within the Authorized project to compensate for adverse impacts caused by inundation of Marine Creek, diversion of Lebow Creek, and impoundment of riparian resources associated with Samuels Avenue Dam (operational water surface elevation of 525 feet). Aquatic mitigation would be developed at Ham Branch, which surfaces at the eastern bluffs of Fort Worth and flows through Harmon Park to its confluence with the West Fork Trinity River. The total project, as documented within the Upper Trinity River Central City Fort Worth, Texas Final Environmental Impact Statement dated January 2006, with the project's environmental improvements was considered to sufficiently and totally compensate for the project's direct and induced impacts to important aquatic, wetland, riparian and upland forests. The Authorized Central City Project was ultimately administratively determined to be environmentally acceptable.

The Riverside Oxbow ecosystem restoration study resulted in an administratively approved project, which focuses on restoration of an oxbow of the West Fork of the Trinity River that had been severed during channelization of a segment of the West Fork. Key components of the approved Riverside Oxbow Ecosystem Restoration Project include removing an earthen plug at the upper end of the oxbow to connect it to the Trinity River, modification of the Beach Street crossing of the oxbow to remove an existing undersized culvert as well as fill in the oxbow and to construct a replacement span bridge. Structures would be placed in-channel to regulate flow and water depth for habitat quality and maintenance of water surface elevation within the channel. Aquatic habitat would also be improved by providing riparian forest and native grassland vegetative buffers adjacent to the oxbow. Other restoration measures of the approved plan include improving and adding additional acreages of wetlands adjacent to the remnant Sycamore Creek channel and development of two ponded areas within drying beds associated with an abandoned waste water treatment facility. Previously highly disturbed floodplain areas would be restored to native grasslands with riparian forested mottes and the forested floodplain along West Fork would be improved through selectively clearing non-native invading plant species and planting of native hard and soft mast trees. Details of the plan including projected ecosystem restoration and limited recreation benefits along with an analysis of environmental effects are discussed in detail within the Riverside Oxbow, Upper Trinity River, Fort Worth, Texas, Interim Feasibility Report and Integrated Environmental Assessment, dated April 2003. An Addendum to the Report was approved in April 2005, which removed some restoration measures from the project due to the non-essential nature of the restoration measures and their location in the floodplain.

The City of Fort Worth in June 2006 requested that the Corps consider the benefits of modifying the Authorized Central City Project by incorporating features of the Riverside Oxbow Ecosystem Restoration project and including areas within the Riverside Oxbow project as replacement hydraulic mitigation sites. The request listed seven reasons for this proposal including improving fish and wildlife habitat, real estate cost savings, and fewer impacts due to construction within the same time frame. Preliminary evaluation by the Corps of the city's proposal during the summer and early fall of 2006 indicated that such a proposal had merit. In the fall of 2006, Corps of Engineers Headquarters direct the Fort Worth District to initiate more detailed planning level investigation of the City of Fort Worth's proposal. The U.S. Fish and Wildlife Service's Habitat Evaluation Procedures (HEP) as described in their Ecological Services Manual (102 ESM 5) are the basis of the habitat evaluations used for the planning level analysis and the results of the HEP analyses are reported in this Appendix.

For purposes of this Supplement to the Final Environmental Impact Statement for the Central City Project, the "No Action" alternative is considered to be the separate implementation of the authorized Central City project and the administratively approved Riverside Oxbow project. The habitat outputs of this No Action and the Modified Central City alternatives are based on a common "future without (w/o) project" condition to allow comparison of the two alternatives' outputs. This "future w/o project" condition is the same as that used in the original Central City and Riverside Oxbow studies except in some areas of the Riverside Oxbow project where land use changes necessitated revising the "future w/o" project condition.

HABITAT EVALUATION PROCEDURE

Species models used to determine Habitat Suitability index (HSI) values were developed by the original Central City and Riverside Oxbow study teams. For each of these studies similar species guilds that are representative of each habitat type evaluated was developed and a list of structural features to be determined in the field was compiled. Results of these two independent studies are documented in their respective project reports and environmental documents. During the current study to evaluate the potential to modify the existing authorized Central City project, additional habitat evaluations were conducted solely to address specific sites that were found to not be adequately addressed in the prior studies. For example, additional clarification of a proposed valley storage site within the Gateway East study reach of the Riverside Oxbow approved project required updated information and consequently some additional habitat evaluation was undertaken in that area.

Updated Vegetation Mapping

Analysis of existing vegetation was conducted following methods conducted for the original studies. A primary reason for this level of detail was to assure avoidance of important resources on sites that would not have been affected by the prior valley storage requirements and to establish a similar level of detail for the combined study area. For example, the analysis conducted on the original Riverside Oxbow was based upon spectral analysis and limited ground-truthing to meet funding and time constraints for that study as compared to more detailed analysis with significantly more ground-truthing for the original Central City Study. Existing vegetation mapping for the Riverside Oxbow study was upgraded to match the level of analysis conducted for Central City. In addition, two additional areas that were not included in either of the previous study areas may potentially be affected by fill. One site is located on an existing closed sanitary landfill on the east side of the West Fork of the Trinity River just east of Gateway Park. The other potential fill site is within an old limestone quarry near North Interstate Highway Loop 820 near Meacham International Airport. Vegetation/land use mapping of both these sites was conducted solely for impact assessment as no habitat development would be feasible in these two sites. The vegetation data and mapping outputs for the combined study area are stored electronically and maintained by the Fort Worth District. See Figure E-1 for a map of the vegetation of the entire study area.

Acreages used in calculating Habitat Units (HU's) and Average Annual Habitat Units (AAHUs) were derived through Geographic Information System (GIS) interpretation of recent digital-orthophotography and color IR with field verification of habitat types by biologists with the Corps of Engineers, US Fish and Wildlife Service, and Texas Parks and Wildlife Department from August 2006 through July 2007.

As the majority of the habitat development would come from the Riverside Oxbow area under the modified Central City alternative, most effort was concentrated to assuring that the analysis was based upon sound understanding of the existing and future without a project conditions within this area.

Within the original and revisited Riverside Oxbow study area which totals approximately 1200 acres in size nine study reaches (Figure E-1) was developed to track proposed project impacts and benefits. Table E-1summarizes the conditions found during the current study as it was found that several significant changes in land use had transpired since the original study was completed.

Table E-1
Vegetation Type or Land Use (acres) within Central City and Riverside Oxbow study areas as determined during current study (2006-2007)

	Disturbed	Forbland	Grassland	Grassland Savannah	Riparian Forest	Upland Forest	Shrubland	Water	Emergent Wetland
Central City	1827.6	0.0	2313.8	17.4	314.8	535.4	1.3	299.6	14.9
Riverside Oxbow	172.3	8.6	509.3	16	278	68.3	44.4	84.6	19
Total	1999.9	8.6	2823.1	33.4	592.8	603.7	45.7	384.2	33.9

Projections of the Future “Without Project” Condition

During plan formulation for the authorized Central City and approved Riverside Oxbow projects, “future without project” conditions were projected for points in time over a 50 year period of analysis for the each study reach. Existing acreages of riparian resources were believed to be fairly well protected by existing regulations and public appreciation was believed to be sufficient to prevent substantial loss of acreages of riparian forest. However, habitat quality was projected to decrease at a slightly higher rate over time due to invasion by invasive non-native species such as chinaberry and Chinese privet. Upland forest was projected to lose acreage and habitat quality at a slightly higher rate due to the position of these resources near the outer edges of the floodplain, or outside of the floodplain. Developmental pressures and reduced regulatory control would contribute to upland forest losses. Emergent wetlands, although protected extensively by regulatory controls, are known to be ephemeral in nature, and there is little incentive to maintain existing wetlands that were not established for environmental restoration or environmental mitigation purposes. Therefore, based upon observations of existing wetlands and the ongoing changes that natural forces are causing, it is believed that for the most part existing wetlands will be significantly reduced in acreage and quality during the planning period. These “future w/o project” habitat conditions were annualized and used as a basis for evaluating the impacts and benefits of the Central City and Riverside Oxbow projects as documented in their respective reports.

During this evaluation of modifying the authorized Central City project to incorporate features of the Riverside Oxbow project and to consider areas within Riverside Oxbow as replacement hydraulic mitigation sites “future without project” conditions were revised to include changes that were not anticipated in the original studies. Most significant has been the increased disturbances of riparian and adjacent habitat by natural gas exploration. A fifty-year period of analysis was used to calculate the Average Annual Habitat Units (AAHUs) for the "Future without

Project" condition and for the No Action and Modified Central City alternatives, utilizing the methodology identified in the US Fish and Wildlife Service's 102-ESM-5 guidance. The "Future without Project" assumptions are described in detail in Attachment 1 to this Appendix and "Future w/o project" AAHUs for all study reaches were calculated and are displayed in the attachment to this appendix. These "future without project" AAHUs were the basis for computing the impacts and benefits of the No Action and Modified Central City alternatives.

MODIFIED CENTRAL CITY ALTERNATIVE

A primary objective in formulating the modified Central City alternative is to minimize adverse effects to existing resources and to minimize placement of project features in locations that would decrease the ability to improve resources identified as important for fish and wildlife habitat utilization. Early during the revised study, representatives of the Corps of Engineers, U.S. Fish and Wildlife Service, and Texas Parks and Wildlife Departments identified resources that should be avoided to protect the key aspects of the previously approved Riverside Oxbow project and location of those resources where impacts would not threaten the potential restoration opportunities. Figure 7 showing those important resources within the Riverside Oxbow is incorporated into the Supplemental EIS. As the study progressed and additional valley storage sites were identified for consideration within the entire modified study area, important resources, such as riparian forest and wetlands were identified and recommendations made for avoidance to the extent possible. Figure E-1 shows existing vegetation and land uses determined during this study, including identification of location of the important resources established as habitat types to avoid to the extent practicable during the development of valley storage excavation site locations and physical placement.

Major structural developments associated with the Authorized Central City project would remain unchanged and include the Bypass Channel, the Interior Water Feature, all related flood control gates, all pedestrian and vehicular bridges, and future development by private interests of the Trinity Uptown area. Among the proposed modifications are the relocation of the Samuels Avenue Dam and associated small craft locking facility and Marine Creek Dam, the removal of the primary valley storage at Riverbend, and addition of new valley storage areas along West Fork including the Ham Branch area and Riverside Oxbow and Gateway Park. The negative impacts are less significant because much of the existing riparian, upland forest, and wetland habitat in the Riverbend area will not be impacted and therefore a greater net gain of habitat outputs is possible. A substantial amount of riparian and upland forest habitat will also be developed by utilizing the Riverside Oxbow and Gateway Park valley storage sites for dense forest and wetland development.

Some minor impacts would still result to riparian forest, upland forest and wetland habitat due to excavation, access roads, and other changed project features and are summarized in Table E-2. For example 5.4 acres of riparian habitat within Ham Branch (Site 9) lie within the valley storage area that would be developed by breaching the levee and reconstructing a new levee to the north, but would not be removed by construction. The impacts in Ham Branch to these resources would be negligible as they would only be affected by backwater from extremely rare events. Impacts that required further consideration include the riparian forest impacts from the Riverside Oxbow and Gateway Park sites, upland and shrub land impacts within Gateway Park sites other than site 17, shrub land in the fill sites, and upland forest within the valley storage contingency sites. The minor riparian forest impacts within the Riverside Oxbow and Gateway Park should be more than compensated as a result of the extensive riparian forest that would be developed in that area following excavation for valley storage.

Table E-2
Habitat Impacts due to Changed Features
(Valley Storage and Disposal Sites)

	Riparian Forest		Wetland		Upland Forest		Grassland	
	Acres	AAHU	Acres	AAHU	Acres	AAHU	Acres	AAHU
Primary Valley Storage Site								
2	0.1	0.05	0	0	0	0	20.7	9.23
5a	0	0	0	0	0.5	0.20	17.2	5.96
5c	0	0	0	0	0	0	14.2	4.9
21	0	0	0	0	0.5	0.17	14.0	4.84
9	0	0	0	0	2.2	0.98	66.0	23
3	0	0	0	0	1.0	0.5	3.4	1.63
10	0.2	0.1	0	0	0	0	1.2	0.67
11	0	0	0	0	0	0	9.0	0.71
12,14	1.9	1.13	0.8	0.14	0	0	86.5	49.2
13	0	0	0	0	0	0	2.3	0.18
15	0.6	0.45	0	0	0.2	0.12	16.3	1.52
16,18	4.7	3.52	0	0	10.5	5.35	60.6	5.67
17	0	0	0	0	0.3	0.14	24.9	2.34
21	0	0	0	0	0.5	0.17	14.0	4.84
Subtotal	**7.5**	**5.25**	**0.8**	**0.14**	**15.7**	**7.63**	**350.3**	**114.69**
Disposal Sites								
5b east	0	0	0	0			12.7	4.39
5b west	0	0	0	0	0.09	0.03	13.8	4.77
South of 5c	0	0	0	0	0.5	0.29	7.7	2.66
Near Bypass	0	0	0	0	0.1	0.05	0.6	0.31
Near Meacham	0	0	0	0	3.9	2.3	10.3	0.85
WWTP	0	0	0	0	0.4	0.18	0.2	0.02
1st Street landfill	0	0	0	0	1.85	0.07	74.5	6.12
Subtotal	**0**	**0**	**0**	**0**	**6.84**	**2.92**	**119.8**	**19.12**
Contingency Valley Storage Sites								
1	0	0	0.2	0.04	3.7	2.68	24.2	10.79
6	0	0	0	0	0.4	0.16	15.9	5.51
7	0.2	0.11	0	0	0.1	0.03	22.3	7.72
8	0	0	0	0	0	0	16	5.54
22	0	0	0	0	8.5	4.04	98.2	46.75
Subtotal	**0.2**	**0.11**	**0.2**	**0.04**	**12.7**	**6.91**	**176.6**	**76.31**

Stream Aquatic

Aquatic impacts to Marine Creek would be reduced by the Modified alternative because of less stream length being inundated due to a lower water surface elevation and even though a

short reach of Marine Creek would be excavated. Negative impacts to Lebow Creek would be totally eliminated due to the relocation of Samuels Avenue Dam, precluding the need to fill the lower end of the creek and to relocate the mouth of the stream downstream of the dam. However, the improvements to the stream aquatic habitat proposed to occur within Lebow Creek as part of the Authorized Central City Project would not be achieved because of the relocation of Samuels Avenue Dam upstream of the location previously approved negating the feasibility of providing a continuous low flow near Brennan Avenue . The aquatic mitigation plan presented for the authorized Central City project required aquatic mitigation in Lebow Creek and additional aquatic mitigation within Ham Branch to offset impacts to Marine Creek. The current analysis for the Modified Central City alternative indicates that the Ham Branch aquatic mitigation would be inadequate to compensate for even the reduced impacts to Marine Creek. Subsequently, additional aquatic mitigation is proposed within Sycamore Creek within the Riverside Oxbow area.

Slope from the proposed Trinity River connection, through Sycamore Creek channel and the oxbow to its confluence with the West Fork below Beach Street Dam is only approximately 6 feet, of which only 1 foot would be Sycamore Creek and the remaining 5 feet would be in the Oxbow. A series of rock weirs would be utilized in the oxbow and smaller rock structures would be developed in Sycamore Creek to provide the basis for developing pools, riffles, and runs through the entire system. See Figure 12 of the SEIS for approximate location of those rock weirs. See Figure E-2 for a conceptualized drawing of how the aquatic features would be longitudinally incorporated into Sycamore Creek and into the Riverside Oxbow.

Sycamore Creek would average 10 feet in width at riffle control structures and would have average depth of about 1 foot over its approximate 3,200 foot restored length. Average velocity through the riffle complexes would be about 1 foot per second, which would be beneficial to anticipated darter utilization of the riffles and provide sufficient oxygenation within pools to support a wide variety of high value fisheries.

Stream bank riparian grasses along with preserved specimen burr oak and pecan trees existing along the alignment of the restored Sycamore Creek would provide shading, cover and supplemental food components to the aquatic system. Based upon this concept, which mimics high quality streams within the Central City study area such as lower segments of Marine and Lebow Creek it is anticipated that the Sycamore Creek Channel as restored would ultimately provide at minimal 0.75 acres of high value aquatic habitat. An Index of Biotic Integrity score of 47 was estimated to be appropriate for Sycamore Creek as proposed to be restored. Following the methodology that was utilized in the original Central City EIS, an IBI score would translate into an estimated future with project habitat suitability of 0.85. Since the stream based aquatic habitat would provide fisheries benefits to the entire 3200 feet of restored Sycamore Creek there would be a minimum of 0.64 habitat units established. As flow would be maintained during all times of each year, the seasonally adjusted habitat units and average annual habitat units attributable to stream restoration in Sycamore Creek would also be 0.64.

Stream impacts would be essentially fully mitigated by implementation of the aquatic mitigation plan at the Ham Branch site referenced in the original Central City EIS, and by implementation of restoration of flows through Sycamore cutoff with developed in-channel riffles and pools as a component of the Modified alternative. Table E-3 displays the analysis of stream based aquatic impacts, mitigation improvement analysis. With Sycamore Creek using a conservative estimate of 0.75 acres of stream habitat, the net AAHU after implementation of improvements would result in a net gain of 0.22 AAHUS. This difference is considered to be within the margin of error for this analysis and therefore it can be presumed that the stream aquatic impacts are fully compensated by the implementation of Hams Branch and Sycamore Creek channel improvements. Additional benefits from returning base flows and structural habitat modifications of aquatic habitat of the Riverside Oxbow would be restoration benefits in excess of those determined for the original Riverside Oxbow study. The modified alternative

would provide stream aquatic habitat benefits of 4.8 AAHUS while the no action alternative provided no documented net stream aquatic habitat benefits.

Table E-3
Stream Aquatic Impact, Mitigation and Improvement Analysis
Modified Central City Alternative

	Habitat Units at Sampling Date	Future Without (Seasonally Adjusted)	Future With Project	Future With Project and Stream Mitigation	Gain or (Loss)
	HU	AAHU	AAHU	AAHU	AAHU
Marine creek					
Plunge pool riffle	1.60	0.80	0	0	(0.80)
Waterfall to Exchange	1.12	0.28	0.11	0.11	(0.17)
Lebow Creek					
Confluence area	0.20	0.10	0.10	0.10	0
Upstream reach	0.31	0.16	0.16	0.16	0
Ham Branch	0.25	0.25	0.25	0.8	.55
Sycamore Creek	NA	0.0	0.00	0.64	0.64
Net AAHU Following all Mitigation					.22
Riverside Oxbow	NA	0.0	4.6	4.6	4.6
TOTAL AAHU					**4.82**

Habitat Development

The study of the Modified Central City alternative evaluates a shift of the primary location of habitat development from the previously authorized Riverbend area of the West Fork on the west side of Fort Worth to the Riverside Oxbow and Gateway Park locations on the on the east side of downtown Fort Worth. Two small oxbow restoration components in the Rockwood Park area are proposed for retention into the Modifed Alternative as proposed for the Authorized plan. The primary habitat development features of the approved Riverside Oxbow project including the restoration of West Fork Trinity River flows through the oxbow, improvement of existing riparian forest values, creation and improvement of wetlands, and development of native grassland buffer along the oxbow corridor have been retained. The primary difference between the approved Riverside Oxbow project and the Modified alternative has been to significantly increase the size of area where riparian forest could be developed in both the reaches above and below Beach Street. This increase in riparian forest development was possible due to the relocation of valley storage to the Riverside Oxbow area. Excavation provides the valley storage needed, however, additional hydraulic roughness is required at some sites to balance the hydrology and hydraulics of the study area to minimize adverse downstream hydraulic impacts. The hydraulic model was run and it was determined that the roughness of the existing downstream riparian forest within the Gateway Park East study reach is approximately what should be established for some the valley storage sites. Based upon this analysis, the existing riparian forest was further evaluated to determine the components of the forest that could be incorporated into the excavated valley storage sites to provide the required hydraulic roughness and provide riparian forest habitat benefits.

The Gateway Park East reach of the modified study area has been found to contain areas of high quality riparian woodlands, areas that are severely degraded due to abandoned drying beds, as well as a very narrow riparian corridor comprised of non-mast producing light seeded invader trees and shrubs. According to the Draft Fish and Wildlife Coordination Act Report for the Riverside Oxbow Ecosystem Interim Feasibility Study, two sites were evaluated within the dense riparian forest within the Gateway Park East zone along the West Fork downstream of the abandoned waste water treatment plant and East Fourth Street. These habitat evaluation sites were identified as Sites 002 and 003. Site 002 was generally described as woodland with medium dense understory. Dominant tree species included sugar hackberry, pecan, Chinaberry (non-native), box elder and American elm. Shrub consisted of box elder, privet (non-native) and coralberry. The predominant grass identified was wild rye. Vines and forbs identified in Site 002 included pokeweed, poison ivy, hedge parsley, wild onion, saw greenbrier, giant ragweed, common trumpet-creeper, toothed spurge, stinging nettle and *Viola sp*.

Site 003 was generally described as woodland with open understory dominated by pecan, a hard mast producer. Cedar elm, hackberry, box elder and American elm were also observed. Shrubs and grass found were the same as at site 002. Vines and forbs identified included poison ivy, dead-nettle (also known as henbit a non-native), wild celery, hedge parsley, dandelion, greenbrier and Japanese honeysuckle (non-native).

Some of the data collected at these sites are helpful in describing the character of the forest that would be useful for guiding forest development within the proposed valley storage sites. These data are shown in the Table E-4. Other data collected provides information more specific to habitat quality determinations than providing descriptors of the forest stand.

Table E-4
Structural Riparian Habitat Composition Parameters Estimated at Gateway Park East Corridor
(From USFWS Draft Coordination Act Report for Riverside Oxbow, September 2002)

Parameter	Site 002	Site 003	Forest Average
Percent Tree Canopy Closure	85	70	77.5
Percent Tree Canopy Closure of Mast Producers Greater than 6 inches dbh	10	70	40
Percent Canopy Closure of Deciduous Trees in Stand	85	70	77.5
Average dbh of Overstory Trees (inches)	11	22	16.5
Average Height of Overstory Trees (feet)	40	50	45
Percent Shrub Crown Cover (less than 15 feet in height)	15	40	27.5

While the information in Table E-4 provides a description of the dense forest it does not provide information that could be used to establish roughness coefficients for use in the hydraulic modeling. After further consideration, it was determined that basal area of trees (Table E-5) within this area would be a good parameter to use for establishing the relationship of existing forest density to existing over bank roughness. Future basal area can be projected based upon anticipated tree growth rates within the proposed forest establishment zones at time intervals that would provide forecasting useful for determining both future over bank roughness and habitat suitability values.

Table E-5
Existing Basal Area of Trees and Shrubs Gateway Park East Corridor

	Tree Basal Area in Square ft per acre	Shrubs Basal Area in Square Feet per Acre	Total Square Feet per Acre
Site A	70	5	75
Site B	80	5	85
Site C	90	15	105
Site D	60	5	65
Site E	110	10	120
Average	**82**	**8**	**90**

To develop a tree basal area of 82 square feet per acre within high density riparian forest, it was determined that trees would need to be planted on approximate 8 foot center in the valley storage areas. This is based upon an estimate that under predicted growth conditions in the valley storage excavation areas, one inch diameter trees would grow to approximately five inches in diameter at breast height (dbh) within 15 years. Six hundred (600) trees per acre with 5 inch dbh would provide 82 square feet per acre basal area. In addition, to account for anticipated mortality and to provide habitat variety, it was determined that 100 seedlings and 40 shrubs or vines per acre would be planted within the areas proposed for high density forest development. See Figure 12 of main body of SEIS for locations of the proposed high density forest development within valley storage excavations.

While initial tree planting density within the proposed deeply excavated valley storage areas was determined to provide hydraulic roughness similar to that currently existing in downstream study reaches, the species selected for planting reflect those that would provide optimum fish and wildlife habitat. Additional forest habitat that would be developed in other areas of the Riverside Oxbow include light riparian forest development and scattered riparian forest development. Light riparian development would consist of native grassland with tree, shrub and vine plantings at ten percent of the high density forest. Scattered density forest would consist of tree shrub and vine plantings at five percent of the high density forest plantings. Both light and scattered density forest was evaluated as savannah as defined by the US Fish and Wildlife Services habitat modeling guidelines. Figure 12 indicates areas within Riverside Oxbow that would be developed as savannah or other grasslands. Improvement of existing forest would consist of plantings of trees and shrubs at the density described in the original Riverside Oxbow restoration report.

Trees, shrubs and vines recommended for planting cannot be specifically chosen at this time due to unknown site specific soil quality and moisture conditions; however, the following list provides a number of species by types that would provide future habitat quality within the range of projected values. Some additional soil manipulations including furrowing to provide strips of slightly drier soils may be necessary to establish some of these species. Slopes around the perimeters of the valley storage excavation sites would also provide appropriate areas for habitat development.

Tree plantings should consist of 60 percent hard mast broken down as follows:

40% Oaks	20% Hickories
1. Shumard oak	1. Pecan
2. Burr oak	2. Black walnut
3. Water oak	
4. Overcup oak	
5. Southern red oak	

Soft mast and other hardwoods plantings should be derived from the following groups by percent as indicated:

10% Elms:	10% Other Hardwoods
1. Cedar elm	1. American Holly (Ilex opac)
2. Texas sugarberry	2. Mulberry
	3. Bois d' Arc
	4. Green ash
	5. Boxelder

Shrubs and vines should be selected from the following list and planted at the densities described for each riparian forest and savannah restoration:

1. Native wild plums
2. Yaupon
3. Deciduous holly
4. Sumac
5. Redbud
6. Rough-leafed dogwood
7. Coralberry
8. Common persimmon
9. Swamp privet
10. Hawthorn
11. Buttonbush
12. Trumpet creeper
13. Peppervine
14. Blackberry/dewberry
15. Virginia creeper
16. Carolina snailseed
17. Coral honeysuckle (*Lonicera sempervirens*)

Future With Modified Alternative and Revised Riverside Oxbow Habitat Suitability Determinations for No Action Alternative

Professional judgment by an interagency team was used to estimate forest structural changes over the 50 year period of analysis and to determine future habitat suitability indices for riparian forest development, management of existing forest, wetland development and management and grassland savannah consisting of five percent or ten percent tree canopy or pure native grasslands. It was determined that riparian forests developed on existing floodplain grasslands would develop an ultimate 0.80 habitat suitability by year 50 while riparian forests developed on deeply excavated floodplain lands would generate 0.60 habitat suitability units per acre by year 50. The reduced values anticipated at year 50 for the deeply excavated lands were based upon estimations of tree growth restrictions from slightly increased flooding depths and durations and the difficulties in reclamation of areas where parent soils have been disturbed and removed. Habitat suitability for management of existing forests and wetland developments were similar to projections for similar habitat developments utilized in previous studies within the general Upper Trinity River study area. These future conditions were then annualized over the 50 period of analysis. Planning assumptions over time, acreages of trees managed or developed, wetlands developed and various grassland habitat improvements are contained within Attachment 1 to this appendix.

In order to allow a direct comparison of the Modified Central City alternative with the No Action alternative it was determined that the features outlined within the Riverside Oxbow Project Report and Addendum (2005) as part of the No Action alternative should be reassessed using the same professional judgment used in determining habitat suitability indices for similar habitat measures of the Modified Central City alternative.

With the Modified Central City Alternative, the proposed habitat development within the Riverside Oxbow/Gateway Park study area in the Oxbow North, Oxbow Central, Oxbow South, Gateway Central, Gateway South, Gateway Beach, Gateway Park and Gateway East study reaches consists of :

1. Create or develop 137.6 acres of riparian forest on existing grasslands and excavated valley storage sites
2. Improvement of riparian forest habitat on 263.6 acres
3. Create, develop and improve 52.2 acres of wetlands
4. Develop 76.9 acres of native grassland savannah with 5% to 10 % tree cover
5. Develop native grassland on 10.1 acres
6. Improve habitat quality of 53.3 acres of native riparian grasslands
7. Establish turf grass for stabilization on 124.7 acres

Development of oxbows within the West Fork Rockwood reach and the development and management of riparian forest within the Ham Branch area of the West Fork South study reach

would also be constructed as outlined within the Central City action alternative described within the Final Environmental Impact Statement for the Central City project (2006).

Development of wetland functional values requires that appropriate soils are inundated or saturated with sufficient frequency and duration to encourage growth of aquatic plants that are selected for fish and wildlife habitat utilization. Water for these wetlands will be derived from local sources including the Trinity River to maintain or augment water from local drainage and precipitation runoff. Gateway Beach wetlands would be located in an area that receives significant runoff and is also at a depth near groundwater, therefore minimal supplemental watering would be needed for this site, however for this and the other wetlands, pumping stations will be implemented following a design to allow complete filling of the wetlands within a 30 day time period as needed to best mimic naturally occurring conditions in this ecoregion.

COMPARISON OF OUTPUTS BETWEEN NO ACTION AND MODIFIED ALTERNATIVE

Table E-6 provides a summary of the acres of the habitat types that would be involved within the “No Action” alternative which includes both the authorized Central City project and approved Riverside Oxbow project report conditions.

Table E-7 provides a summary of the acres of habitat types that would be involved with the Modified Alternative action of removing the Riverbend Valley Storage, hydraulic mitigation and habitat development measures and modifying Riverside Oxbow ecosystem restoration features by adding riparian woodlands, improving wetland development and native grassland and grassland savannah development.

Table E-6
Habitat Development Acres considered in the No Action Alternative

Study Reach	No Action Alternative														
	Riparian Acres				Wetland Acres			Upland Acres				Savannah & Grassland Acres			
	P	C	I	S	P	C	S	P	C	I	S	P	C G	C S	S
Clear Fork West	0	0	0	0					-7.29		-7.29		-47.42	0	-47.42
Clear Fork East	0	0	0	0					-1.65		-1.65		-1.01		-1.01
North Main	0	-4.88	0	-4.88					-22.23		-22.23		-138.72		-138.72
West Fork North	0	0	0	0					-3.10		-3.10		-71.20		-71.20
West Fork South	0	1.4*	7.4*	8.8					-3.01		-3.01		-31.45		-31.45
West Fork Riverbend[2]	0	69.86	19.17	-49.98	0	6.22	6.22		4.22	13.30	17.52		-104.38	0	-104.38
West Fork Rockwood[2]															
Central City Subtotal	**0**	**66.38**	**26.57**	**92.25**	**0**	**6.22**	**6.22**	**0**	**-33.06**	**13.30**	**-19.76**	**0**	**-394.19**	**0**	**-394.19**
Oxbow North	18.5	20	20.3	58.80	0	0		0	0	0	0	0	36.4	12	48.40
Oxbow Central	3.1	0	0	3.10	0	12.3	12.3	0	0	0	0	0	0	71.6	71.6
Oxbow South	0	2	7.8	9.80	0			0	0	0	0	0	0.9	14.9	15.8
Gateway Central	0	1.5	9.7	11.20	0			0	0	0	0	0	3.2	12.9	16.1
Gateway South	5.2	13.3	15.7	34.20	0			0	0	0	0	0	1.3	15.6	16.9
Gateway Beach	0	21.6	27.4	49.0	0	10	10	0	0	0	0	0	0	0	0
Gateway Park	0	0	0	0	0			0	0	0	0	0			
Gateway East	0	7	97.1	104.1	0	26.8	26.8	0	0	0	0	0	3.8	3.8	7.60
Riverside Oxbow Subtotal	**26.8**	**65.4**	**178.0**	**270.2**	**0**	**49.1**	**49.1**	0	0	0	0	0	**45.6**	**130.8**	**176.4**
TOTAL	**26.80**	**131.78**	**204.57**	**363.15**	**0**	**55.32**	**55.32**	**0**	**-33.06**	**13.30**	**-19.76**	**0**	**-348.59**	**130.8**	**-217.79**

P = Preserve
I= Improve existing habitat
C= Create or Develop new habitat acreage (-) indicates losses of acres within respective study reach : * Ham Branch Features
S= Subtotal acreage within habitat type
C G = Create or Develop Native Grasslands
C S =Create or Develop Savannah/grasslands

Table E-7
Habitat Development Acres considered in the Modified Alternative

Study Reach	Riparian Forest Acres				Wetland Acres				Upland Forest Acres				Grassland/Savannah Acres					
	Preserve	Create	Improve	Subtotal	Preserve	Create	Improve	Subtotal	Preserve	Create	Improve	Subtotal	Preserve	Create Native	Create Savannah	Turf	Improve Native	Subtotal
Clear Fork West	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.4	0.0	0.0	-7.4	-48.1	0.0	0.0	0.0	0.0	-48.1
Clear Fork East	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.7	0.0	0.0	-1.7	-1.0	0.0	0.0	0.0	0.0	-1.0
North Main	-4.9	0.0	0.0	-4.9	0.0	0.0	0.0	0.0	-22.2	0.0	0.0	-22.2	-138.7	0.0	0.0	0.0	0.0	-138.7
West Fork North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.7	0.0	0.0	-3.7	-99.5	0.0	0.0	0.6	0.0	-98.9
West Fork South	0.0	1.4	7.4	8.8	0.0	0.0	0.0	0.0	-5.7	0.0	0.0	-5.7	-14.4	0.0	0.0	90.8	0.0	76.4
West Fork Riverbend	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
West Fork Rockwood	-0.1	20.5	0.0	20.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	22.5	0.0	24.3
SUBTOTAL	**-5.0**	**21.9**	**7.4**	**24.3**	**0.0**	**0.0**	**0.0**	**0.0**	**-40.7**	**0.0**	**0.0**	**-40.7**	**-299.9**	**0.0**	**0.0**	**113.9**	**0.0**	**-186.0**
Oxbow North	-0.2	24.9	37.9	62.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	11.3	46.4	56.5
Oxbow Central	-1.9	45.2	2.8	46.1	-0.8	0.0	0.0	-0.8	0.0	0.0	0.0	0.0	-86.5	0.5	21.5	37.2	0.0	-27.3
Oxbow South	0.0	21.7	0.0	21.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.7	1.5	0.0	3.3	0.0	-0.9
Gateway Central	-0.1	0.0	2.1	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	16.8		0.0	22.3
Gateway South	-0.6	14.6	24.4	38.4	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	-0.2	-16.3	0.0	0.0	4.5	0.0	-11.8
Gateway Beach	-4.5	31.2	34.6	61.3	0.0	15.0	6.9	21.9	-11.7	0.0	0.0	-11.7	-61.7	8.1	35.9	41.0	6.9	30.2
Gateway Park	-0.2	0.0	55.0	54.8	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	-0.1	41.2	0.0	2.7	27.3	0.0	71.2
Gateway East	0.0	0.0	106.8	106.8	0.0	37.2	0.0	37.2	-0.2	0.0	0.0	-0.2	0.5	0.0	0.0	0.1	0.0	0.6
SUBTOTAL	**-7.5**	**137.6**	**263.6**	**393.7**	**-0.8**	**52.2**	**6.9**	**58.3**	**-12.2**	**0.0**	**0.0**	**-12.2**	**-124.2**	**10.1**	**76.9**	**124.7**	**53.3**	**140.8**
East First Street**									-1.9				-74.5	0.0	0.0	79.1	0.0	4.6
WWTP**									-0.4				0.0	0.0	0.0		0.0	0.0
Meacham Airfield area disposal**									-3.9				-10.3	0.0	0.0	0.0	0.0	-10.3
SUBTOTAL	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-6.2**			**-6.2**	**-84.8**	**0.0**	**0.0**	**79.1**	**0.0**	**-5.7**
TOTAL	**-12.5**	**159.6**	**271.0**	**418.1**	**-0.8**	**52.2**	**6.9**	**58.3**	**-59.0**	**0.0**	**0.0**	**-59.0**	**-508.9**	**10.1**	**76.9**	**317.7**	**53.3**	**-50.9**

Preserve if positive number, a negative value indicates a loss of habitat acres * Ham Branch Features **Disposal Sites not within identified study reaches
Create or Develop new habitat acreage: For summary information, any losses identified in the preserve column would be subtracted from this column

Acreages provide a means of describing the extent of action proposed with either alternative, however, habitat suitability indices varies widely by the type of habitat measure being proposed. To be consistent with the procedures to develop and display habitat outputs resulting from alternative implementation, and to provide a reasonable means to determine localized project impacts, or benefits, the project alternatives were evaluated using the Habitat Evaluation Procedures as the method to project time weighted values (average annual habitat values). Table E-8 provides a comparative breakout of habitat gains and losses for each habitat type considered between the No Action and Modified Alternatives.

Table E-8
Habitat Outputs (AAHUs) By Study Reach (Outputs are after impacts)

Study Reach	No Action Alternative[1]				Modified Central City Alternative			
	Riparian	Wetland	Upland	Savannah & Grassland	Riparian	Wetland	Upland	Savannah & Grassland
Clear Fork West	0.00	0.00	-10.43	-24.56	0.00	0.00	-10.48	-24.87
Clear Fork East	0.00	0.00	-0.81	-0.38	0.00	0.00	-0.81	-0.39
North Main	-2.87	0.00	-11.09	-71.85	-2.87	0.00	-12.18	-75.90
West Fork North	0.00	0.00	-0.77	-26.89	0.00	0.00	-1.17	-40.50
West Fork South	2.04	0.00	-1.49	-11.88	2.04	0.00	-2.75	-16.65
West Fork Riverbend[2]	44.34	12.47	-8.80	-28.40	0.00	0.00	0.00	0.00
West Fork Rockwood[2]	--	--	--	--	7.15	0.00	0.00	-12.93
Central City Subtotal	**43.51**	**12.47**	**-33.39**	**-163.96**	**6.32**	**0**	**-25.96**	**-169.60**
Oxbow North	20.25	2.68	0.00	27.49	22.14	0.00	0.00	-7.17
Oxbow Central	-1.37	10.26	0.00	25.74	16.39	-0.14	0.00	-38.76
Oxbow South	1.68	0.00	0.00	13.62	9.50	0.00	0.00	-0.10
Gateway Central	7.92	0.00	0.00	13.17	0.96	0.00	0.00	11.03
Gateway South	7.44	0.96	0.00	-0.6	8.24	0.00	-0.12	-2.20
Gateway Beach	12.26	6.40	0.00	-6.45	21.15	16.71	-5.35	28.64
Gateway Park	0.00	0.00	0.00	-7.79	5.31	0.00	-0.23	-5.89
Gateway East	15.15	22.42	0.00	-0.92	19.81	31.21	-0.09	0.87
Riverside Oxbow Subtotal	**63.13**	**42.72**	**0**	**64.26**	**103.5**	**47.78**	**-5.79**	**-15.33**
Gateway Oakland(1st street fill)	0.00	0.00	0.00	0.00	0.00	0.00	-0.07	0.54
Meacham Airfield area fill site	0.00	0.00	0.00	0.00	0.00	0.00	-2.30	-0.85
TOTAL	**106.84**	**55.19**	**-33.39**	**-99.70**	**109.82**	**47.78**	**-34.12**	**-185.23**

(1) From original project reports, Riverside Oxbow Department of Army approved measures reassessed with same over time conditions as Modified Central City alternative
(2) Reaches combined in final Central City EIS

Outputs in Table E-8 are those that remain after impacts have been subtracted from any positive gains attributed to habitat development. The results indicate that the Modified Alternative would provide greater overall riparian forest benefits, but slightly less wetland and upland forest benefits. However, within Riverside Oxbow study reaches the habitat outputs are improved

substantially for riparian forest, and moderately improved for wetlands. The outputs in Table E-8 take into account impacts listed in Table E-2 and impacts attributable to unchanged features within the original Central City study reaches. Therefore the AAHUS documented reflect net project gains by reach and overall study area by alternative. The net gains for riparian and wetlands indicate that these two resource types have been fully compensated in the Modified Central City alternative as was demonstrated for the Original Central City components within the FEIS and for the approved Riverside Oxbow project report. Mitigation for upland forest impacts with the Modified alternative could be accomplished by out of kind riparian forest development benefits.

RISK AND UNCERTAINTY Development of forest on highly disturbed soils is extremely dependent on site preparation and long term operation and management. Studies have been initiated to assist in determining how well tree plantings will survive and grow within the excavated valley storage sites. Habitat Suitability Indices (HSI's) displayed in the attachment were based on the presumption that these studies will indicate that a reasonable growth rate of desirable forest species will occur over the study period. Initial results of groundwater studies on frequency, depth, and duration of surface water flooding indicate that as long as no excavated site slated for riparian forest habitat development has a bottom elevation below 500 ft NGVD, forest habitat development should proceed as estimated, however, if additional refinement of data during future studies indicate otherwise the projected habitat suitability indices may vary. Initial studies also indicate that sedimentation from overbank flooding into the valley storage areas will not present major issues related to growth of planted vegetation.

Sustainability: Riparian forest developed within the valley storage mitigation sites will forever be subject to extremes of moisture due to periodic inundation and possible soil water changes. The project will be designed to drain rapidly to ensure valley storage capability is maintained. Further issues related to fluctuating ground water tables may be identified for future resolution. While initial studies indicate little deposition of sediments will occur, the forest as it matures will shed limbs, leaves and even full trees from disease or wind storm events. Further, without some means to trap and eliminate floatables and other trash that will enter into the depressed areas, there ultimately will be some buildup and loss of valley storage. While unlikely that reclamation of valley storage within the excavated sites will be required within the 50 year planning horizon, it should be recognized that valley storage losses could possibly accumulate to the point that maintenance excavation would be required, and that the subsequent potential to adversely impact the benefits of the forest development could be high. Any future excavation in the valley storage sites would be conducted in order to retain the design level flood protection associated with the existing West Fork channel improvements and Central City Modifications.

MONITORING AND ADAPTIVE MANAGEMENT

The Corps of Engineers along with the local sponsor and resource agencies would develop a complete adaptive management plan prior to development of habitat measures associated with this project. Goals for hydraulic roughness and environmental success will require careful consideration to assure that both objectives are met. Generally for environmental success, an 85 percent survival of all trees planted would be expected over the first three years after planting. However, at minimal, due to the risk and uncertainties specified, additional monitoring parameters would be added to account for introduction of undesirable species such as non-native privets or chinaberry, or high densities of low habitat producing trees such as willows. Prescriptive modifications would be proposed in relation to on-site monitoring results and could include changes in species to promote within the wetlands as well as within the woodlands. Native riparian grassland development was historically managed by naturally occurring fires and mass grazing events, which can not be duplicated within the urban environment. In addition, it is well established that within native grasslands, some species planted may not germinate for several years after planting. Therefore it will be necessary to do yearly evaluations of growth rates and density establishment by species. Selected mowing regimes will be developed based upon need to foster or hinder develop of species as they develop. A secondary but necessary

output of the adaptive management plan would be a complete Operations and Management Plan that the sponsor would utilize following completion of the construction phase of the project and handoff to the sponsor for future maintenance and future Corps of Engineers annual inspections.

The high density riparian forest that would be established in the Riverside Oxbow and Gateway Park portion of the study area is needed for both hydraulic roughness and to meet habitat development objectives. The need to promote tree growth rapidly to provide necessary hydraulic roughness and habitat benefits requires that tree and shrub planting densities will be higher than normally promoted in this ecoregion. As these trees and shrubs develop and mature, periodic inspection of basal area will be required. Adjustments through clearing and cleaning of non natural deposits of trash and floatables will be necessary. Funding for monitoring and long-term management is essential to help assure success on both counts. Because of the necessity to attain hydraulic roughness through dense forest development and to reasonably meet habitat development projections, monitoring will be conducted for a period of 15 years after initial tree planting and one seasons growth has occurred. Monitoring of wetlands will continue for a period of 5 years and stream habitat will continue for a period of 10 years after completion of construction.

While there is optimism for the success of the proposed reclamation of valley storage excavation sites within the Riverside Oxbow by establishing a high density riparian forest, there is risk that the growth rate may not meet expectations or that local site conditions may not foster the long term survival of vegetation that would be initially planted. To minimize this possibility, additional data will be sought during detailed design to determine best grading plans to promote correct soil moisture and provide for maximum acreages of areas that would be successfully maintained. Once final plans are determined and the project constructed, monitoring will be conducted on an annual basis for tree survival and following any flooding events. Benefits of irrigation types, survival rates by species and by types of plantings, such as bare root, modified root growth, containerized, seedlings versus advanced growth trees will be monitored. Growth rate after planting, including diameter, height and crown spread will be monitored. Natural introductions into the ecosystem of natives and non-native invaders will be monitored. Periodically functionally analysis, including habitat evaluations and hydraulic functions analysis will be conducted.

Should it be determined that adjustments in tree species or methods of planting need to be modified prior to replanting, such adjustments will be made. Should it be determined that the long term site conditions will not promote high density, high value riparian forest habitat, modifications to include changing the restoration to accommodate more ephemeral wetlands, with modified fill zones to promote tree growth will be considered.

Wetland and stream habitat development proposed are based upon designs and strategies that have been previously used successfully within the Upper Trinity River Basin, however, monitoring will be extended and success criteria will be evaluated periodically over 5 and 10 years respectively for these habitat developments. Adaptive management and review of success criteria were also incorporated as elements of the aquatic and wetland mitigation plans submitted to resource agencies. Elements that will be monitored include sediment transport, in-situ riffle-pool-run changes, benthic habitat, fisheries development and use, ecosystem function, wetland plant spread rates, non-desirable wetland plant encroachments and herbivory.

The estimated cost for implementation of the monitoring and adaptive management plan for the riparian forest, wetlands and stream habitat is $1,760,000 which is less than one percent of the $220,000,000 total project cost.

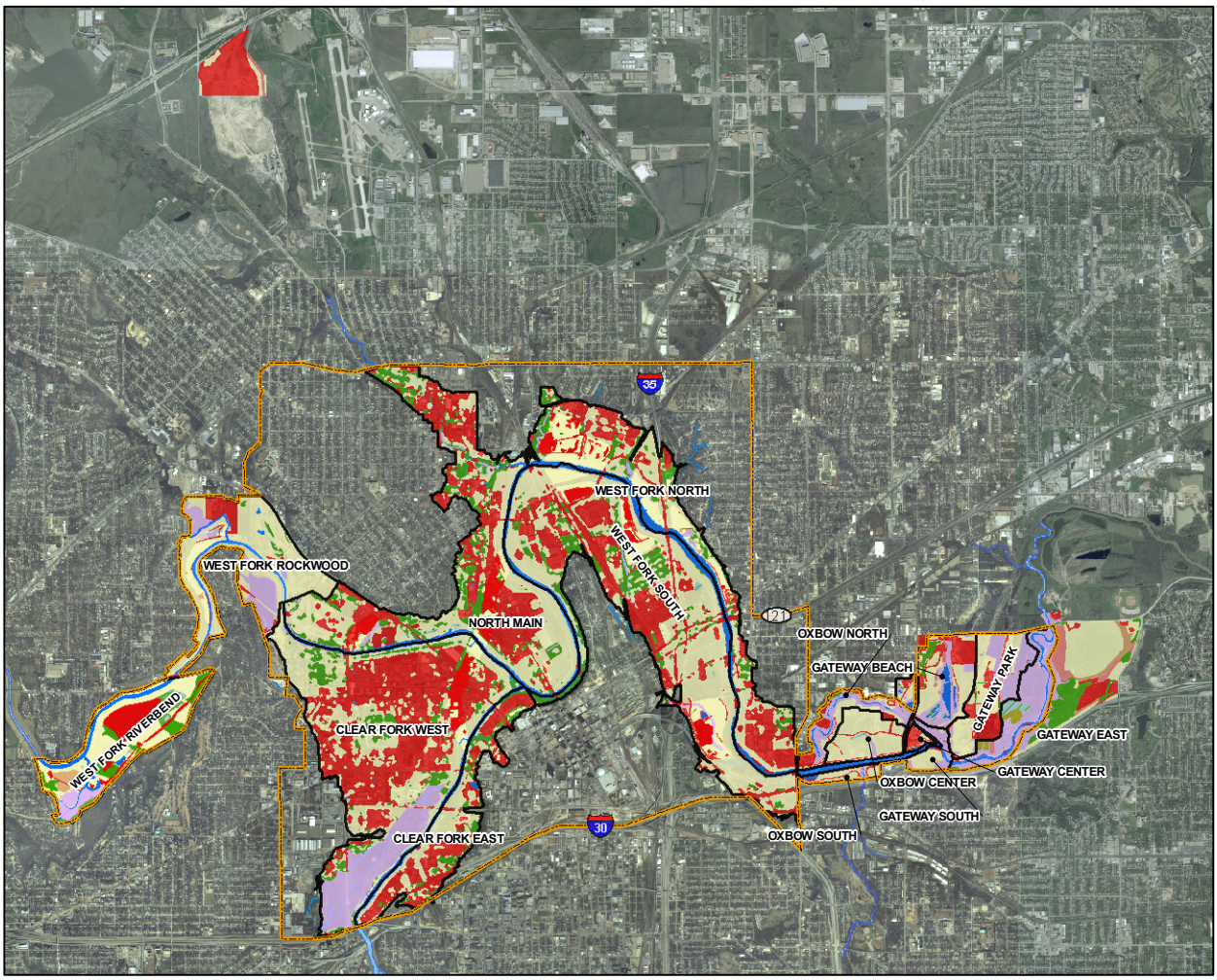


Figure E-1
Existing Vegetation Classes
Modified Central City

Legend

- MODIFIED STUDY AREA
- STUDY REACH BOUNDARIES

EXISTING VEGETATION CLASSES

- DISTURBED
- FORBLAND
- GRASSLAND
- GRASSLAND/SAVANNAH
- RIPARIAN
- SHRUBS
- UPLAND
- WATER
- WETLAND
- RIVERS

N

0 0.375 0.75 1.5 Miles

Aerial Photography Date: January 2005

US Army Corps of Engineers
Fort Worth District

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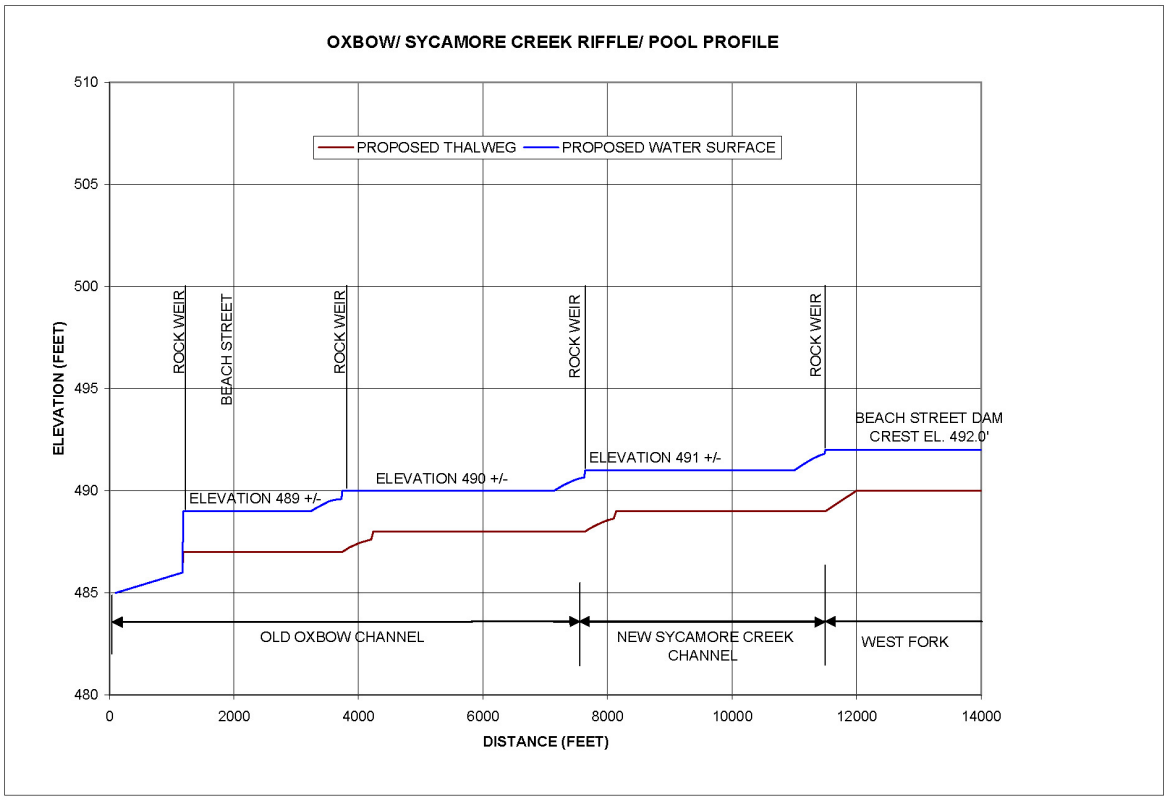

Figure E-2
Proposed Riverside Oxbow-Sycamore Creek Aquatic Habitat Development

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Fort Worth District

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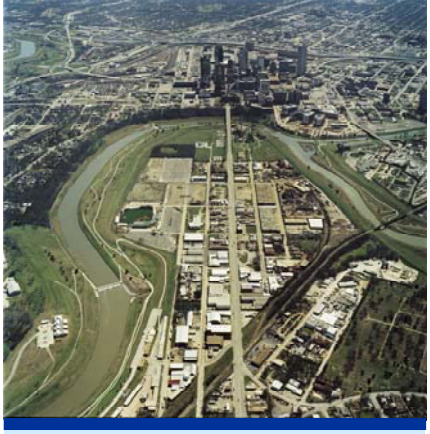
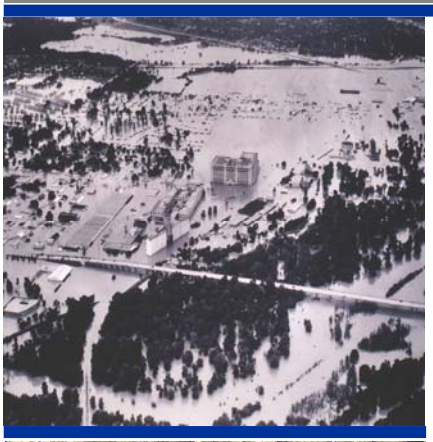


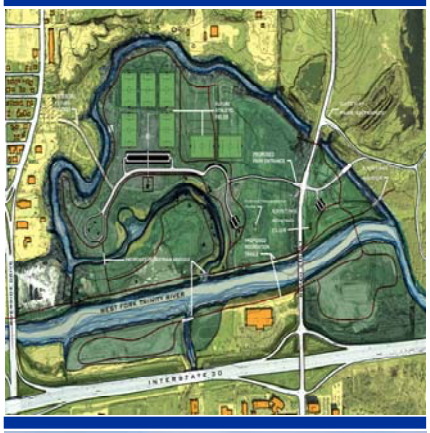
Fort Worth Central City Preliminary Design

404(B)(1) Analysis



Final Supplement No. 1
to the Final Environmental
Impact Statement

Appendix F



March 2008

Rendering Image courtesy of CDM

CDM

TARRANT REGIONAL WATER DISTRICT

Section 404 (b) (1) Analysis

Fort Worth Central City

Modified Central City Project

1.0 Project Description

1.1 Authority and Purpose

Corps participation in the Central City Project was authorized by Section 116 of the Consolidated Appropriations Act, 2005 which directed the Corps to undertake the Central City project as generally described in the Trinity River Vision Master Plan and authorizes the Corps participation at a total cost not to exceed $220,000,000. Section 116 further establishes that the Corps share of that project will be $110,000,000. The Trinity River Vision Master Plan's goals for the Central City project were: develop the river as an aesthetic and recreational focal point for Central City redevelopment; provide for a higher density of people living, working, playing and learning; orient mixed use development on the river; develop an urban lake; provide higher constant water level; eliminate levees where possible; continue trails through downtown consistent with the overall Trinity River Master Plan; improve water quality and wildlife habitat; and provide linkages to neighborhoods and districts. These goals should be accomplished while restoring the design level of flood protection to the Central City area and improving interior drainage.

Discharge of fill material into "waters of the United States" including wetlands associated with the project require compliance with Section 404 of the Clean Water Act. This Section 404(b) (1) analysis is one step in that compliance. Future project authorizations could change the level of Corps participation; however, if level of participation by the Corps is subsequently increased and it is still within the scope of the Central City project evaluated in this document, no further analysis under Section 404 would be necessary.

1.2 Background

A Final Environmental Impact Statement (FEIS) was completed for the original Central City Project in January 2006 and the Central City Project Report was completed in March 2006. The Record of Decision (ROD) was signed, and the Project Report recommending the Central City Community-Based Alternative was found to be technically sound and environmentally acceptable, by the Assistant Secretary of the Army (ASA (CW)) on 7 April 2006.

By letter dated 22 June 2006, the City of Fort Worth requested that the Corps of Engineers conduct an evaluation to consider the potential benefits of modifying the original Central City Project to incorporate the Riverside Oxbow Ecosystem Restoration Project. The City's request recognized that each of these projects are moving forward as individual projects and that they are located adjacent to one another. The City and the Tarrant Regional Water District, the non-Federal sponsor for these two projects, indicated their opinion that based on their adjacency, there might be merit in merging the two projects. In their letter, the City of Fort Worth identified potential benefits of combining the projects that would not be achieved if they were to continue to proceed as individual projects. In response to the City's letter request, the Fort Worth District Corps of Engineers performed an initial evaluation which suggested that the concept merited detailed study. The result of those detailed evaluations is presented in Supplement No. 1 to the Final EIS for the Central City Project.

Based upon detailed evaluations presented in Supplement No. 1 to the Final EIS for the Central City Project, and prior to public coordination under the National Environmental Policy Act, The Fort Worth District has selected the Modified Central City alternative for recommendation. The major difference between the Modified and

original Central City alternatives is in location of valley storage sites required to accommodate the increased hydraulic efficiency of the bypass channel, a primary component of the Central City Project, relocation of Samuels Avenue Dam, and the incorporation of many features of the Riverside Oxbow Project. The Modified alternative retains the major physical features of the original Central City Project but utilizes existing public lands to a greater extent and minimizes use of private lands to accommodate the valley storage requirement.

1.3 Location and General Description

The Central City project, described as the Community Based Alternative in Chapter 3 of the FEIS as modified by Supplement No.1 to the Final Environmental Impact Statement (SEIS) would be located on the Clear and West Forks of the Trinity River in Fort Worth, Tarrant County Texas. This comprehensive project would incorporate a bypass channel, a levee system, and associated improvements to divert flood flows around a segment of the existing Trinity River adjacent to downtown Fort Worth. The specific components of this modified plan are discussed in Chapter 3 of the SEIS.

The project also includes hydraulic mitigation to comply with valley storage requirements. The hydraulic mitigation would be accomplished at six locations including the Rockwood West, University Drive, downstream sites in the vicinity of Samuels Avenue, Riverside Park, Ham Branch, and Riverside/Gateway Park. An in-channel dam, on the West Fork, just upstream of Marine Creek would impound water to a normal water surface elevation of approximately 525 feet NGVD. A low water dam is proposed on Marine Creek to establish a pool elevation of approximately 516.5 NGVD and lock structure located at the dam will provide water connectivity between pools. In addition, the Riverside/Gateway Park mitigation site would be ecologically restored to re-establish the biological integrity by reconnecting the severed channel and restoring riparian woodlands, emergent wetlands, and native grasslands. Two oxbows within the Rockwood Park area would be reconnected to the West Fork providing improved aquatic habitat to the system. Mitigation for stream habitat losses due to inundation of portions of Marine Creek will be accomplished by stream habitat development within Ham Branch and in the Sycamore Creek Oxbow previously severed from the Trinity River. The components of the Modified Central City Project are shown on **Figure 1**.

1.4 Alternatives Considered

Section 404(b) (1) guidelines of the Clean Water Act requires that "except as provided under section 404(b) (2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." The guidelines consider an alternative practicable "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

The Central City FEIS reviewed and evaluated the following alternatives: No Action Alternative, Principles and Guidelines Based Alternative (P&G alternative), and Community Based Alternative. Within the P&G, and Community Based Alternative, alternative locations, configurations, and size of the bypass channel, valley storage, interior water feature, and isolation gates were analyzed as discussed in Chapter 3 of the FEIS. The Recommended Plan's alignment and location of these specific features within the river corridor was based on technical studies, such as Hydrology and Hydraulic, and Geotechnical Investigations that provided in-depth consideration of logistics and functionality. Combining the Central City Project valley storage requirements and the Riverside Oxbow Project was not evaluated at that time because the Riverside Oxbow Project had been recommended for authorization and the study team believed that authorization was imminent.

Neither the No Action Alternative nor the P&G Alternative fulfilled the overall project purposes and goals of the authorized Central City project as described in the Trinity River Vision Master Plan. Therefore, they are not considered "practicable" alternatives under the 404 (b) (1) guidelines and it was determined that the Community Based Alternative as recommended by the FEIS was the least damaging practicable alternative. This plan

substantially fulfilled the overall project goals described in the Trinity River Vision Master Plan (April 2005).

The Riverside Oxbow Ecosystem Restoration study area encompassed approximately 1060 acres and is located just east of downtown Fort Worth, on the West Fork of the Trinity River. The study area's river reach lies downstream of Riverside Drive (the downstream end of the Fort Worth Floodway project) and extends to a point coinciding with the East 1st Street Bridge crossing of the West Fork. The reach includes the old West Fork channel, which formed an oxbow when the channel was realigned several decades ago, the West Fork and Sycamore Creek confluence, and a low water dam downstream of Beach Street.

Several alternative plans were formulated during the Riverside Oxbow Ecosystem Restoration study that led to the identification of the National Ecosystem Restoration (NER) Plan. In addition a "No Action" alternative and a Locally Preferred Plan (LPP) were carried to the final array of alternatives. The NER plan, as modified by addendum dated April 2005 was approved by the Secretary of Army. The approved plan consists of reestablishing low flows through the old severed West Fork of the Trinity River oxbow including replacing the existing Beach Street Bridge; creation of emergent wetlands, open water, and vegetative fringe habitat; habitat improvement of existing forested tracts, including establishment of a riparian buffer along the West Fork from Riverside Drive to East 1st Street. Additional features of the plan include reforestation of land using a variety of native hard and soft mast trees and shrubs; new park entrance, replacing the Beach Street Bridge, preservation and habitat improvements of native prairie and scrub/shrub uplands (see figure 2 of the SEIS for details of the approved Riverside Oxbow project features).

Additionally, alternatives were evaluated during the evaluation and analysis to merge the Central City Project with features of the Riverside Oxbow Project. This analysis in the SEIS includes the evaluations of the Technical and Environmental acceptability of modifying the Central City Project to incorporate features of the Riverside Oxbow Project in terms of hydraulic efficiency, valley storage, increased opportunity for riparian, aquatic and wetlands restoration, more comprehensive and synergistic development of recreation opportunities and implementation.

The project would result in a loss of floodplain or valley storage due to the fact that the bypass channel is shorter and more efficient than the existing river channel. Without mitigation, as much as 5,250 acre feet of valley storage could be lost. A number of alternative valley storage sites were considered and evaluated to provide hydraulic mitigation as discussed in Chapter 3 of the FEIS. Additional alternatives and sites were further considered and evaluated during this SEIS process. The supplemental evaluation includes a review of environmentally sensitive areas, minimization of adverse impacts and hydraulic suitability. Chapter 3, formulation in the SEIS discusses the evaluation of storage mitigation and explains the rationale for determining the recommended sites. The compensatory mitigation would off-set this potential loss of storage by creating valley storage mitigation sites along the West Fork of the Trinity River upstream of the project area, in the vicinity of Rockwood Park and University Drive, and slightly downstream of the dam in the proximity to Samuels Avenue, Riverside Park and the Riverside/Gateway Park site. These recommended locations were determined to be the least environmentally damaging practicable alternative for hydraulic mitigation. In addition, the Riverside/Gateway Park site also provides the opportunity to develop habitat in an existing floodplain area which includes the original West Fork and Sycamore Creek Oxbow channels. The Corps participation is a subset of the Community Based Alternative and is part of the least environmentally damaging practicable alternative.

A number of alternative locations for the Samuels Avenue Dam were considered and evaluated as discussed in Chapter 3 of the FEIS and in Chapter 3 of the SEIS. A location just downstream of Marine and Lebow Creeks near Samuels Avenue was determined in the Central City FEIS to be necessary in order to meet the goal of raising the Trinity River water level and within Marine Creek to provide a water linkage among neighborhoods, businesses, and cultural amenities of the Central City area. The SEIS re-evaluated this location based upon geotechnical concerns and an effort to reduce impacts to stream and aquatic habitat. The evaluation resulted in a

revised location just upstream of the confluence with Marine Creek. The selected site maintains the pool elevation of 525 NGVD while simplifying the operation of the dam, eliminates the adverse impacts to Lebow Creek, and reduces backwater impacts to Marine Creek.

In association with the proposed new site just upstream of the Marine Creek confluence on the West Fork of the Trinity River and configuration for the Samuels Avenue Dam, a fixed low water dam is proposed on Marine Creek at the confluence with the West Fork of the Trinity River to meet project objectives of navigability and connectivity to the Stockyards area. Several alternatives were evaluated for the Marine Creek low water dam including the use of a gated or fixed structure as well as varying the crest width and height. A fixed structure is recommended on Marine Creek since this alternative is able to meet the design requirements of not increasing existing 100-year water surface elevations on Marine Creek while also minimizing construction, operation, and maintenance costs. The proposed crest elevation of the low water dam is 516.5 NGVD which reduces adverse impacts on Marine Creek upstream from the main river as compared to the elevation of 525 NGVD that would have occurred with implementation of the Samuels Avenue Dam at the location identified within the FEIS.

The Modified Central City Project addresses all of the project objectives contained in the Trinity River Vision Master Plan referenced in the Authorization which satisfy the four overall project purposes, i.e. Flood Damage Reduction, Ecosystem Improvements, Urban Revitalization and Recreation. It provides the design level of protection within the system, and improves the performance of the interior drainage components, reducing the 100-year floodplain in sumps 16W, 24C, 25C, and 26 by 180 acres.

A complete description of the Modified Central City alternative is included in Chapter 3, of the SEIS. Other actions would potentially occur in the future in conjunction with the ultimate development of the Trinity Uptown Features. Some of these activities could impact waters of the United States. These future actions are not being considered during this analysis other than for potential cumulative impacts. Future actions within the area by others would require consideration for compliance with Section 404 of the Clean Water Act at the time they are proposed.

1.5 General Description of Fill Material

The comprehensive Modified Central City project consists of four primary construction areas: the University Drive Hydraulic Mitigation Site; the Bypass Channel Area with associated Interior Water Feature and isolation gates; Samuels Avenue and Marine Creek Dams; and the Hydraulic Mitigation Sites. **Figure 2** denotes the delineation of waters of the United States from the National Hydrographic Dataset products, publication date 2005. Construction of improvements where excavation and or fill are located within the Ordinary High Water Mark (OHWM) of waters of the United States will include the three isolation gates and pedestrian bridges, Samuels Avenue and Marine Creek Dams, ecosystem mitigation and restoration of the West Fork and Sycamore Creek Oxbows, and tie-ins of the Bypass Channel to the existing Trinity River Channel. These locations are shown on **Figure 3**.

An initial geotechnical investigation consisting of a review of existing geotechnical and geologic data and geotechnical exploration was performed to determine general excavation/ fill material characteristics. The fill characteristics within the specific areas identified during the investigation found in general alluvial soils consisting primarily of clay with terraces of sand and gravels overlying generally fresh, unweathered limestone bedrock. The following discussion is applicable to both the overall Modified Central City comprehensive project and the Corps participation unless otherwise noted.

1.5.1 Fill Material Characteristics

A review of existing geologic data for the project area found that the geologic history of the area is complex. During the Triassic and Jurassic periods, withdrawal of the seas from north central Texas along with subsidence of the Gulf Coast Embayment reversed the direction of drainage. The variation of sea levels during the

Cretaceous period generally resulted in multiple layers of geologic deposits. Depositions include members of the Fredericksburg Group which are exposed in the project area and provide the primary geologic formation for construction of the project. This includes the Goodland Limestone, the Kiamichi Formation, the Washita Group, the Duck Creek Formation and the Fort Worth Formation.

Much of the project area is covered with alluvium and terrace materials of Quaternary Age. Bottom-land gravels have formed terraces or benches closer to the stream valleys. These terraces become more distinct as proximity to the current stream channels gets closer. The lowermost terrace is the present floodplain and includes alluvium a few feet above the present stream bed. The alluvial deposits were derived from formations that outcrop within the drainage basin, and range in thickness from a feather-edge to approximately 45 feet. The upland gravels in the area consist of angular gravels, clay and silt. The sand and gravel are mostly poorly sorted fragments of platy limestone. The lower terrace and floodplain deposits consist of rounded gravel, sand and clay. These deposits are generally well sorted and not well cemented.

Preliminary geotechnical investigations have been performed during the initial project Feasibility Studies for both the authorized original Central City and the Riverside/Oxbow Projects. Further investigations will be conducted during the design stage to develop final design parameters and to further define conditions within the combined project area, including the various valley storage mitigation sites, the low water dam at Marine Creek, and an alternate location for the Samuels Avenue Dam and Lock. A discussion of these investigations and results is presented in Appendix B Geotechnical to the SEIS.

The initial geotechnical exploration along the proposed bypass channel and Samuels Avenue Dam site revealed alluvial soils overlying bedrock. The alluvial soils consisted primarily of clay with lenses and layers of sand and gravel and overlying generally unweathered limestone bedrock. This area is within the scope of the Corps participation.

The majority of the clay can be described as having a medium potential for volume change, which is defined as clay with a Plasticity Index ranging from 15 to 28 percent and a Liquid Limit ranging from 35 to 50 percent. The results of permeability tests performed on the clay samples show permeability values are generally low and indicate that the soils are capable of water containment within the proposed bypass channel and levees. The area of the proposed bypass channel is within the scope of the Corps participation.

Seams of sand and gravel overburden soils were found to occur primarily beneath the clay and directly over the limestone bedrock. There was no significant correlation between percent fines, sands, and gravels with depth. Limestone with shale seams was encountered in borings above the proposed lower bypass channel bottom, indicating that some rock excavation would be necessary during construction of the bypass channel, which may then be used as fill elsewhere on the project. The limestone was found to be generally fresh and unweathered, and can be classified as moderately hard. This area is within the scope of the Corps participation level.

Results from site specific geotechnical explorations have not been received from each of the individual valley storage mitigation sites. However, based on previous investigations by the USACE during the Riverside Oxbow Interim Feasibility Study and other studies in the project area, including investigations conducted as part of the closure of the old Riverside Waste Water Treatment Plant; the overburden appears to be clay and claying sands with significant lenses of sand and gravel. The geological deposits in the remaining areas are thought to be similar to that found in the areas investigated. The findings from the initial geotechnical investigations are included in Appendix B of the SEIS.

1.5.2 Fill Classification

Fill operations for the comprehensive Modified Central City Project have been segregated into two classifications based on nature of the operation, proximity of the fill to the existing riverine system and elevation. The nature of each classification is described below and the location of each classification is shown

on **Figure 3** and **Figure 4**. These classifications are applicable to both the overall comprehensive plan and the Corps participation unless otherwise noted.

> ***Cut/Fill within the OHWM***– Material (construction activity) that is placed (occurs) below the Ordinary High Water Mark (OHWM) within the existing riverine sites.
>
> ***Cut/Fill outside the OHWM*** – Material (construction activity) which is placed (occurs) outside of the existing riverine system and OHWM which may have the potential to impact waters of the U.S.

1.5.3 Fill Quantities

Approximately 640,020 cubic yards of material are anticipated to be excavated and/or discharged (filled) as part of the Central City Project within waters of the United States below the OHWM. Of this quantity the estimated fill within the OHWM is approximately 422,605 cubic yards and the estimated excavation quantity is approximately 219,415 cubic yards. The majority of this fill material will form permanent control structures that will be placed within the waterway and the precise amount is dependent on final design.

The material excavated for this project is intended to be used for other project related activities and it is not expected that any excess material from the project would be transported outside of the project area. Contaminated material, if encountered, that is not suitable for placement within the project area would be disposed of at an appropriate licensed landfill facility. Contamination determination is discussed in Section 2.4 of this document.

1.5.4 Source of Fill Material

The fill material for the Modified Central City Project would be generated from excavation activities associated with the project or from the placement of concrete structures within the waterway. Sources would be the same for both the overall comprehensive Modified Central City Plan and the Corps participation. The primary sources of fill material would be from the excavation of the Corps portion of the overall project as follows: construction of the Marine Creek Low Water Dam, Samuels Avenue Dam, the Trinity Point Isolation Gate, the TRWD Isolation Gate and storm water pump station, the Clear Fork Isolation Gate, Interior Water Feature, Ham Branch Mitigation, West Fork (Rockwood) Ecosystem Restoration, Upper Bypass Channel tie-ins to the Clear Fork and West Fork of the Trinity River, the Lower Bypass Channel tie-ins to the West Fork of the Trinity River, Restoration of the old West Fork Riverside Oxbow and Ecosystem Mitigation of the old Sycamore Creek Oxbow.

Preliminary earthwork volume calculations for the currently proposed bypass channel tie-ins, dam construction, new isolation gates and valley storage mitigation sites are summarized in **Table 1**.

Table 1: Approximate Fill/Cut Quantities Within the OHWM.

Description	Fill Cubic Yards	Excavation (Removal) Cubic Yards
Bypass Channel Tie-Ins & Isolation Gates		
Upper Bypass Channel Tie-ins	18,655	10,340
Lower Bypass Channel Tie-ins	0	13,800
Clear Fork Isolation Gate	79,825	1,975
Trinity Point Isolation Gate	22,180	4,620
TRWD Isolation Gate & SWPS	121,900	3,900
Dam Sites		
Samuels Avenue Dam	15,065	22,890
Marine Creek Low Water Dam	4,875	9,485
Marine Creek Channel Improvement	0	1,500
Interior Water Feature		
Interior Water Feature and Pedestrian Bridges	160,105	36,940
Aquatic Mitigation/Restoration Sites		
Rockwood Park Ecosystem Restoration	0	50,000
Ham Branch Aquatic Mitigation	180	5,150
Riverside Oxbow Ecosystem Development	220	13,500
Sycamore Creek Aquatic Ecosystem Development	120	670
Valley Storage Sites		
Rockwood Park West	0	27,100
Samuels Avenue Sites	0	8,540
Riverside Park	0	655
Riverside Oxbow & Beach Street Bridge	0	8,350

1.5.4.1 Bypass Channel Tie-Ins & Isolation Gates

Construction for the Bypass Channel and isolation gates would be done to meet project goals of flood control while providing a catalyst for economic expansion into the area adjacent to downtown Fort Worth and to provide a linkage to the existing Stockyards area. The existing site is primarily urban with a mixture of industrial and commercial sites. Minimal terrestrial or wetland habitat value exists in this area because of the existing level of urban disturbances.

The majority of excavation and fill operations associated with the construction of the Bypass Channel would occur outside of the waters of the United States prior to the full use of the Bypass Channel to convey floodwaters. However, the tie-in of the New Bypass Channel to the existing Clear Fork and West Fork will require excavation within OHWM. This work will include removal of material from the OHWM, overbank and levee section to connect the New Bypass Channel to the main channel. This excavated material will be discharged to upland sites not immediately adjacent to waterways, proper management practices will be used i.e. silt fences, interceptor swales, sediment traps, etc. to prevent and control soil erosion, sedimentation, or discharge of materials to receivable waters.

The three isolation gates will be constructed adjacent to the Bypass Channel on the existing River Channel to provide flood protection during major storm events. Portions of the existing channel will be excavated and concrete gate structures constructed. Precise sequencing of excavation and fill activities, including location and size of temporary coffer dams and sheet pilings, would occur as a part of final design. The structures associated with the three isolation gates will result in approximately 223,905 cubic yards of permanent fill. This portion of the comprehensive plan is part of the Corps participation. Temporary coffer dams or sheet pilings are anticipated near each of the three proposed isolation gates (Clear Fork Gate, Trinity Point Gate, and TRWD Gate). Preliminary estimates anticipate approximately 50,000 cubic yards of temporary fill, from on-site sources, will be required for this purpose. This temporary fill is an impact of the Corps participation.

1.5.4.2 Dam Sites

The Samuels Avenue Dam and Marine Creek Low Water Dam structures located upstream of Samuels Avenue would result in approximately 19,940 cubic yards of permanent material being placed into the West Fork of the Trinity River and Marine Creek and approximately 33,875 cubic yards of excavation and removal. In addition, Samuels Avenue Dam would impound water to an elevation of 525 feet NGVD during normal flow situations. At the Samuels Avenue Dam location, the existing normal water surface elevation (also considered to be the ordinary high water mark) is approximately 500 feet NGVD. Coupled with the development of the bypass channel and the Interior water feature, there would be a combined increase in water surface area of approximately 120 acres at normal flow conditions resulting from the project.

Precise sequencing of excavation and fill activities, including location and size of sheet piling would occur as a part of final design. In addition, deepening of the Marine Creek Channel is required for approximately 160 ft in length just upstream of 23rd Street.

All disturbed sites associated with excavation and discharge of fill materials would be protected during construction by appropriate erosion control practices including silt fences, interceptor swales, sediment traps. Prior to the removal of the erosion control practice all exposed areas would be vegetated or otherwise mechanically stabilized. These impacts are considered within the scope of the Corps participation.

1.5.4.3 Interior Water Feature

This feature is associated with the overall comprehensive plan but the fill would not be included in the Corps participation. As a result of this fill the channel depth within the Interior Water Feature would vary between 10 and 15 feet. The earthwork-related fill associated with the interior water feature of the Modified Central City Plan is necessary to maximize recreational and aesthetic uses of this water feature. Thus the 160,105 cubic yards of permanent fill is reviewed both comprehensively and clarified as impacts of the Corps participation based on the fill associated with the interior water feature and the isolation gates.

1.5.4.4 Aquatic Mitigation and Restoration Sites

Excavation and removal of deposits and sedimentation will be required for the improvement of aquatic habitat at the Rockwood Park, Ham Branch, Riverside Oxbow and Sycamore Creek sites. These areas with exception of Ham Branch, currently have limited connectivity to the main water course; however, care will be taken during the design process to define measures and construction sequence. Approximately 69,320 cubic yards of material and sediments will be removed from these areas. Locations which are dry or have intermittent water supply will be excavated in sequence so that activities within the OHWM are minimized. Temporary bulkheads and dams will be used to isolate excavated areas until major activities are complete.

1.5.4.5 Valley Storage Sites

The sites selected for valley storage are generally overbank areas which are out of the main channel and riverine. These sites will be excavated to provide the additional valley storage required for the 100 yr and SPF flood events. However some grading and earthwork will be required for site drainage on the channel bank near the waterline and within the OHWM. Approximately 44,645 cubic yards of material will be removed from this overbank area within the OHWM. Proper controls and management practices will be used i.e. silt fences, interceptor swales, sediment traps, etc. to prevent and control soil erosion, sedimentation, or discharge of materials to receivable waters while they are being re-vegetated.

1.6 Cut/Fill Outside the OHWM

The Modified Central City Project also includes a number of related construction activities which have the potential to impact receivable waters. These activities include excavation of Valley Storage Sites outside the OHWM but within the 100 year floodplain, raising University Drive out of the 100 year flood elevation, levee

tie-ins to the new channel, overbank excavation, pedestrian bridges, and disposal of excavated materials at upland locations, landfill sites outside of the OHWM, 100 year and SPF limits. These are summarized on **Table 2** and shown on **Figure 4**.

Table 2: Approximate Cut/Fill Quantities Outside the OHWM.

Description	Excavation - Cubic Yards	Disposal - Cubic Yards
Valley Storage Sites		
Rockwood West	120,900	0
Samuels Avenue Sites	858,460	0
Riverside Park	301,345	0
Ham Branch	3,300	19,300
Riverside Oxbow	2,206,825	0
Gateway Park	860,000	0
University Drive		
University Drive	0	130,000
Interior Water Feature		
Interior Water Feature and Pedestrian Bridges	398,145	685
Upland Disposal Sites		
Brennan Avenue Landfill	0	663,000
Abandoned Impound Lot	0	490,000
Abandoned Eastside Landfill	0	1,138,000
Abandoned Eastside WWTP	0	1,515,000
North Gateway	0	426,000
Other Upland	0	17,200
Tie-ins, Gates and Structures		
Upper Bypass Channel Tie-ins	125,000	0
Lower Bypass Channel Tie-ins	77,920	85,925
Clear Fork Isolation Gate	0	117,500
Trinity Point Isolation Gate	12,800	28,775
TRWD Isolation Gate & SWPS	30,985	331,400
Samuels Avenue Dam	78,115	26,780
Marine Creek Low Water Dam	31,685	3,600
Pedestrian & Beach Street Bridges	1,320	955

1.6.1 Valley Storage Mitigation Sites

Valley Storage Mitigation will be provided by excavation of areas adjacent to the river but outside of the OHWM. There are five (5) general locations where Valley Storage Hydraulic Mitigation will occur by excavation. These are described in the SEIS and summarized as follows:

Rockwood Park West is a 23 acre site, publicly owned (City of Fort Worth); within the existing Trinity River floodplain on the southwestern portion of the existing Rockwood Park Golf Course. The site is bounded by the Trinity River on the east and existing federal levee to the west. Currently the site contains several golf course holes which would be eliminated as part of the city's plan to scale down the course. Vegetative cover on the site is primarily grassland with minimal tree coverage. Tree coverage to north and south of the site are to be preserved. The proposed work includes grading the site to gently slope towards the river to a bank elevation approximately 2 ft. above the proposed normal pool. Excavated materials will be transported and disposed of off-site.

The Samuels Avenue sites cover approximately 40 acres of public property within the Trinity River floodplain and are located downstream of the Samuels Avenue Bridge. The sites lie along the north and south banks of the West Fork Trinity River. The sites are bounded by Brennen Avenue to the north, Northside Drive to the east and south, and the Union Pacific Railroad right-of-way to the west. Vegetative cover on the site is primarily grassland. Proposed work includes grading the sites to gently slope towards the river to a bank elevation

approximately 1 ft. above the static water elevation controlled by the 4th Street low water dam. Excavated materials from the sites will be disposed of in the adjacent City impound lot and Brennen Avenue landfills.

The Riverside Park site is a 20 acre, publicly owned (City of Fort Worth) property located on the east bank of the West Fork Trinity within the Trinity River floodplain. The site is located immediately north of E. Belknap street and is bounded by the Oakhurst Scenic Drive on the east. The north side of the site is defined by an area of large old growth trees which are to be preserved. Vegetative cover on the site is mainly mowed grass. Proposed work includes grading the site to elevations ranging approximately between 3 ft. and 9 ft. above the static water level of 501 NGVD. Excavated materials will be transported and disposed of off-site to the landfill sites.

The Riverside Oxbow Sites are located immediately north of Interstate 30 and bounded by Beach Street on the east and Riverside Drive on the west consisting of approximately 200 acres entirely within the existing floodplain. The site is primarily encompassed within the current river channel and the old West Fork River Oxbow; however portions of the site extend to the north for ecosystem restoration purposes. The Riverside Oxbow Valley Storage Site also includes some property on the south bank near Sycamore Creek. Much of the Oxbow area is in tall grass with a number of scattered mature trees, mostly pecan. The old River Oxbow Channel is lined by dense riparian vegetation consisting of mature trees. A secondary Oxbow from Sycamore Creek also runs through the interior of the site. The site will be excavated from the two year flood elevation to just over the five year. Proposed recreational features include soccer fields, basketball courts, splash park and picnic areas.

The Gateway Park sites are located east of the Riverside Oxbow. The approximately 225 acres are bounded by Beach Street on the west, East 1st Street on the north, Trinity River on the east and I-30 to the south. Northeast and eastern portions of the site are characterized by fairly dense and mature riparian woodlands while the central and southern portions of the site are predominantly park and athletic facilities. The northwest portion of the site is largely vacant land with some commercial development along Beach Street. Proposed work includes grading the sites to elevations ranging from 5-year to less than 2-year frequency event flood elevations to maximize Valley Storage benefits. Ecosystem restoration will include riparian woodlands, emergent wetlands, and buffer, and native grassland. Existing woodland vegetation near the Gateway Park drive, along the Trinity River, and northeastern portions of the site would be preserved and enhanced as part of the ecosystem restoration. Portions of the excavated material from this site will need to be disposed of off-site at the abandoned Eastside Landfill. The site also contains an abandoned wastewater treatment plant site which is proposed for disposal of the excavated materials to minimize transport.

In addition five contingency Valley Storage sites have been identified which could be used to supplement the primary Valley Storage sites if it is found that additional valley storage is required. These sites are discussed in Chapter 3 of the SEIS and are located outside of the OHWM. Therefore there would be no change in the fill/cut quantities within the OHWM if any of these contingency sites are required.

1.6.2 University Drive Hydraulic Mitigation Site

University Drive crosses the West Fork and is located upstream and to the west of the proposed bypass channel. The site is an existing roadway with several commercial businesses located to the east. The site is within the 100-yr and SPF floodplain. Minimal habitat exists in this area because of the urban environment. The site is approximately 10 acres of roadway right-of-way. University Drive Mitigation consists of raising the roadway with excavated material within the 100-yr floodplain and is a key component in mitigating the loss of floodplain or valley storage. Site work would include raising the existing roadway profile out of the 100 year floodplain.

Construction of the University Drive embankment would occur outside the OHWM but within the 100-yr and SPF floodplain. Disturbed sites including areas of fill would be protected with appropriate erosion control practices. Prior to the removal of the erosion control practice all exposed areas would be vegetated and

stabilized. This site is within the scope of the Corps participation.

1.6.3 Upland Disposal Sites

The disposal of excavated fill material would be primarily by cut and fill operations using bulk scrapers. Additional materials would be transported by haul truck from the point of excavation to the designated disposal site when scrapers are infeasible or uneconomical based on haul distances. Excavated material would be sorted and handled on site prior to placement in the designated disposal area. Excavated material would be placed in suitable lifts and compacted as required for structural and soil stability design criteria. Excavated materials from the Valley Storage and Ecosystem Restoration Sites will be taken to sites out of the Riverine Environment and out of the 100 year and SPF floodplain limits. The sites include the old Brennen Avenue Landfills, the City's Impoundment Lot, property on the North Gateway site, the old abandoned wastewater treatment facility, and the closed Eastside Landfill. Separate erosion and run-off control plans will be prepared for the various construction contracts specific to each disposal site. The plans will include requirements for buffer zones, sedimentation basins, silt fences and interceptor trenches.

1.6.4 Bypass Channel Tie-Ins, Isolation Gates, and Dams

The tie-in of the new Bypass Channel to the existing Clear Fork and West Fork consisting of levees and high retaining walls, and construction of the isolation gates will occur outside of the OHWM. This excavation and fill operations associated with the construction of the Bypass Channel tie-ins, and isolation gates will include placing suitable fill for new levees and retaining wall outside the OHWM, and to connect the levee and hard edge sections of the new Bypass Channel to the main channel. Excavated material will be used to construct the new levees and as back fill behind the new retaining walls and isolation gate structures. Similarly construction of the Samuels Avenue and Marine Creek Dams will require excavation for the construction of training walls and fills outside of the OHWM. Excess excavated material from these sites, not required for backfill, will be hauled for disposal at one of the designated disposal sites. All disturbed sites would be protected during construction by appropriate erosion control measures i.e. silt fences, interceptor swales, and sediment traps

2.0 Factual Determinations

The factual determinations are applicable to both the overall comprehensive plan and the Corps participation unless noted otherwise.

2.1 Physical Substrate Determinations

2.1.1 Substrate Elevation and Slope

The new Bypass Channel would connect to the existing Clear Fork and West Fork of the Trinity River at the same elevation as existing channel. This area is within the scope of the Corps participation.

2.1.2 Sediment Type

No previous sediment transport studies in the Trinity watershed reaches potentially affected by the Modified Central City Project were found which includes the Corps portion of the Modified Central City Project. The sediments in the project area are anticipated to be similar to that found in the geotechnical investigation performed for the project and other portions of the Trinity floodplain which have been described as alluvium floodplain deposits including indistinct low terrace deposits, gravel, sand, silt, silty clay and organic matter.

2.1.3 Fill Material Movement

Excavated material would be used for subsequent fill operations on the project. Fill material as placed during the Modified Central City Project including the Corps portion of the project would be permanently stabilized to minimize the potential for movement or erosion of these areas. Permanent soil stabilization practice would include slope vegetation with native plantings and in potential high energy area concrete or other armor would

be used to protect the areas and minimize adverse impacts to aquatic and terrestrial habitat.

2.1.4 Physical Effects on Benthos

Temporary effects to benthos would occur during the construction process. Temporary fill in the form of coffer dams or sheet piling would have direct impact on the area of fill and would have additional temporary effect on the areas that would be dewatered prior to construction of the three isolation gates, Samuels Avenue Dam, Marine Creek Dam and the Interior Water Feature. The Interior Water Feature would be enlarged by removal of soil from the uplands adjacent to the Clear Fork and West Fork confluence area. Approximately 35 acres of river channel bottom would be filled with some of the material removed from the adjacent uplands. After completion of the Interior Water Feature, coffer dams would be removed and the area re-flooded. Benthic organisms are known to rapidly recolonize disturbed areas within streams and impoundments. Combined with the bypass channel, about 112 acres of new lentic habitat would be developed including substrate for development of benthic habitat.

As most of the aquatic habitat within the study area is greatly influenced by in-channel dams, primary long-term effects on the stream habitat occurred following placement of the dams. The increased depth of flooding over portions of the study area would not result in significant effect on benthos as productive zones would be re-established along the slope of the channels and within the raised bed of the Interior Water Feature.

Due to the inundation of approximately 2,700 feet of Marine Creek there would be a shift from benthic organism's characteristic of flowing water habitat to those adapted to more lake-like conditions. Fisheries sampling within Marine Creek indicate that important fisheries that rely on benthic organisms associated with shallow riffle/pool sequencing are present.

Both the temporary negative impacts and the potential long term positive impacts are within the scope of the Corps participation of the project.

2.1.5 Other Effects

None.

2.1.6 Actions Taken to Minimize Impacts

Efforts will be made to avoid or preserve valuable aquatic and terrestrial habitat concurrent with achieving the project, flood damage reduction, ecosystem improvement and recreational goals Adverse impacts during construction would be minimized through the implementation of erosion control and storm water pollution prevention measures such as silt fences, temporary and permanent soil stabilization practices, and turbidity barriers. To compensate for unavoidable adverse impacts, an aquatic mitigation plan that incorporates additional aquatic habitat mitigation has been developed in Ham Branch, a tributary to the West Fork Trinity River that crosses the floodplain on the right bank downstream of the existing Trinity Railway Express crossing, and in Sycamore Creek at the Riverside Oxbow site.

2.2 Water Circulation, Fluctuations, and Salinity Determinations

2.2.1 Water Chemistry

The State of Texas biennial inventory indicates historical compliance with standards for all water quality parameters in the stream segments affected by the project. The proposed project which includes the Corps participation is not expected to change this.

The impact of the proposed project on dissolved oxygen (DO), nutrients, biochemical oxygen demand (BOD), and phytoplankton (as measured by chlorophyll a) as functions of stream hydrology and hydraulics, upstream

loadings, in stream kinetics, and environmental conditions (temperature, light levels, and wind speed) was assessed. The United States Environmental Protection Agency (USEPA) Water Quality Analysis Simulation Program (WASP) version 6.0.0.12 (USEPA 2004) was used to perform the majority of the analyses. The result of this modeling indicates no adverse impact to dissolved oxygen below stream standards. Full discussion of the modeling results is included in the SEIS.

2.2.1.1 Salinity

Not applicable.

2.2.1.2 Clarity

There would be a temporary increase in turbidity when the bypass channel and dam structure is opened to the flow of the river; however this should be limited to the initial stabilization period. Coffer dams would be used during construction to minimize erosion around work zones open to flow from the river. Clarity temporary impacts are within the scope of the Corps participation.

2.2.1.3 Color

During all but extreme low flow events there is no concern related to changes in color of water as compared to the existing conditions. During extreme low flow events occurring during warm seasons, the potential for concentrations of algae to increase is possible within the enlarged impounded area. This could increase the potential for the water to be greener that would occur without the project during those conditions. The potential for an increase in algae concentrations is within the scope of the Corps participation.

2.2.1.4 Odor

A slight chance for odor could result if under stratified conditions a release is being made from the bottom layers of the water at Samuels Avenue. Any additional odor problems would be of short duration and are not expected to be a significant problem since similar conditions currently exist at existing low water dams. The potential for temporary odor changes are within the scope of the Corps participation.

2.2.1.5 Taste

No water supply withdrawals exist within the area of influence of this project therefore no taste issues are anticipated.

2.2.1.6 Dissolved Gas Levels

Table 3 contains the associated water quality standards for DO to achieve the high aquatic life designated use associated with the stream segments affected by this project. Modeling results show that DO concentrations within the waterway proposed under the project would be maintained above the State of Texas standard of 5 mg/L and vary little from current conditions. These modeling results show the Corps participation would not cause any significant changes of Dissolved Oxygen concentration levels.

Table 3: Dissolved Oxygen Criteria for Waterways in the Central City Area.

Mean (mg/l)	Minimum (mg/l)	Spring Mean (mg/l)	Spring Minimum (mg/l)
5.0	3.0	5.5	4.5

2.2.1.7 Nutrients and Eutrophication

For the majority of the year, the Clear and West Forks of the Trinity River through downtown Fort Worth are essentially lakes. Low water dams/grade control structures throughout these reaches impound water into

quiescent linear lakes. Measured chlorophyll a concentrations (up to 50 – 90 µg/l) are indicative of possible eutrophication (Chapra 1998) in this system. However, these values are associated with warm, extended low-flow conditions and storm flows quickly "flush" the system. No additional sources of nutrients would be added to the system from this project; therefore, no additional eutrophication is anticipated from proposed changes to the system. These potential impacts are within the scope of the Corps participation because the dam creates the lake impoundments even though the impoundment is not a direct element of the Corps participation.

2.2.2 Current Patterns and Circulation

2.2.2.1 Hydrologic Regime

The West Fork of the Trinity River in downtown Fort Worth is formed by the confluence of the West Fork and the Clear Fork. The West Fork above the Clear Fork confluence drains 2085 square miles while the Clear Fork drains 521 square miles. Major impoundments, including Lake Worth, Eagle Mountain Lake and Lake Bridgeport on the West Fork and Benbrook Lake on the Clear Fork have a profound effect on the flow regime in the downtown area. Within the study area, the lower end of the reach is impounded to elevation 500 feet by the Fourth Street Dam, the next upstream reach is inundated at elevation 505 by TRWD Dam, and Nutt Dam inundates reaches of the Clear Fork and West Fork to elevation 520.

United States Geological Survey (USGS) gauge records are available for the Clear Fork just above the existing confluence and for the West Fork just downstream of the confluence. Only flows recorded since October 1956 were used; thus the effects of Lake Worth and Benbrook Lake are included in the analysis. The mean flow in the West Fork during this period was 423 cubic feet per second (cfs), with an average of 148 cfs contributed by the Clear Fork. The median flows of the West Fork and Clear Fork were 34 cfs and 19 cfs, respectively. These flows are subject to substantial seasonal and year-to-year variability. Mean annual flows on the West Fork have been as low as 25 cfs (recorded in 1978) and as high as 1828 cfs (recorded in 1990). Drought years in the mid-1950s produced even lower flows. The average West Fork flow follows a seasonal pattern that peaks in May and falls to an annual minimum in August. The median mean August flow is 39 cfs and the median minimum daily flow of the year is 3.9 cfs.

The West Fork flow regime would be altered during extreme storm events by the proposed University Drive Hydraulic Mitigation improvement. Under proposed conditions there is no anticipated alteration of the current Clear Fork flow regime above the Clear Fork Gate. Minor flow changes below Clear Fork Gate would occur during normal flows, however, in the event of a major storm event, the Clear Fork Gate closure would reroute flows to the bypass channel. Major changes between 7th Street and Samuels Avenue would occur due to construction of the Bypass Channel and interior water feature. During low flows, water levels would be maintained at approximately 524.3 feet, which would create a pool from Samuels Avenue Dam, upstream on the West Fork above the confluence for a distance of 32,000 ft (6.1 miles) and along the Clear Fork above the confluence for 4,650 ft (0.88 miles).

2.2.2.2 Current Pattern and Flow

The flow supply to the Modified Central City Project area would continue in much the same quantity as under current conditions. After construction of the bypass channel, circulation in the existing system would be altered. However, this is not expected to have a significant effect on water quality. This alteration is within the scope of the Corps participation.

2.2.2.3 Velocity

Under existing conditions, velocity varies from approximately 4.8 feet per second in the vicinity of Fourth Street dam on the West Fork just downstream of the Highway 121 Bridge to 11.7 feet per second at the North Main Street Bridge crossing for the 100 year storm event. As a result of implementation of the project, velocity increases in the 100 year event are generally less than 1.0 feet per second with the exception of the entrance to

the proposed bypass channel and at University Drive Hydraulic Mitigation site where appropriate armoring would be included in facilities design. The velocity changes at the entrance of the proposed bypass channel and at University Drive Hydraulic Mitigation site are within the scope of the Corps participation.

2.2.2.4 Stratification

It is expected that the waterway as proposed would stratify thermally. Stratification has been observed at times in the existing waterway and historical data from these impoundments demonstrate compliance with the DO standard in the epilimnion (as required by the State of Texas). Evaluation of the project conditions indicate that stratification would occur, but to no greater degree that has historically occurred, indicating that the proposed project would meet water quality standards for DO (see Water Quality Impact Assessment in SEIS). The Corps participation would not have any significant negative impacts to the stratification.

2.2.3 Normal Water Level Fluctuations

Minimal fluctuation in water levels is expected under normal flows because the Samuels Avenue Dam would be used to control water levels. However, during extreme storm conditions, water level variations can be expected. Water surface elevations under such conditions are summarized in **Table 4**. Storm event water levels under proposed conditions are generally less than existing conditions. These water level fluctuations during extreme storm conditions would be less than existing conditions due to the Corps participation of this project.

Table 4: Water Surface Elevations at Specified Stations Along the Trinity River.

		Existing Conditions - Water Surface Elevation				
Station	**Approx. Location**	**Median flow**	**Annual average flow**	**2-yr**	**10-yr**	**100-yr**
222998	West Fork at Riverside Dr.	488.4	488.8	506.3	515.0	520.0
237615	West Fork at N. I-35W	500.7	501.3	507.4	516.4	522.9
243471	West Fork at Marine Creek Confluence	500.7	501.3	509.0	517.7	525.1
262599	West Fork at University Dr.	520.1	520.2	528.4	533.1	541.4
		Proposed Conditions - Water Surface Elevation				
Station	**Approx. Location**	**Median flow**	**Annual average flow**	**2-yr**	**10-yr**	**100-yr**
222998	West Fork at Riverside Dr.	488.4	488.8	505.9	514.0	519.6
237615	West Fork at N. I-35W	500.7	501.3	507.1	515.5	522.5
243471	West Fork at Marine Creek Confluence	524.3	524.3	511.6	517.2	525.1
262599	West Fork at University Dr.	524.3	524.4	525.6	530.7	540.2

2.2.4 Salinity Gradients

Not applicable.

2.2.5 Actions to be Taken to Minimize the Impacts

The impact on water quality for the proposed project configuration was analyzed as a part of the preliminary design of the project. The analysis demonstrates that the project would have no significant impact on water quality. Results of this analysis are discussed in detail in the SEIS. The assessment did recognize that because flows during dry periods are slight (approximately 5 cubic feet per second), it may be beneficial to implement practices to manage circulation and water quality and aesthetics in the system. Several options to accomplish

this have been considered and would be further evaluated during final design. These options could be necessary for both the overall comprehensive plan and the Corps participation. Criteria for consideration of these and possible new options would include cost effectiveness and sustainability:

Augmenting flow with other sources. The supply augmentation options discussed in Section 3.0 of the FEIS would provide the benefits of increasing circulation within the system.

Inducing large scale circulation mechanically. Several mechanical means could be used to induce circulation throughout the waterway. Subsurface pumps could be employed to force large volumes of water to move within the channel associated with the system. The proposed storm water pump station for the interior waterway could be configured to accomplish this in addition to its primary function of conveying larger storm flows.

Inducing localized circulation mechanically. Surface aerators (commonly seen as fountains) could induce circulation in localized areas if needed. Pumps could be used to pull water from the waterway and allow it to return to the waterway over cascades or other aesthetic features on a localized basis. This option is outside the scope of the Corps participation.

Provide additional hydraulic structures to direct flow as needed. Hydraulic structures could be configured within the waterway such that low flows are distributed as desired to have complete circulation within the system. These structures, likely subsurface and analogous to grade control structures, would have no effect on the performance of the system in regards to larger flood flows.

2.3 Suspended Particulate/ Turbidity Determinations

2.3.1 Expected Changes at Discharge Sites

There could be temporary increases in suspended particulate and turbidity levels during storm events prior to permanent stabilization. These increases, however, would be of a short duration and tolerable to aquatic organisms downstream. Construction design and phasing have been planned to minimize turbulence and generation of suspended particulates through the use of temporary erosion control measures and soil management plan defining silt fences, interceptor swales, and sediment traps requirements . The temporary increases in suspended particulate and turbidity levels during storm events prior to stabilization are within the scope of the Corps participation at the discharge sites.

2.3.2 Effects on Chemical and Physical Properties of the Water Column

2.3.2.1 Light Penetration

The proposed project would not change the depth to which light penetrates within the water column.

2.3.2.2 Dissolved Oxygen

Water quality models demonstrate that dissolved oxygen concentrations would be changed very little by the proposed project and would remain above the State of Texas standard of 5 mg/L (see Water Quality Impact Assessment in SEIS for more detailed discussion). These changes discussed are impacts that are within the scope of the Corps participation.

2.3.2.3 Toxic Metals and Organics

The Modified Central City Project is contained within two State of Texas River Segments of the Trinity River, Segment 0806 West Fork below Lake Worth and Segment 0829 Clear Fork below Benbrook Lake. The lower one mile of segment 0829 from 7th Street to the confluence with the West Fork and the lower 22 miles of Segment 0806 from the confluence of the Clear Fork have been listed by the State of Texas as not meeting water

quality standards because of high levels of chlordane in fish tissue. This designation lead to the development and implementation of a Total Maximum Daily Load (TMDL) process specific for that waterway and legacy pollutant and is addressed through the TMDL for Legacy Pollutants in Streams and Reservoirs in Fort Worth (TNRCC 2001).

The Texas Commission on Environmental Quality (TCEQ) has prepared an implementation plan; Implementation Plan for Fort Worth Legacy Pollutant TMDLs (TNRCC July 2001) for this TMDL and will continue to monitor chlordane in fish tissue in the Fort Worth area. The TMDL monitoring data showed that chlordane is declining in the environment because improved environmental practices. Recent sampling by the United States Fish and Wildlife Services (USFWS) found that chlordane concentrations in fish tissue have decreased slightly within the project area (USFWS 2004) and does not appear on the 303(d) list. Existing evaluations indicate there is no known reason why the proposed project would increase the likelihood of chlordane in the waterway. In addition, portions of Segment 0806 (lower 22 miles) and Segment 0829 lower mile are listed on the Draft 2006 Texas 303(d) List (June 27, 2007) as Category 5 *does not meet applicable standards for PCB's*. This designation requires the development and implementation of a TMDL. The category is further classified as 5a – *a TMDL is underway, scheduled or will be scheduled.* The target date for the TMDL is 2010.

The project is being structured such that all construction will comply with the TMDL plan set forth by TCEQ which requires appropriate management practices to limit sediment discharge. As a precursor to construction, additional analytical sampling will be done within areas impacted by excavation or fill. The additional analytical sampling that will be done will be in areas that are within the Corps participation. Regional storm water monitoring and an assessment of other permitted discharges in the region indicate that no other toxic metals or organics are expected in the waterway currently or as a result of the proposed project.

2.3.2.4 Pathogens

The lower 22 miles of Segment 0806 West Fork Trinity River below Lake Worth is included on the Draft 2006 Texas 303 (d) list (June 27, 2007) as not meeting applicable standards for bacteria. It is listed as category 5 a, *TMDL is underway, scheduled, or will be scheduled.* The target date for the TMDL on the West Fork Segment is 2009.

In addition, two unclassified water bodies 0806D Marine Creek, a two mile stretch upstream of the confluence with the West Fork and 0806E Sycamore Creek, five mile stretch upstream from the confluence with the West Fork. These are listed as category 5c – *additional data and information to be collected.*

There currently are no municipal wastewater treatment facilities discharging upstream of the immediate project area. As such, bacteria currently contributed to these reaches of the Trinity River come from urban and rural runoff. The changes resulting from the proposed project would not result in any increase in bacteria within the affected waterways. It is anticipated that, over the long-term, the project may even reduce bacterial loads through improved urban runoff management practices and upgraded wastewater collection systems within the project area. TRWD currently monitors waterways associated with the proposed project for bacteria and posts signs in public areas prohibiting contact recreation when bacterial counts exceed State criteria.

2.3.2.5 Aesthetics

As discussed in 2.2.5, several options would be considered in final design to maintain aesthetics including:

- Augmenting flow with other sources;
- Inducing large scale circulation mechanically;

- Inducing localized circulation mechanically; and

- Provide additional hydraulic structures to direct flow as needed.

An adverse impact to water aesthetics in urban areas is floatable material. Typically litter that has washed into drainage ways with storm water runoff, floatable material can aggregate on waterway banks and collect on structures creating unsightly clutters of trash. While the project per se would not cause additional sources of floatables, the increased public use of the area is anticipated to result in the need to further reduce the undesirable effect of floatables within the area. In conjunction with the additional hydraulic assessments associated with final design of the project, studies would investigate how floatable material would interact within the system and provide design strategies to minimize adverse interactions including review of the Corps participation. The local sponsor, TRWD, is already experimenting with strategies to identify sources of floatables to the Trinity basin and how existing movement of these materials can be reduced by capturing and removal through use of netting, booms, etc.

Aesthetics of the water course depend on water appearance, odor, and taste (if a drinking source). The water color and clarity in the general vicinity of the project area is similar to other portions of the Trinity River. It should be noted that the TCEQ report "Draft 2006 Texas Water Quality Inventory" (TCEQ, 2006) documented that algal growth was of "no concern" in a relatively large portion (about 9 of 14 miles) of the Clear Fork below Benbrook Lake (TCEQ Stream Segment 0829) based on chlorophyll *a* water sample test data and that remaining portion of this stream segment was not assessed for algal growth. In the same report, water in the West Fork in an 11-mile reach below Lake Worth was not assessed for algal, but water below this reach (lower 22 miles of TCEQ Stream Segment 0806) was identified as an algal growth "concern" based on chlorophyll - a screening assessment. Based on this information, the existing water in the vicinity of the project area will have probable episodes of algal growth in late spring-summer months. On such occasions, water color may take on a green cast, but significant floating algal mats are not known to occur. Water in the project vicinity is currently not used as a public water supply source and the taste quality of existing area waters is not known. If used as a public water source, it anticipated that the taste quality after water treatment would be similar to treated water from Benbrook Lake and Lake Worth. On the whole, the aesthetic appeal is considered good and similar to the shallow lake fringes of Benbrook Lake and Lake Worth.

Construction activities for the comprehensive Modified Central City Project, including the Corps participation component, will temporarily affect stream turbidity which will hence have temporary adverse effect on stream aesthetics. However, storm water controls, erosion controls, silt fences or hay bales, and onsite best management practices such as siltation pounds, dust control and stabilized construction entrances will be incorporated into the project construction activities such that effects will be minimal and temporary. Algal growth would be a potential aesthetic concern if stream stagnation occurs as result of increased evaporation and low downstream releases. However, the Modified Central City Project is flexible by design and would allow flows through the system to simulate a similar flow-through condition as the existing stream. Further, the maintenance of a good aesthetic appeal of the water course is a primary proponent objective. In addition, other water quality features have been suggested by the proponent to further improve water quality aesthetics beyond the existing conditions.

2.3.2.6 Others as Appropriate

None.

2.3.3 Effects on Biota

There are no anticipated measurable effects to important biota related to water quality changes attributable to the project.

2.3.4 Actions taken to Minimize Impacts

Additional water quality data collection and refinement of water quality and hydraulic modeling tools will be undertaken during the course of project design and implementation in order to guide activities in a manner that minimize impacts to water quality. This includes all features of the Modified Central City Project, including the Corps participation, because they are interdependent and therefore cannot be separated for purposes of water quality and hydraulic modeling. The Project Management Plan for the Modified Central City Project will include review of the design and plans and specifications by appropriate personnel to insure they include actions necessary to minimize impacts to water quality.

2.4 Contamination Determinations

Prior to excavation activities and particularly for the bypass channel or interior water features, Phase II Environmental Site Assessments (ESAs) will be conducted in areas with known or potential soil contamination. The results from the Phase II ESA(s), and any following contaminant delineations that may be required, would be used to determine the proper handling procedures during excavation of the impacted areas. A soil management plan will be developed for areas with soil contamination. The plan would include a description of the nature and extent of the contamination, including figures, with delineation of contamination, volume of expected contaminated material, and soil handling methodologies (screening, segregation, treatment/discharge methods, etc.). The majority of the excavation activities are within the scope of the Corps participation and ESA's will be conducted accordingly.

If contaminated soils that exceed regulatory standards are found during construction, they would be handled and disposed of in accordance with all State and federal regulations that could include (but are not limited to):

- Placement in a Subtitle D landfill;
- Placement in a Subtitle D landfill after on-site treatment; or
- Placement in a Subtitle C hazardous waste landfill/discharge facility.

The appropriate discharge method would be determined by the chemical characteristics of the soil, effectiveness of the method for protecting the environment, regulatory requirements and cost.

Soil handling and discharge would be conducted in accordance with the applicable local, state, and federal laws, regulations, and rules. Coordination with the appropriate regulatory agencies would help guide the soils excavation, remediation, reuse, and discharge efforts during the establishment of the Trinity River bypass channel. These procedures and considerations are incorporated into the plans for executing the Corps participation.

2.5 Aquatic Ecosystem and Organism Determinations

Temporary effects to West Fork and Clear Fork aquatic ecosystem would occur as a result of construction sequencing of the proposed project. Coffer dams and temporary diversions would contribute to short term effects.

Long term effects would be attributable to the permanent structures and the operation of the project. Because the West and Clear Forks through downtown Fort Worth are currently impounded by low water dams, the extension of that impoundment by the construction of Samuels Avenue Dam would not have any substantial effect on biota within the river itself. However, exceptional and high quality aquatic habitat within Marine Creek would be adversely impacted as a result of inundation effects of the Marine Creek Low Water Dam. The effects of significance would be from the loss of riffle pool complexes. Other adverse impacts to wetlands and riparian forest habitat would occur from construction of the project. As identified in the Modified Central City

alternative SEIS, the project would impact only 0.8 acres of wetlands but would only impact 0.14 average annual habitat units (AAHUs) . In addition the comprehensive activities associated with the modified alternative would impact about 12.4 acres of riparian forest having 8.12 AAHUs. These impacts would result in negative responses by fish and wildlife resources of the study area if left unmitigated. These impacts would be caused by the Corps participation specifically the results of the Samuels Avenue Dam operations.

Wetlands and riparian habitat losses would be compensated by the development of ecosystem improvement measures associated with the Riverside Oxbow habitat development, West Fork Rockwood and West Fork South (Ham Branch drainage area) sites. Riparian forest development and management would provide a net gain of 109.8 AAHUs of riparian forest over the 8.12 AAHUs lost as a result of the project. Approximately 58 acres of wetlands would be provided at the Riverside Oxbow sites that would result in the ultimate provision of a net gain of 47.78 AAHUs of wetland values. Monitoring of the ecosystem improvements would be conducted throughout establishment of wetland and woodlands. Adaptive management would be incorporated as necessary to assure success of the environmental mitigation. The wetland and riparian forest development needed to compensate for modified city alternative impacts are within the scope of the Corps participation.

The USFWS has provided Planning Aid Letters, information that was utilized during the planning of this project, and has coordinated with the Corps and local sponsors, and has approved a plan to partially mitigate the impacts caused by inundating exceptional and high quality Marine Creek lentic aquatic habitat through the proposed aquatic improvements at Ham Branch. In addition Sycamore Creek aquatic benefits of the modified plan are being evaluated by resource agencies during review of this document and the Draft SEIS.

Aquatic mitigation at Ham Branch and Sycamore Creeks was found to be necessary to fully compensate aquatic impacts and would be completed following studies to determine a stream configuration that is geomorphically stable based upon hydrology, sediment characteristics and slope. Typical cross-section and plan view of proposed mitigation features are presented in Appendix E to the SEIS. The aquatic mitigation at Ham Branch and Sycamore Creek is within the scope of the Corps participation.

At Ham Branch, development of a riparian forested buffer of 50 foot in width on either side would produce both riparian forest and stream aquatic benefits. Contouring of the channel bank as necessary to provide appropriate interaction between the riparian vegetation and the aquatic environment would be done prior to reforestation. The Riparian plantings would include dense development of shrubs and overhanging grasses near the creek channel. Approximately 305 feet of the existing channel would be relocated to provide adequate width for riparian forest development adjacent to an existing fenced soccer field. Riparian forest would be planted on 7.4 acres and the existing 1.4 acres of riparian forest would be improved to provide a total 8.8 acres along the creek. Pending further investigation, approximately 25 percent of the total length (3,568 feet) of the stream segment would be modified to provide approximately 900 linear feet of rock based riffles at locations to be determined by those additional studies. This riparian reforestation and re-contouring mitigation is within the scope of the Corps participation.

Aquatic habitat benefits on Ham Branch would accrue on 3,568 linear feet of stream channel and should provide up to 0.80 AAHU over the without project conditions. The benefits to mitigating within Ham Branch would extend beyond the creek. It is anticipated that significant benefits to the water quality and fisheries within the West Fork immediately adjacent to the confluence should occur; however, current methods to quantify those benefits are unavailable. In addition, the construction of the riparian corridor adjacent to Ham Branch would provide additional significant forest resources in the lower end of the study area, supporting resource agencies recommendations to provide resources of this type at additional locations within the study area.

Proposed stream habitat improvement within the Riverside Oxbow includes restoring the severed Sycamore Creek Oxbow. The available slope from the proposed connection to the Trinity River, through the Sycamore Creek Oxbow channel and the West Fork Oxbow to its confluence with the main stem of the West Fork below

Beach Street Dam is only approximately 6 feet, of which only approximately 1 foot of fall would be through Sycamore Creek and the remaining would be in the Riverside Oxbow. A series of rock weirs would be utilized in the oxbow and smaller rock structures would be developed in Sycamore Creek to provide the basis for developing pools, riffles, and runs through the entire system. See Figure 12 of the SEIS for the approximate locations of the rock weirs.

Sycamore Creek channel reconstruction would average 10 feet in width at riffle control structures and would have average depth of about 1-2 feet over its approximate 3200 foot restored length. Average velocity through the riffle complexes would be about 1 foot per second at the mean low flow of 10 cfs, which would be beneficial to anticipated darter utilization of the riffles and provide sufficient oxygenation within pools to support a wide variety of high value fisheries.

Stream bank riparian grasses along with preserved specimen burr oak and pecan trees existing along the alignment of the restored Sycamore Creek would provide shading, cover and supplemental food components to the aquatic system. Based upon this concept, which mimics high quality streams within the Central City study area such as lower segments of Marine and Lebow Creek it is anticipated that the Sycamore Creek Channel as restored would ultimately provide at minimal 0.75 acres of high value aquatic habitat. An Index of Biotic Integrity (IBI) score of 47 was estimated to be appropriate for Sycamore Creek as proposed to be restored. Following the methodology that was utilized in the original Central City EIS, an IBI score would translate into an estimated future with project habitat suitability of 0.85. Since the stream based aquatic habitat would provide fisheries benefits to the entire 3200 feet of restored Sycamore Creek there would be a minimum of 0.64 habitat units established. As flow would be maintained during all times of each year, the seasonally adjusted habitat units and average annual habitat units attributable to stream restoration in Sycamore Creek would also be 0.64.

Stream impacts would be fully mitigated by implementation of the aquatic mitigation plan at the Ham Branch site referenced in the original Central City EIS, and by implementation of restoration of flows through Sycamore cutoff with developed in-channel riffles and pools as a component of the Modified alternative. Table E-3 of the SEIS displays the analysis of stream based aquatic impacts, mitigation improvement analysis. With Sycamore Creek using a conservative estimate of 0.75 acres of stream habitat, the net AAHU after implementation of improvements would result in a net gain of 0.22 AAHUs. This difference is considered to be within the margin of error for this analysis and therefore it can be presumed that the stream aquatic impacts are fully compensated by the implementation of Hams Branch and Sycamore Creek channel improvements. Additional benefits from returning base flows and structural habitat modifications of aquatic habitat of the Riverside Oxbow would be restoration benefits in excess of those determined for the original Riverside Oxbow study. The modified alternative would provide stream aquatic habitat benefits of 4.8 AAHUs while the no action alternative provided no documented net stream aquatic habitat benefits.

2.6 Proposed Discharge Site Determinations

Placement of material into waters of the United States would be occur in areas where temporary construction such as coffer dams would allow for care of water and within the footprint of Samuels Avenue Dam, the three isolation gates, and within 35 acres of channel bottom within the identified Internal Water Feature and stabilization of the bypass channel sides and bottom. Most of the identified discharge sites are outside of the ordinary high water mark of the Trinity River system or would be conducted in the “dry”. Alternative locations were evaluated for location of the main structural components as discussed in the body of the EIS. These discharge sites are within the scope of the Corps participation.

2.7 Determination of Cumulative Effects on the Aquatic Ecosystem

Cumulative impacts resulting from the incremental consequences of the comprehensive proposed project when added to other past and reasonably foreseeable future actions were considered in the FEIS. The cumulative effects of the action were viewed in the context of direct and secondary impacts of the comprehensive project

when incrementally added to all known reasonably foreseeable actions within the geographic area. Significant direct impacts to wetlands, riparian woodlands and the stream habitat of Marine Creek were identified during project evaluation. Plans to mitigate those resources have been developed and a cumulative effects analysis was thoroughly discussed in Chapter 4 of the SEIS. Complete plan development would provide for cumulative beneficial impacts to wetlands, riparian woodlands and pending completion of the compensatory plan to mitigate stream aquatic habitat losses, no cumulative effects to the aquatic ecosystem. All proposed mitigation is within the scope of the Corps participation which is a portion of the Modified Central City Project.

2.8 Determination of Secondary Effects on the Aquatic Ecosystem

Secondary impacts are those that are caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable. These impacts are induced directly or indirectly by the proposed project. Secondary effects considered in the FEIS included changes in land use; economic vitality; neighborhood character; traffic congestion, with its associated effects on air quality and noise; water quality and aquatic resources and other natural resources. The secondary impacts that are projected to occur were identified and evaluated as part of the comprehensive project and referred to as the "Trinity Uptown Features" within the FEIS. No significant adverse effects to the aquatic ecosystem were found to be attributable to the Trinity Uptown Features which includes all portions of the Corps participation.

3.0 Findings of Compliance for Fort Worth Modified Central City

- No significant adaptations of the guidelines were made relative to this evaluation.

- The No Action and other alternatives analyzed in the Central City FEIS and Riverside Oxbow EA were determined to be not practicable because they do not fully meet the goals and objectives of the Trinity River Vision Master Plan which is the document referenced in the authorization. A number of alternative locations, configurations, and sizes of specific features of the Modified Central City Project were considered taking into account cost, existing technology, and logistics in light of the overall project purposes. The recommended location, configuration, and size of these features are considered the least environmentally damaging practicable alternative.

- Based on discussions with the representatives from the Texas Commission on Environmental Quality (TCEQ), the proposed disposal of materials at locations identified would not violate any applicable State water quality standards. The Corps will continue coordination with TCEQ and no construction affecting waters of the United States will commence until the 401 State Certification has been issued. This certification will be made part of the official record.

- Use of the selected disposal sites will not affect any federally listed threatened or endangered species or their critical habitat.

- The comprehensive Modified Central City Project which includes the Corps participation would not violate terms and conditions of the CDC or Trinity Regional EIS ROD for preventing cumulative impacts to hydrologic resources.

- The proposed disposal will not result in significant adverse effects on human health and welfare, recreational fishing, plankton, fish, shellfish, wildlife or special aquatic sites provided the recommended environmental mitigation and ecosystem improvements are incorporated into the project. If the Corps participation in mitigation were not completed, the proposed discharge could potentially have adverse impacts to human health and welfare, recreational fishing, plankton, fish, shellfish, wildlife and special aquatic sites.

- Appropriate steps to minimize adverse impacts include use of best management practices during construction, working in the stream channel under “dry” conditions to the extent possible and opening the bypass channel during a period of flows that would minimize turbidity development. These steps will be incorporated into all activities of the Corps participation.

- On the basis of the guidelines, the proposed disposal sites for the discharge of dredge material, as specified, comply with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

In an effort not to piecemeal the impacts of these activities this analysis reviewed the overall comprehensive impacts to ensure cumulative impacts are consider as required by 33 CFR part 1508.25. If the analysis did separate the Corps project from the remaining portions of the Modified Central City Project in general the impact from the fill material would decrease in amount and size of the footprint. This would equate to an overall decrease in adverse impacts but would also not fulfill the overall project purpose and objectives. Additionally many benefits of the public interest factor would not be weighed and balanced as appropriate with connected actions.

4.0 References

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