Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Intermittent Stream
Pond/Lake
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

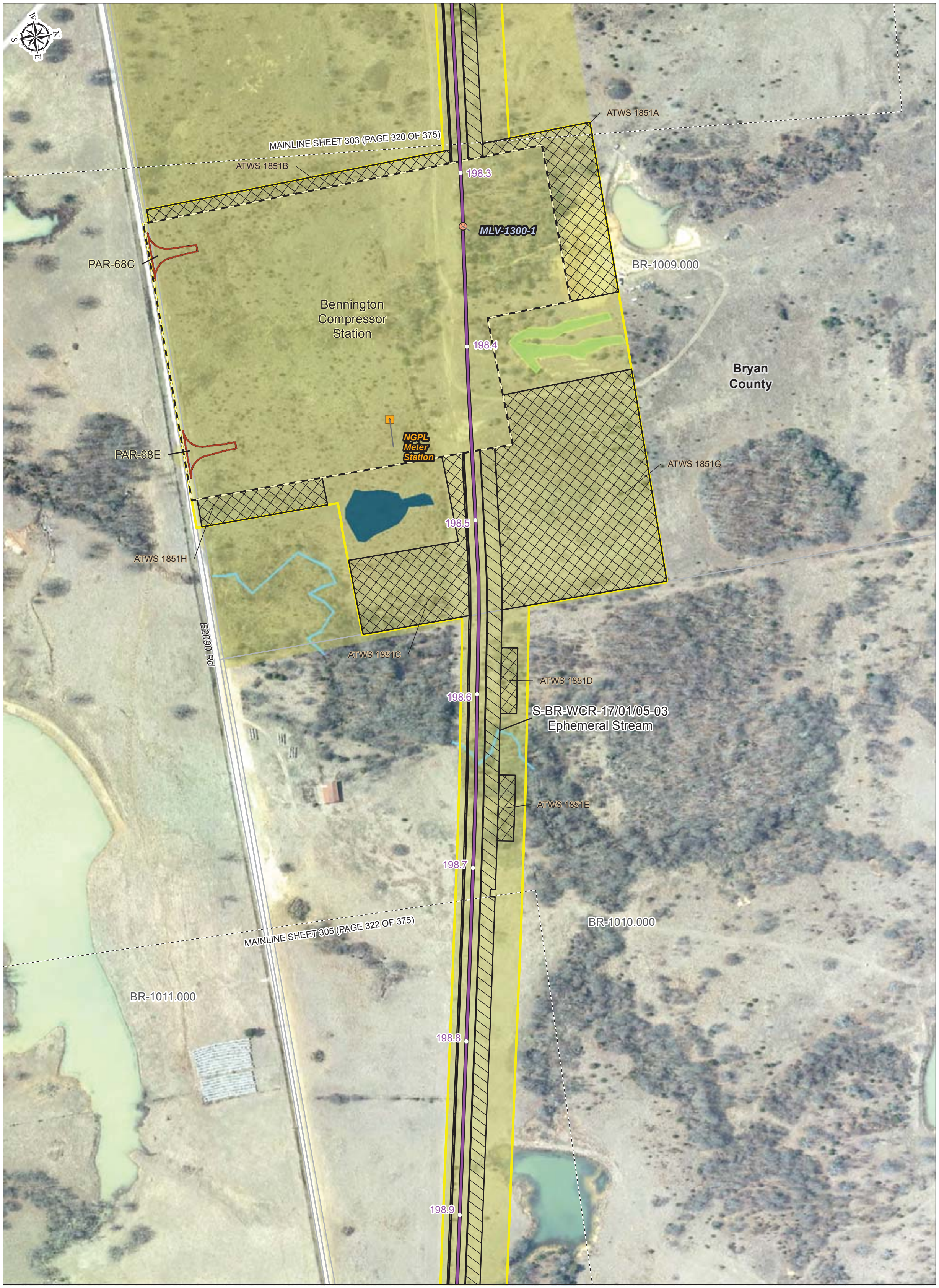
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

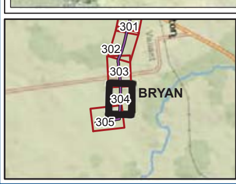
MAINLINE SHEET 303

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 320 of 375 | **DATE:** APRIL 2018





Milepost (0.1)
Valve
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Compressor Station
Adjacent Sheet
Ephemeral Stream
Pond/Lake
PEM
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

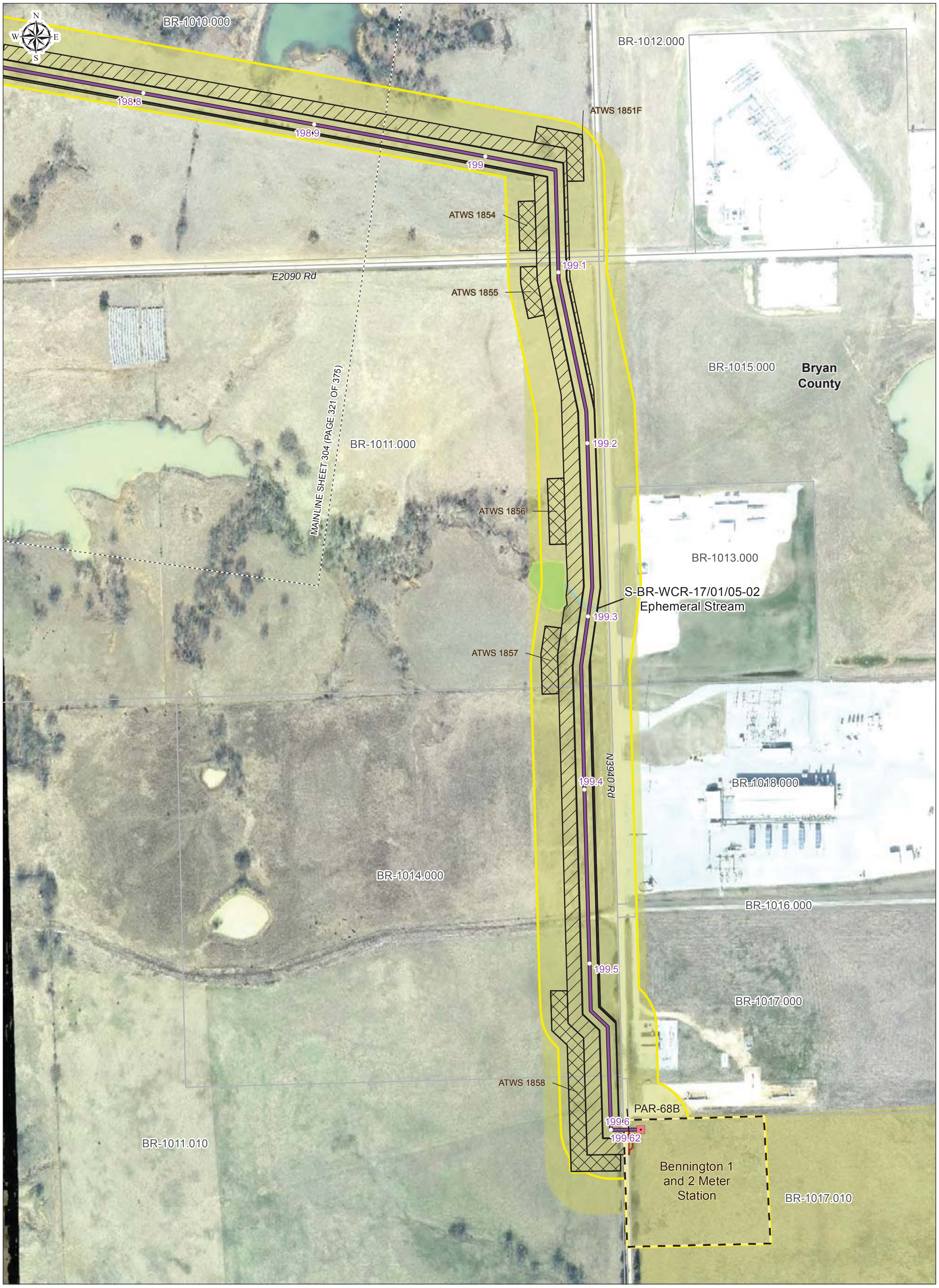
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

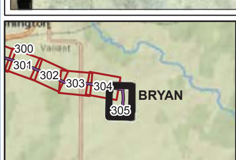
MAINLINE SHEET 304

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 321 of 375 **DATE:** APRIL 2018





Milepost (0.1)
Receiver
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Meter Station
Adjacent Sheet
Ephemeral Stream
PEM
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

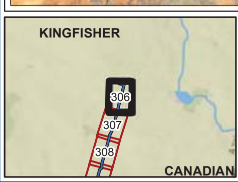
MAINLINE SHEET 305

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 322 of 375 **DATE:** APRIL 2018

CHISHOLM LATERAL



Milepost (0.1)
Launcher
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Meter Station
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

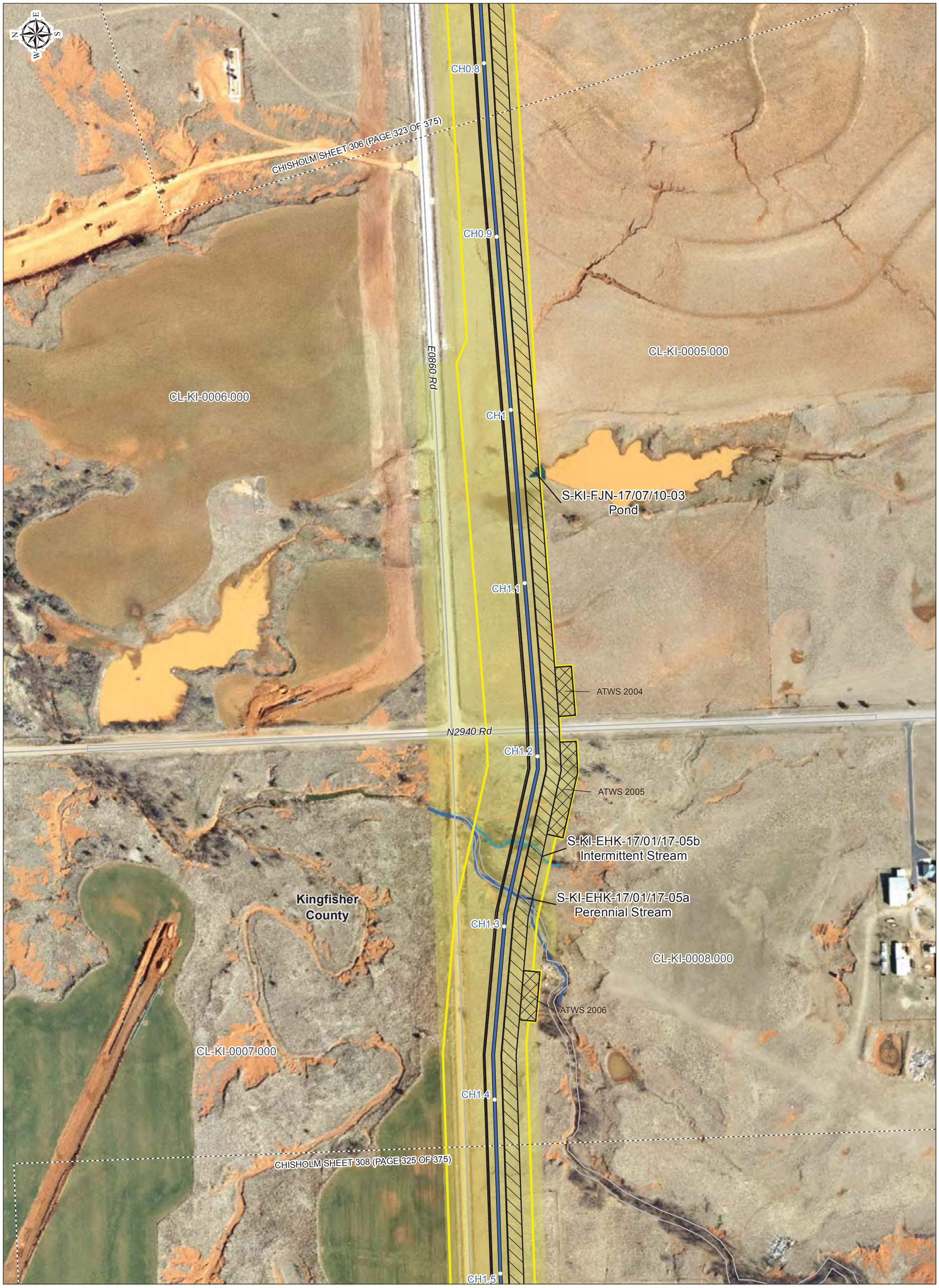
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

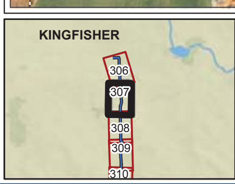
CHISHOLM SHEET 306

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 323 of 375 **DATE:** APRIL 2018





Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Intermittent Stream
Perennial Stream
Pond/Lake
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

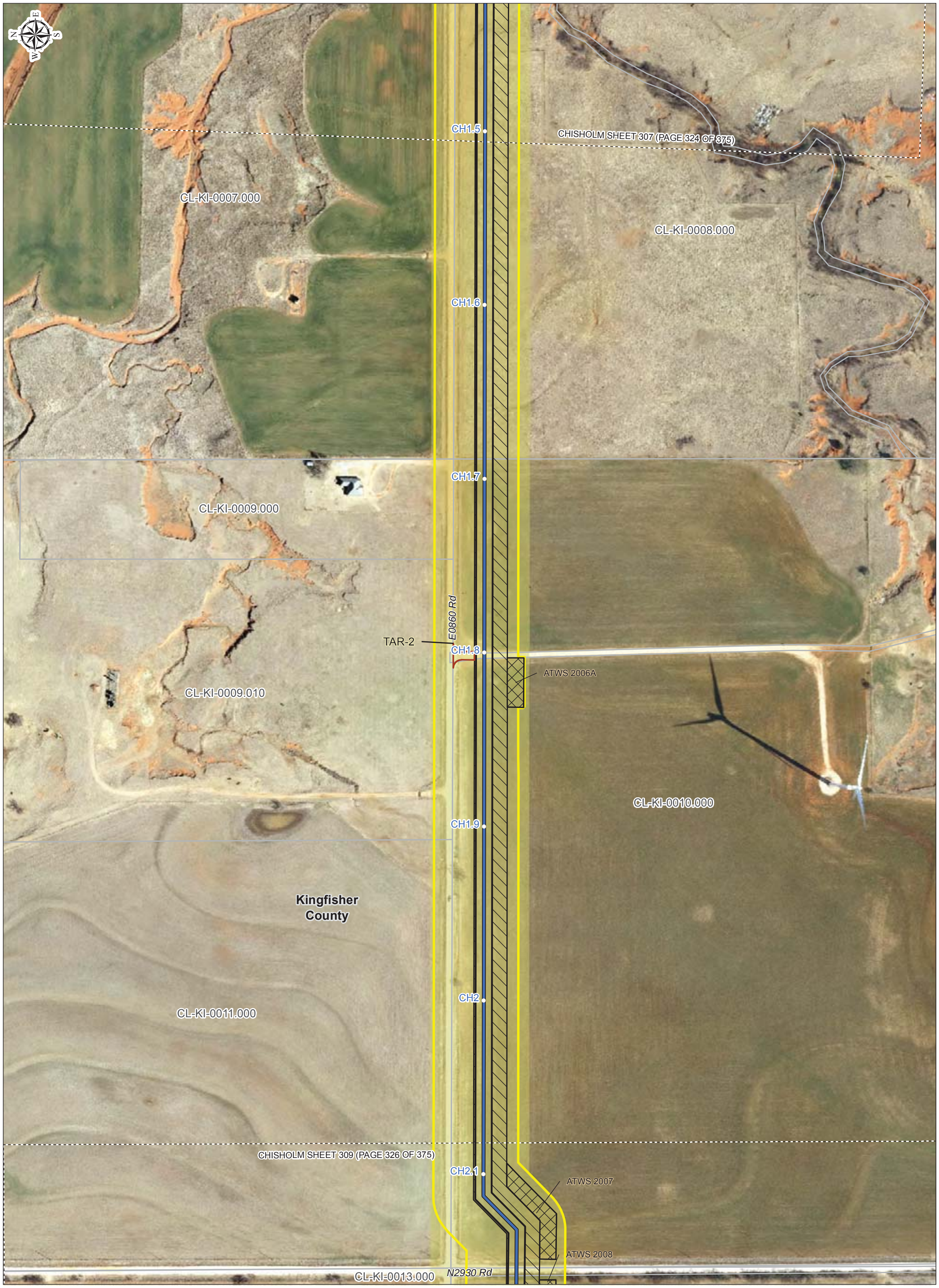
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

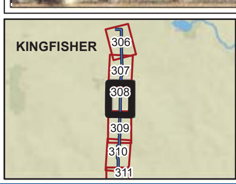
CHISHOLM SHEET 307

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 324 of 375 | DATE: APRIL 2018





Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

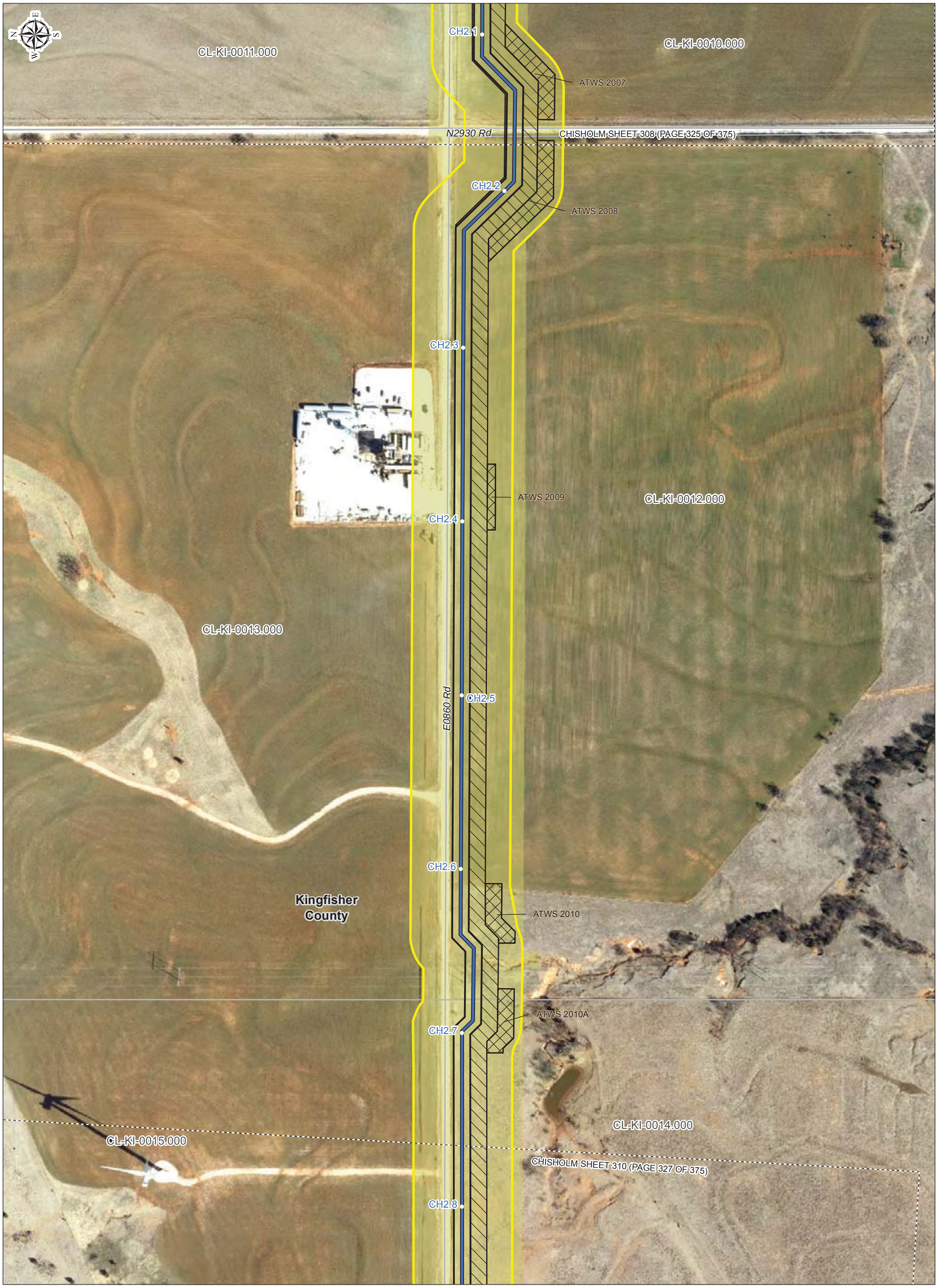
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

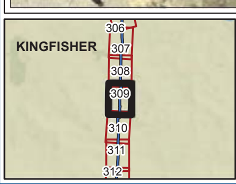
CHISHOLM SHEET 308

0 50 100 200 300 Feet

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

PAGE: 325 of 375 | DATE: APRIL 2018





Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

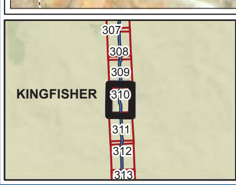
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 309

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 326 of 375 **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 310

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 327 of 375 | DATE: APRIL 2018

Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

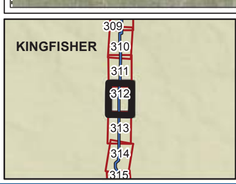
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 311

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 328 of 375 | DATE: APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

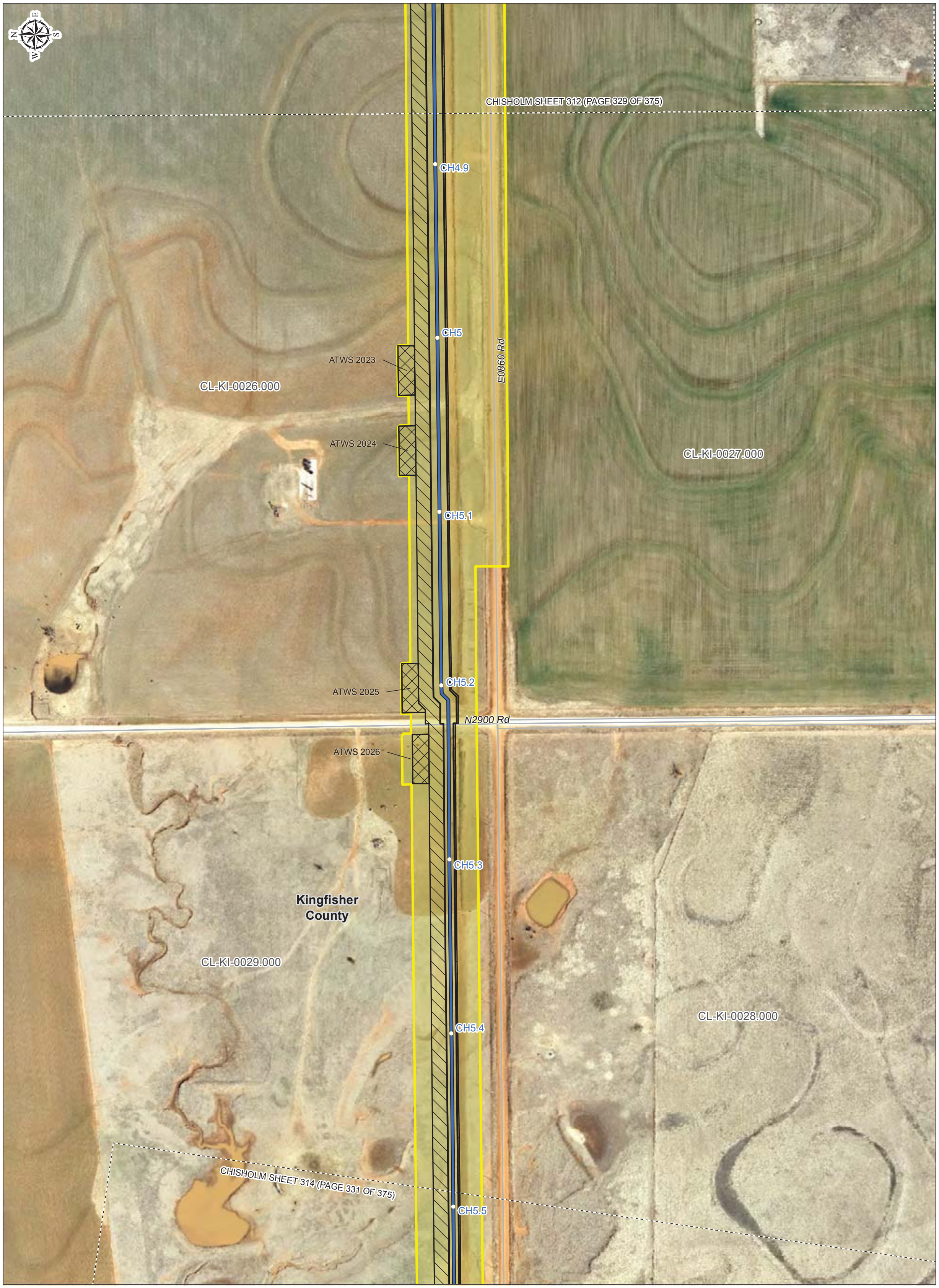
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 312

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 329 of 375 | DATE: APRIL 2018



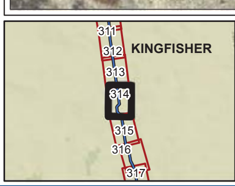
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 313

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 330 of 375 | DATE: APRIL 2018



- Milepost (0.1)
- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Permanent Easement
- Temporary Workspace
- ATWS
- Access Road
- Adjacent Sheet
- Ephemeral Stream
- Intermittent Stream
- Parcels
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- County

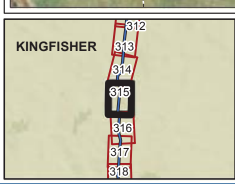
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 314

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 331 of 375 | DATE: APRIL 2018



- Milepost (0.1)
- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Permanent Easement
- Temporary Workspace
- ATWS
- Access Road
- Adjacent Sheet
- Ephemeral Stream
- Pond/Lake
- Parcels
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 315

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 332 of 375 **DATE:** APRIL 2018

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 316

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

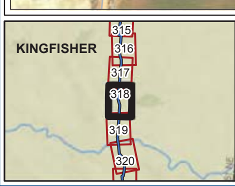
PAGE: 333 of 375 | **DATE:** APRIL 2018

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 317

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

PAGE: 334 of 375 | DATE: APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Intermittent Stream
Pond/Lake
PEM
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

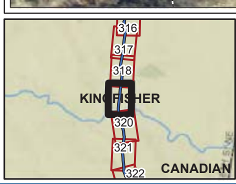
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 318

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 335 of 375 | **DATE:** APRIL 2018



Milepost (0.1)
Valve
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Valve
Adjacent Sheet
Ephemeral Stream
Perennial Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

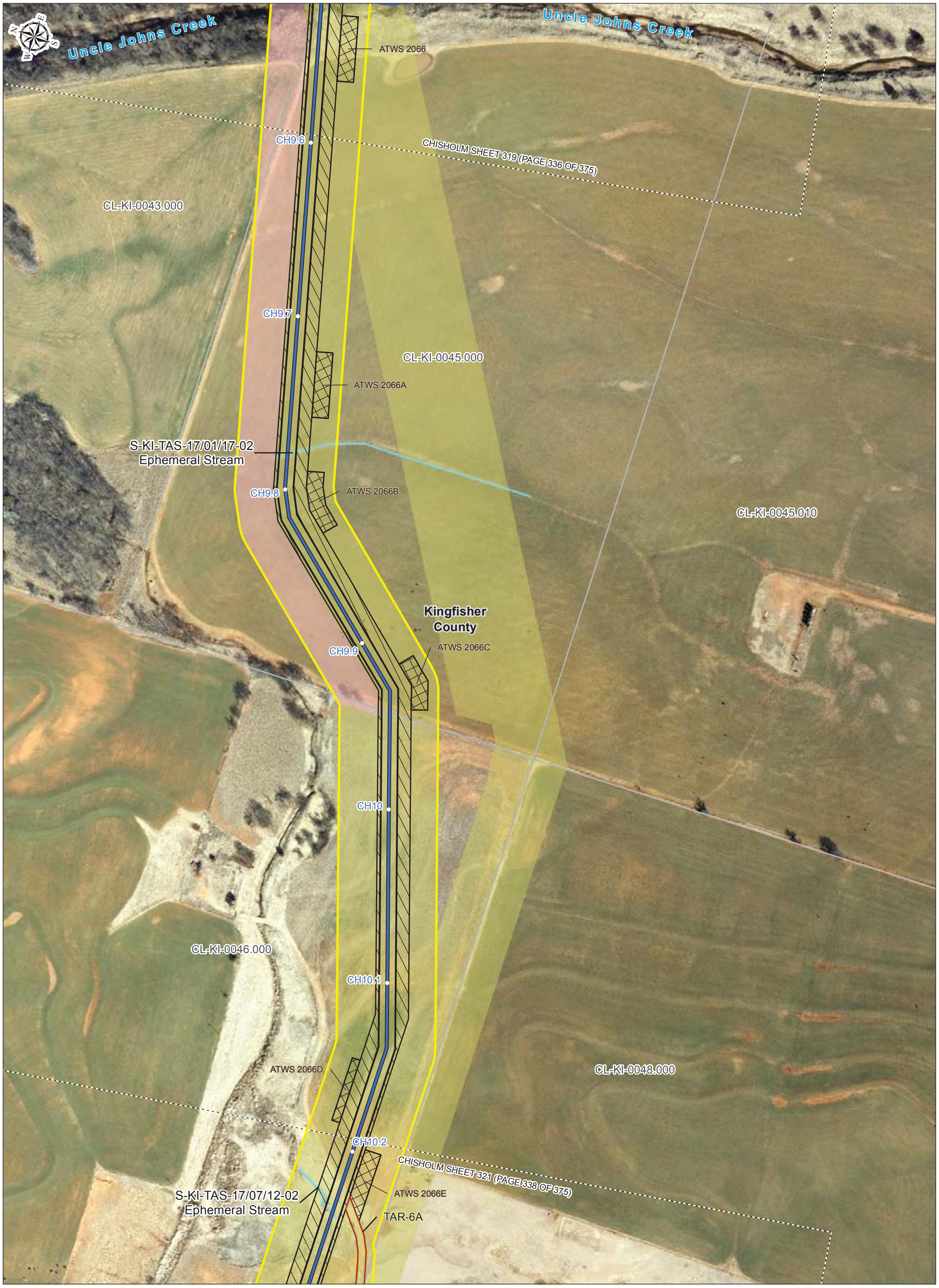
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

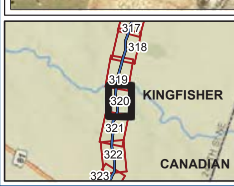
CHISHOLM SHEET 319

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 336 of 375 | DATE: APRIL 2018





- Milepost (0.1)
- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Permanent Easement
- Temporary Workspace
- ATWS
- Access Road
- Adjacent Sheet
- Ephemeral Stream
- Perennial Stream
- Parcels
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- County

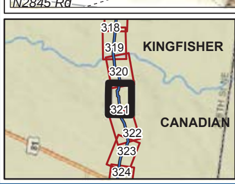
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 320

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 337 of 375 **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Adjacent Sheet
Ephemeral Stream
Intermittent Stream
Pond/Lake
Intermittent Stream (Not surveyed)
PEM
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

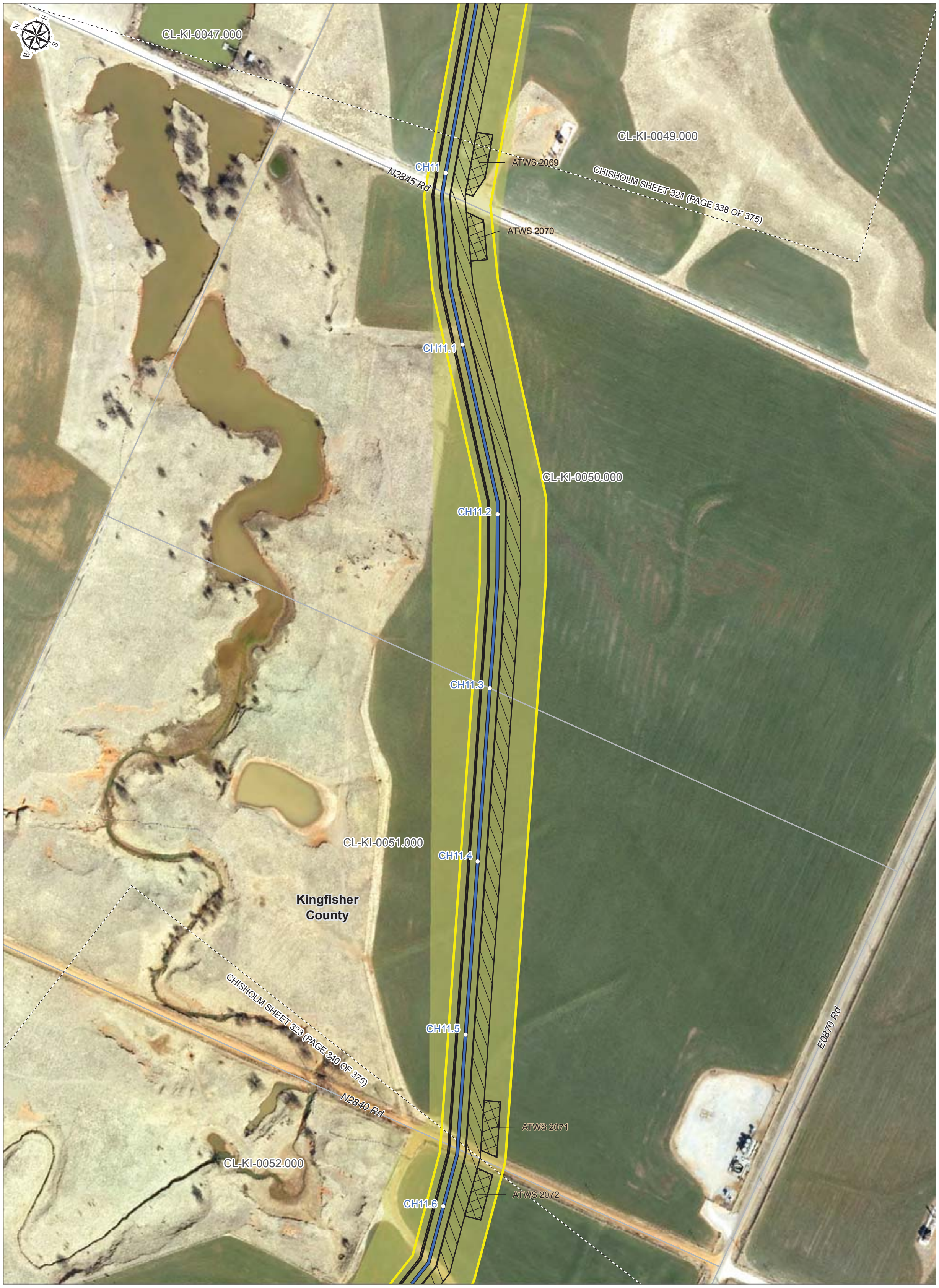
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 321

0 50 100 200 300 Feet

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

PAGE: 338 of 375 DATE: APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 322

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 339 of 375 | DATE: APRIL 2018

Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Perennial Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

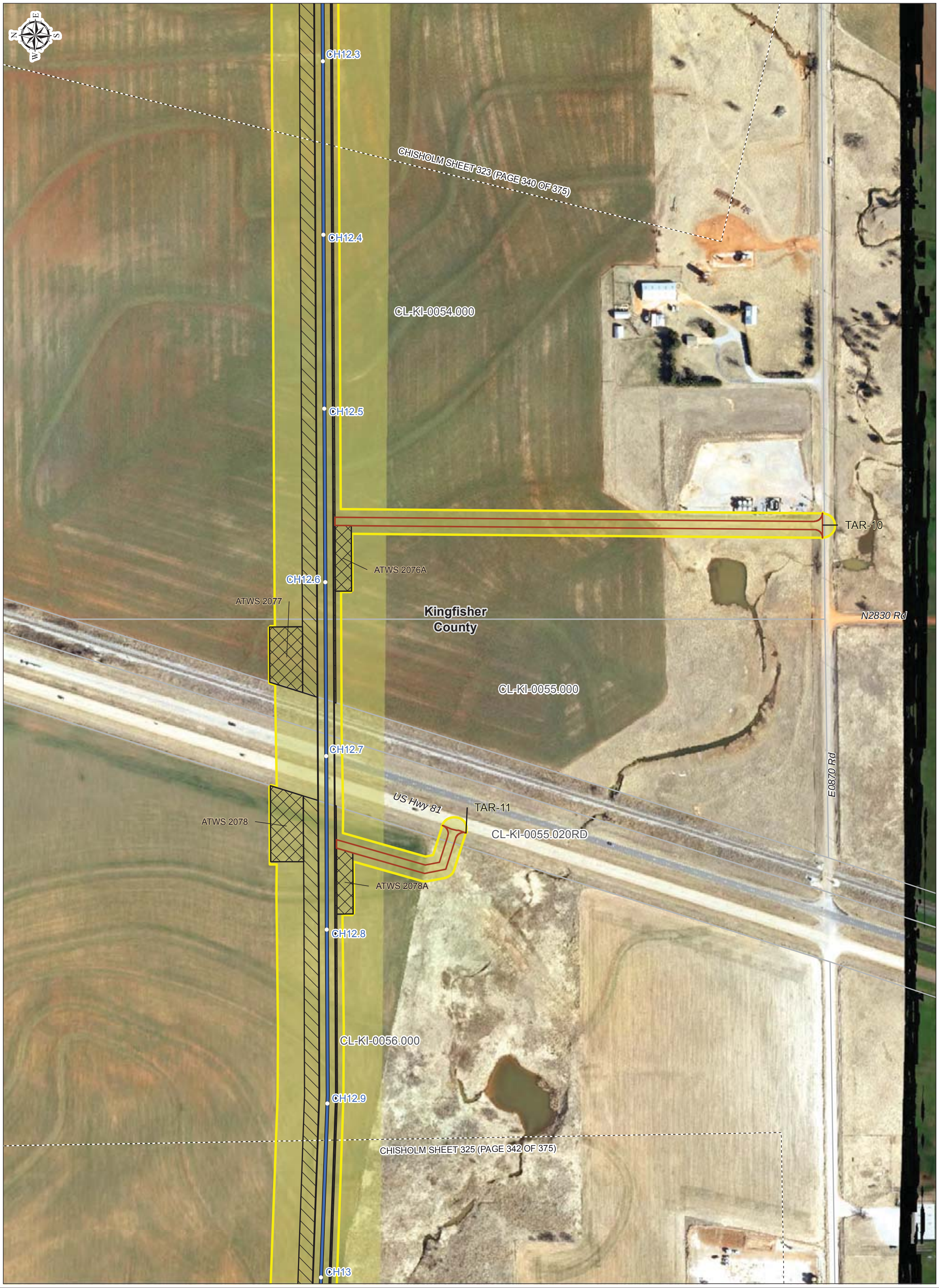
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 323

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 340 of 375 | DATE: APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 324

0 50 100 200 300 Feet

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

PAGE: 341 of 375 **DATE:** APRIL 2018

- Milepost (0.1)
- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Permanent Easement
- Temporary Workspace
- ATWS
- Adjacent Sheet
- Intermittent Stream
- Parcels
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- County

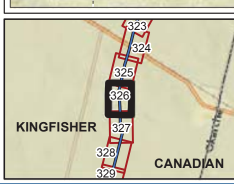
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 325

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 342 of 375 **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 326

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

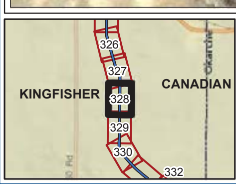
PAGE: 343 of 375 DATE: APRIL 2018

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 327

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

PAGE: 344 of 375 **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
PEM
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

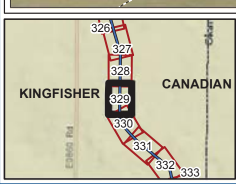
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 328

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 345 of 375 | **DATE:** APRIL 2018



- Milepost (0.1)
- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Permanent Easement
- Temporary Workspace
- ATWS
- Adjacent Sheet
- Ephemeral Stream
- Perennial Stream
- PEM
- Parcels
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 329

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 346 of 375 | DATE: APRIL 2018

Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
Perennial Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 330

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 347 of 375 | DATE: APRIL 2018

Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

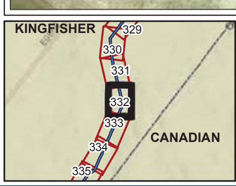
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 331

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 348 of 375 | DATE: APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

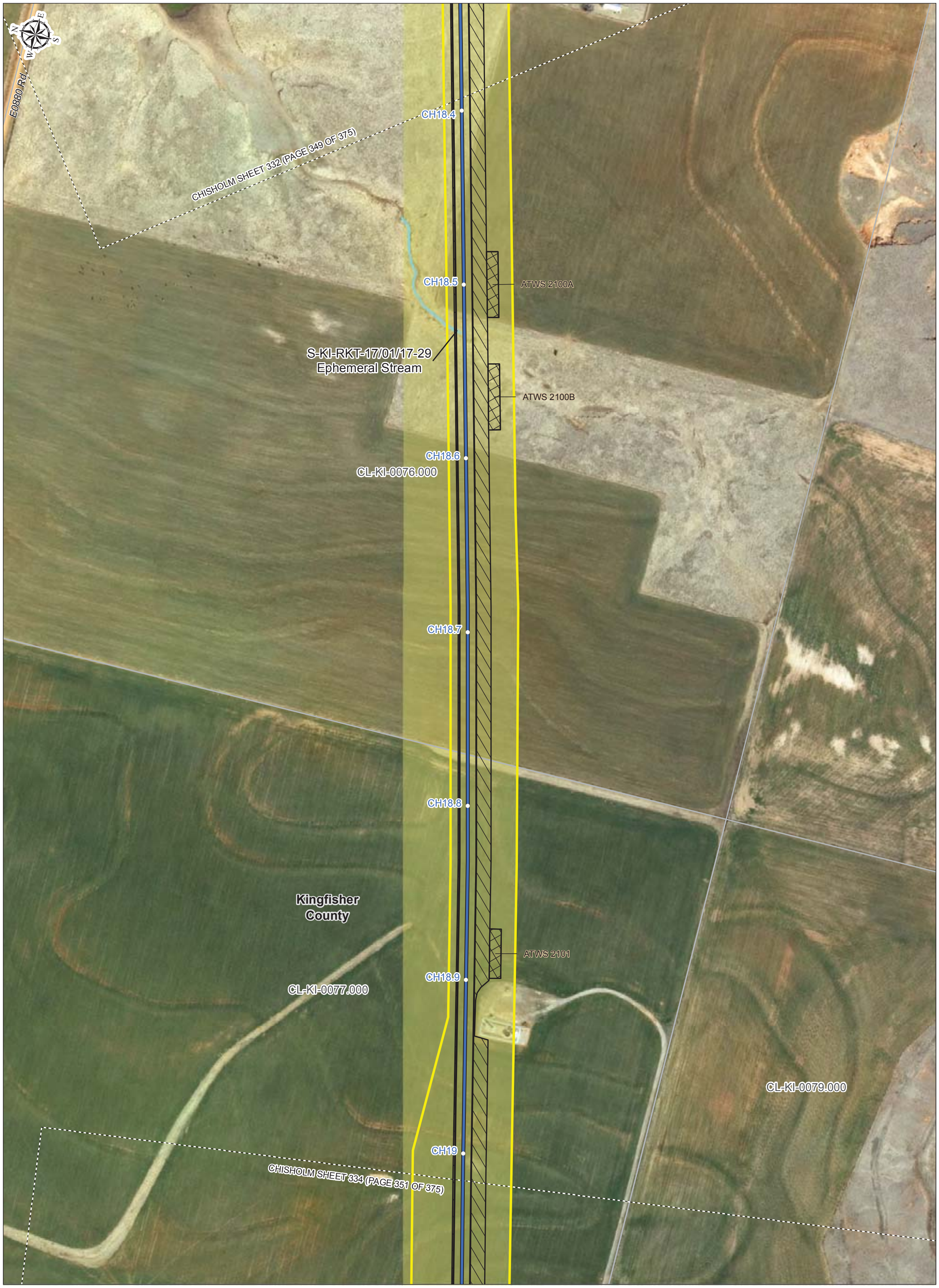
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

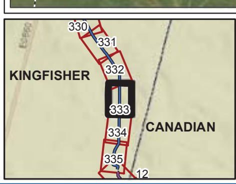
CHISHOLM SHEET 332

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 349 of 375 | DATE: APRIL 2018





Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CHISHOLM SHEET 333

0 50 100 200 300 Feet

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

PAGE: 350 of 375 **DATE:** APRIL 2018

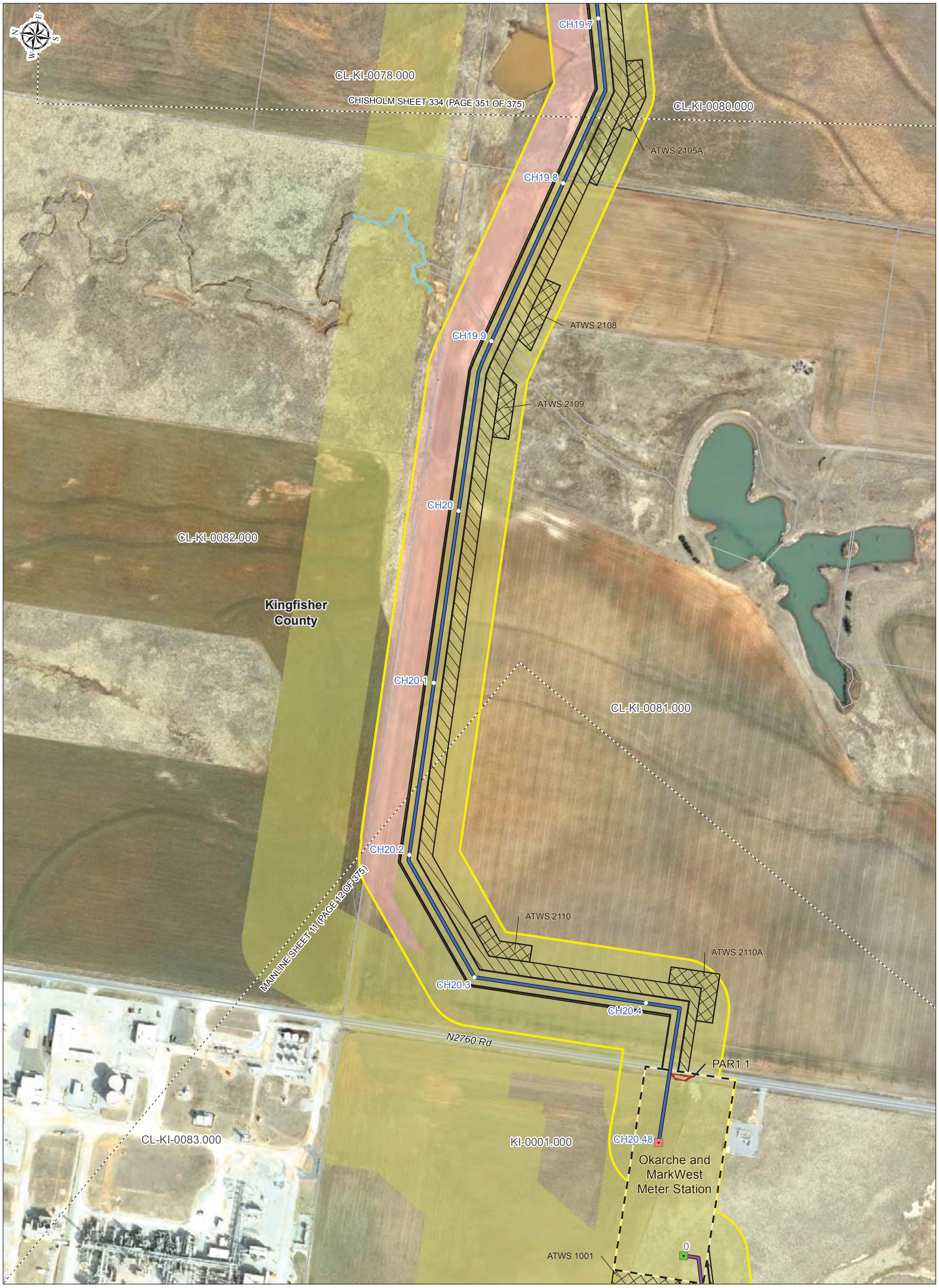
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

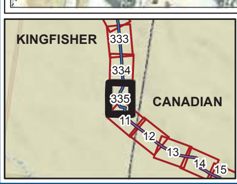
CHISHOLM SHEET 334

0 50 100 200 300 Feet

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

PAGE: 351 of 375 | **DATE:** APRIL 2018





Milepost (0.1)
Launcher
Receiver
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Meter Station
Adjacent Sheet
Ephemeral Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

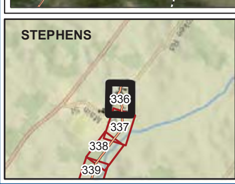
CHISHOLM SHEET 335

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 352 of 375 DATE: APRIL 2018

VELMA LATERAL



- Milepost (0.1)
- Launcher
- Valve
- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Permanent Easement
- Temporary Workspace
- ATWS
- Access Road
- Meter Station
- Adjacent Sheet
- Intermittent Stream
- Pond/Lake
- Intermittent Stream (Not surveyed)
- Parcels
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- Municipality
- County

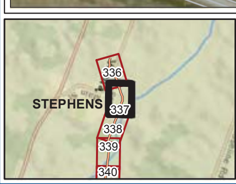
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 336

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 353 of 375 | **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Intermittent Stream
Perennial Stream
Pond/Lake
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

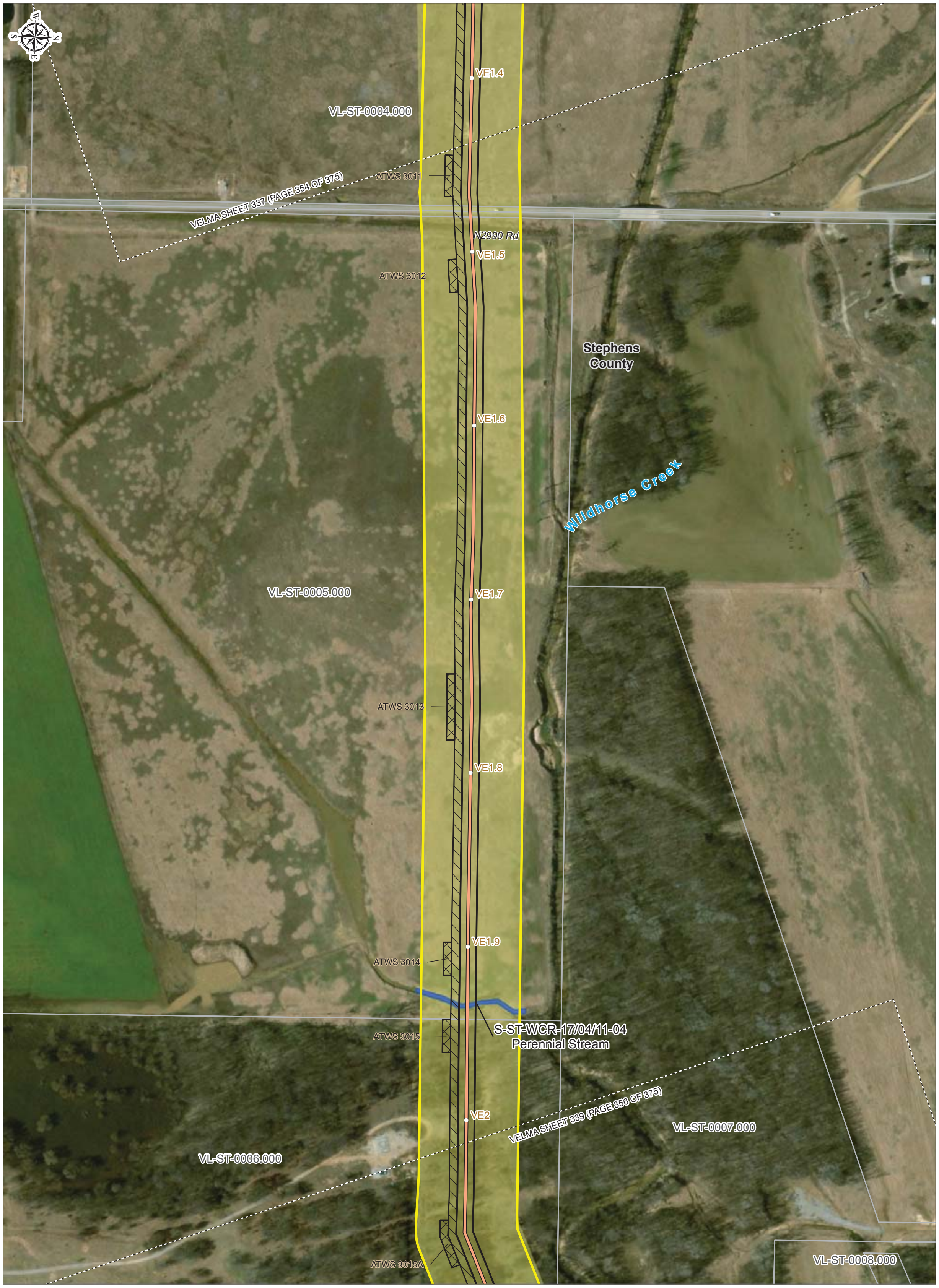
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

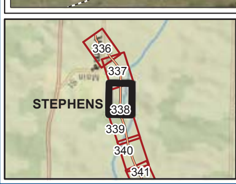
VELMA SHEET 337

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 354 of 375 **DATE:** APRIL 2018





Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Perennial Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

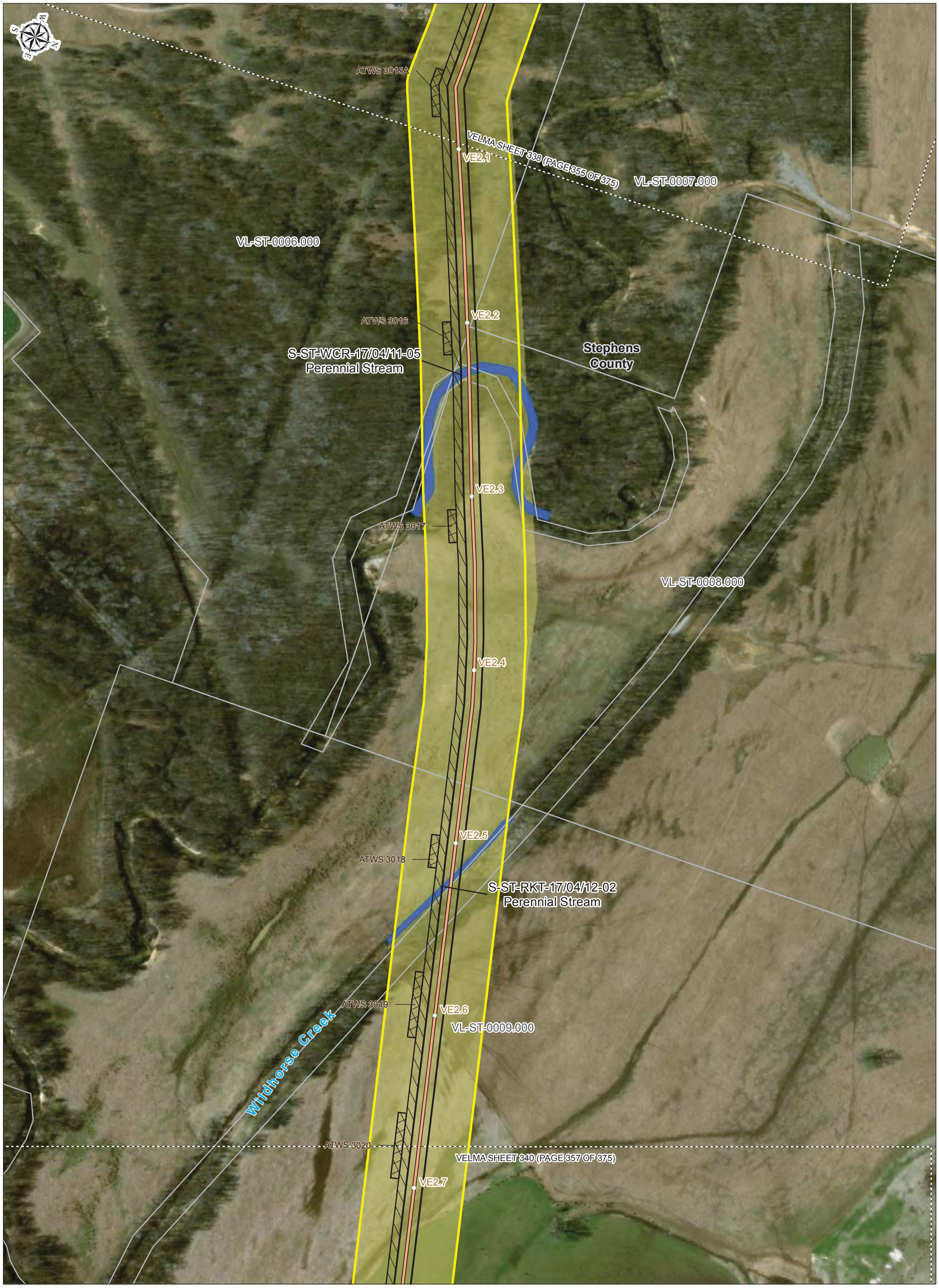
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 338

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 355 of 375 | **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Perennial Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

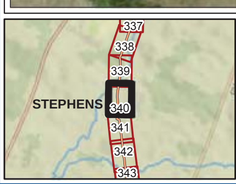
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 339

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 356 of 375 | **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
Pond/Lake
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

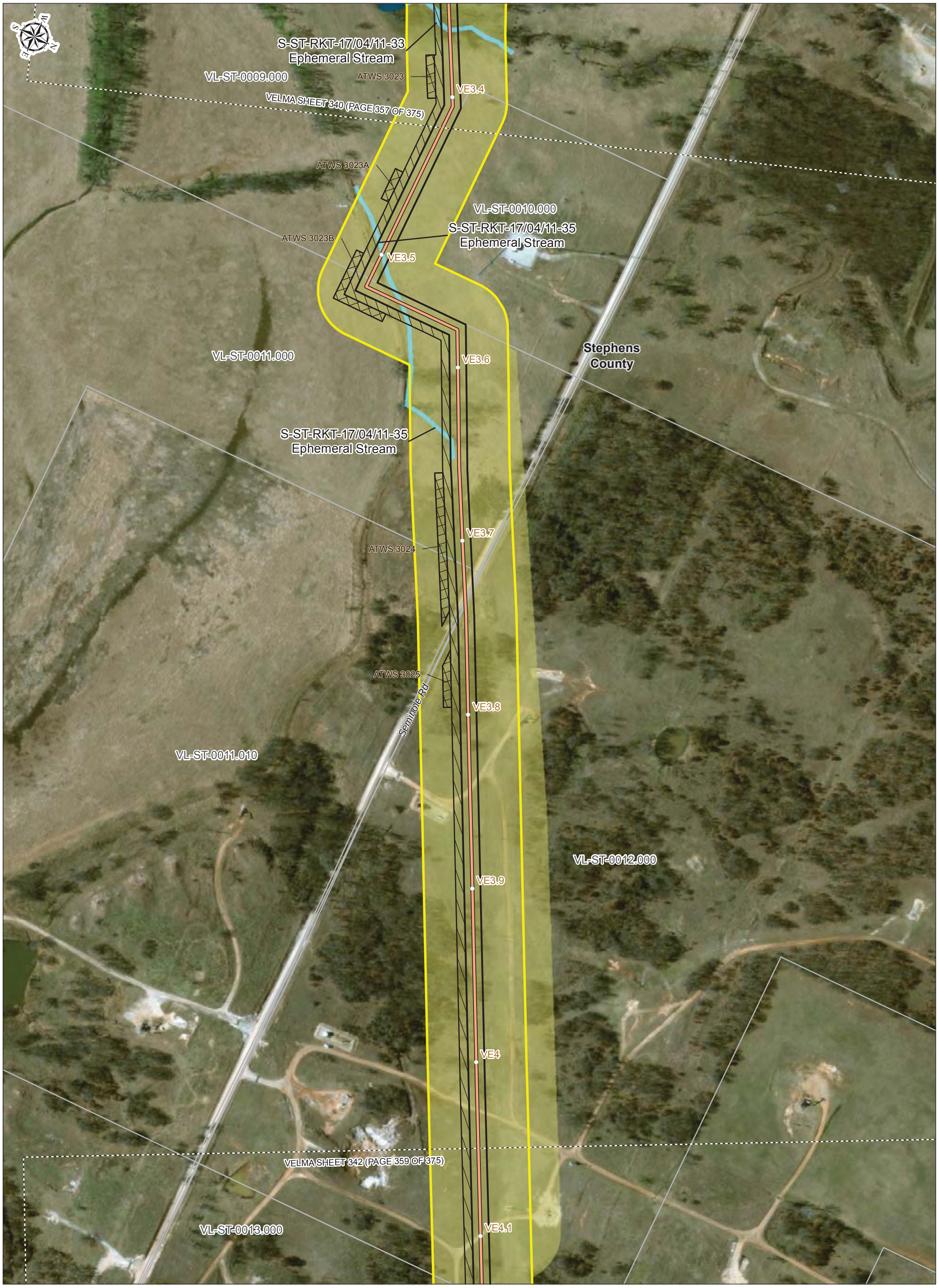
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

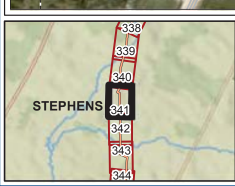
VELMA SHEET 340

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 357 of 375 | DATE: APRIL 2018





Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
Pond/Lake
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

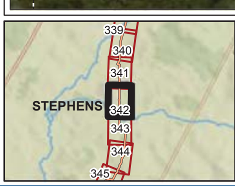
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 341

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 358 of 375 **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Perennial Stream
PEM
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

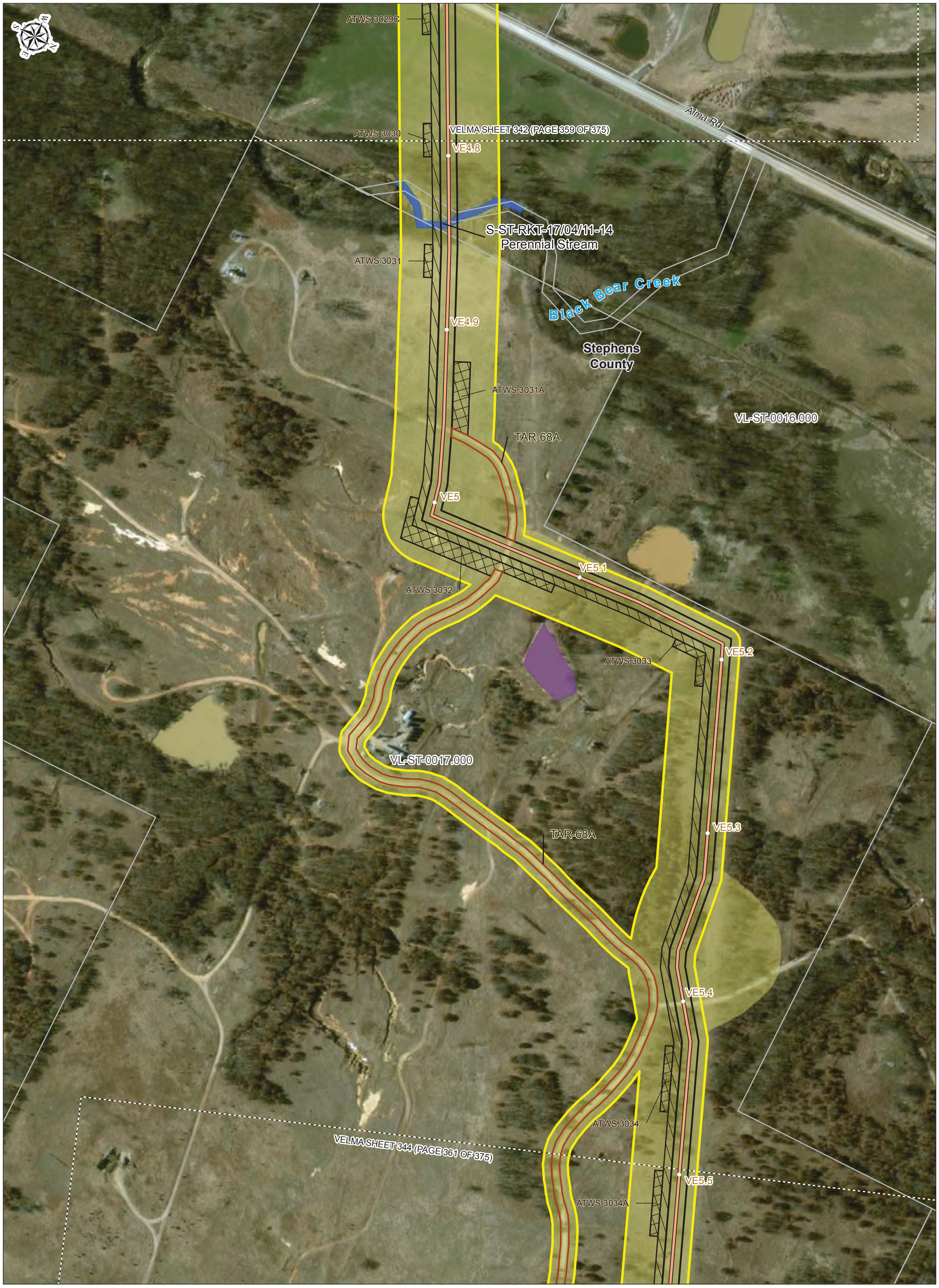
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

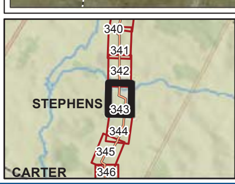
VELMA SHEET 342

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 359 of 375 | **DATE:** APRIL 2018





Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Adjacent Sheet
Perennial Stream
Pond (Not surveyed)
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

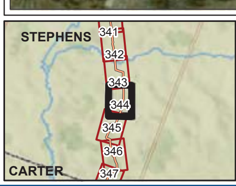
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 343

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 360 of 375 | **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Adjacent Sheet
Perennial Stream
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

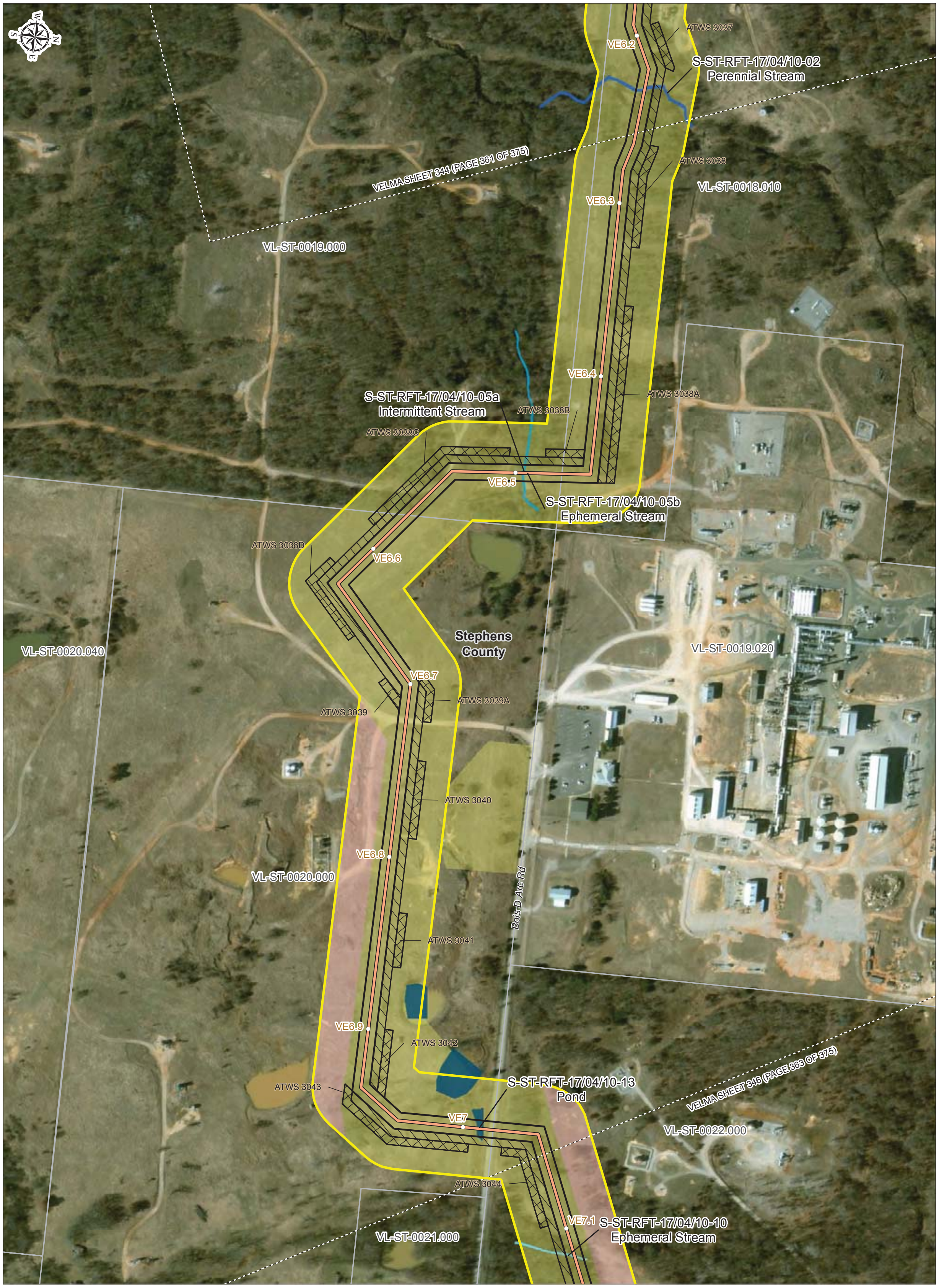
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 344

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 361 of 375 **DATE:** APRIL 2018



Milepost (0.1)	Temporary Workspace	Pond/Lake
Midship Mainline	ATWS	Parcels
Chisholm Lateral	Adjacent Sheet	Survey Corridor
Velma Lateral	Ephemeral Stream	Not Surveyed Area
Permanent Easement	Intermittent Stream	Surveyed Area
	Perennial Stream	County

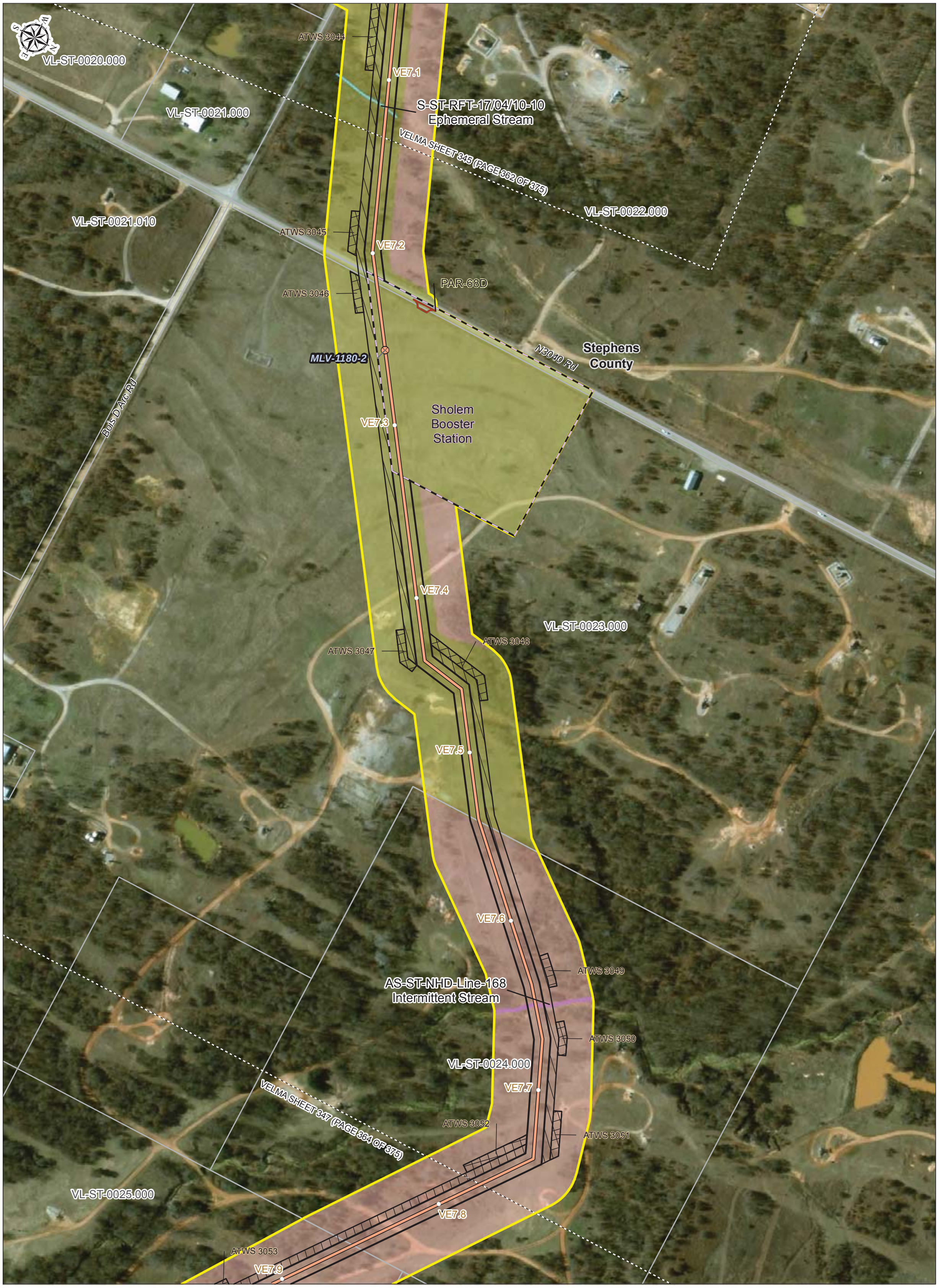
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 345

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 362 of 375 | DATE: APRIL 2018



Milepost (0.1)
Valve
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Booster Station
Adjacent Sheet
Ephemeral Stream
Intermittent Stream (Not surveyed)
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

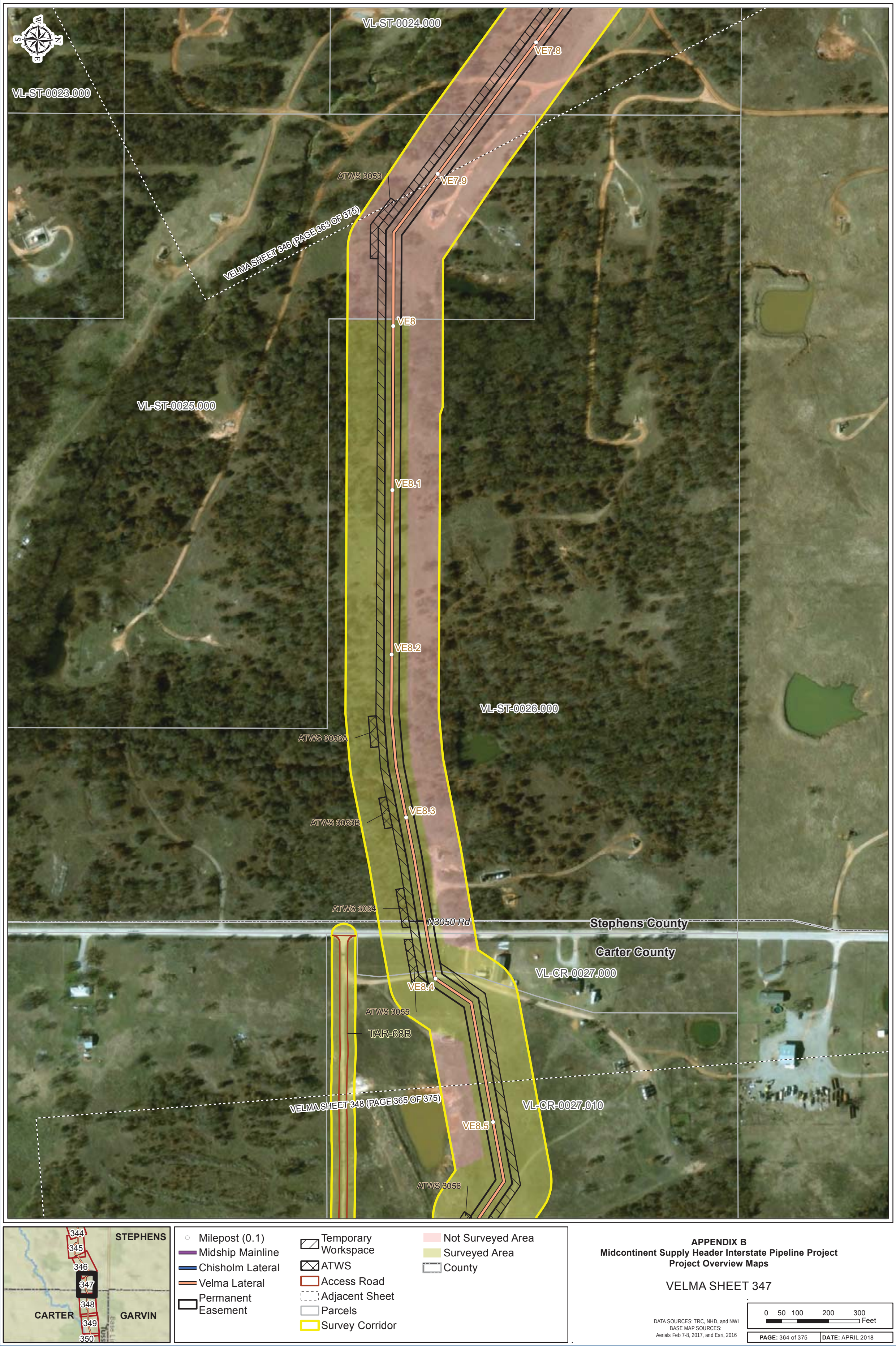
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 346

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 363 of 375 **DATE:** APRIL 2018



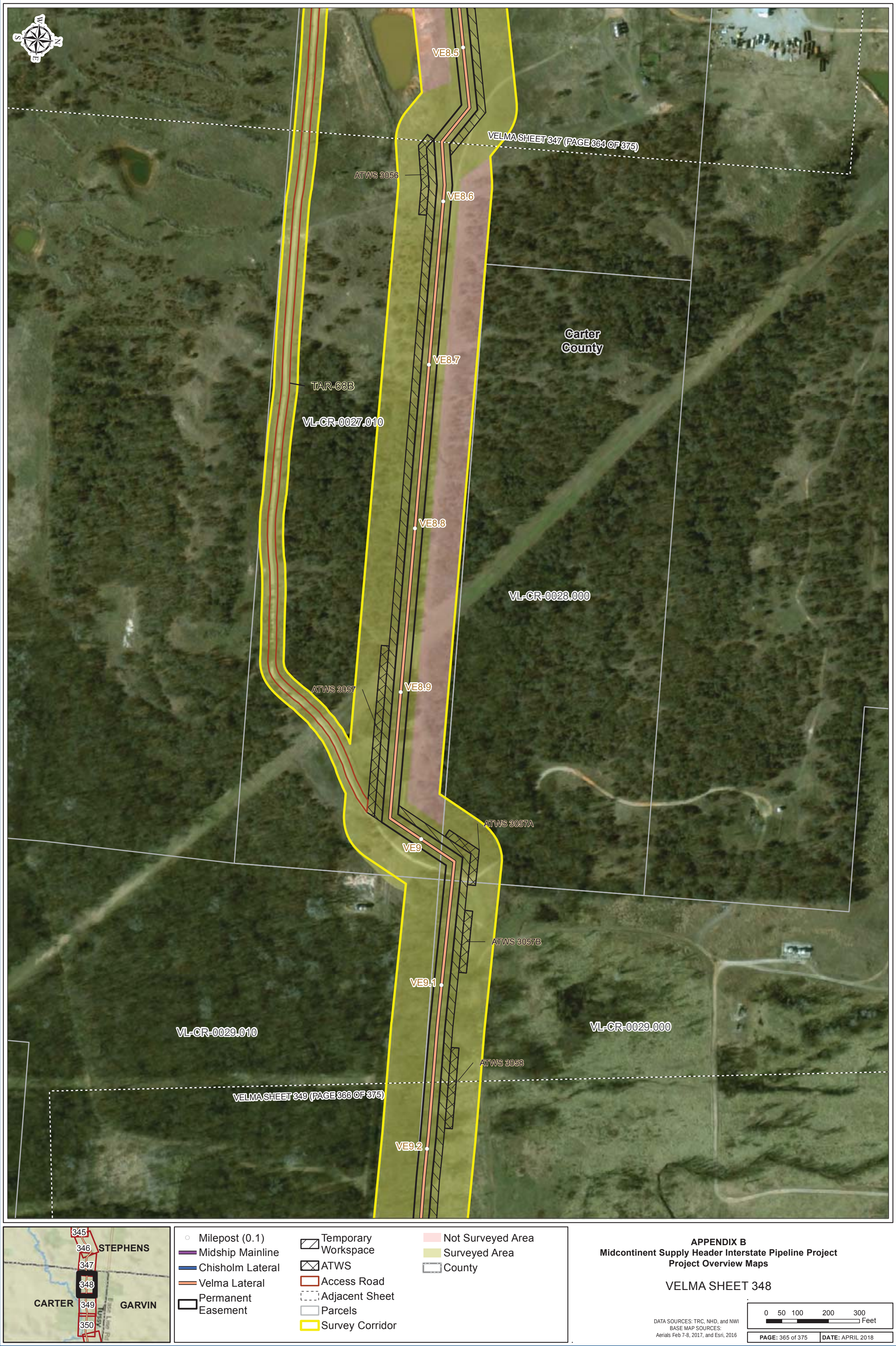
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 347

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 364 of 375 DATE: APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 348

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 365 of 375 **DATE:** APRIL 2018

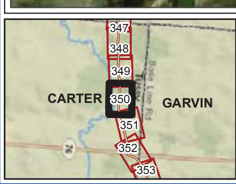
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 349

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 366 of 375 | **DATE:** APRIL 2018



- Milepost (0.1)
- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Permanent Easement
- Temporary Workspace
- Adjacent Sheet
- Perennial Stream
- Parcels
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 350

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 367 of 375 | **DATE:** APRIL 2018

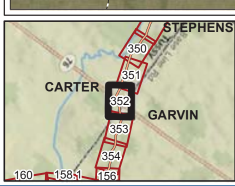
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 351

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 368 of 375 **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
HDD Entry
HDD Exit
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Intermittent Stream
Pond/Lake
PSS
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

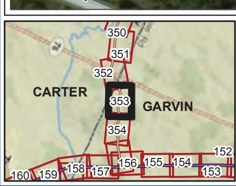
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 352

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 369 of 375 | **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

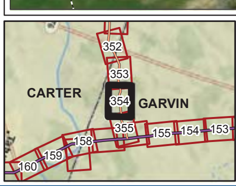
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

VELMA SHEET 353

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 370 of 375 **DATE:** APRIL 2018



Milepost (0.1)
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Adjacent Sheet
Ephemeral Stream
Pond (Not surveyed)
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

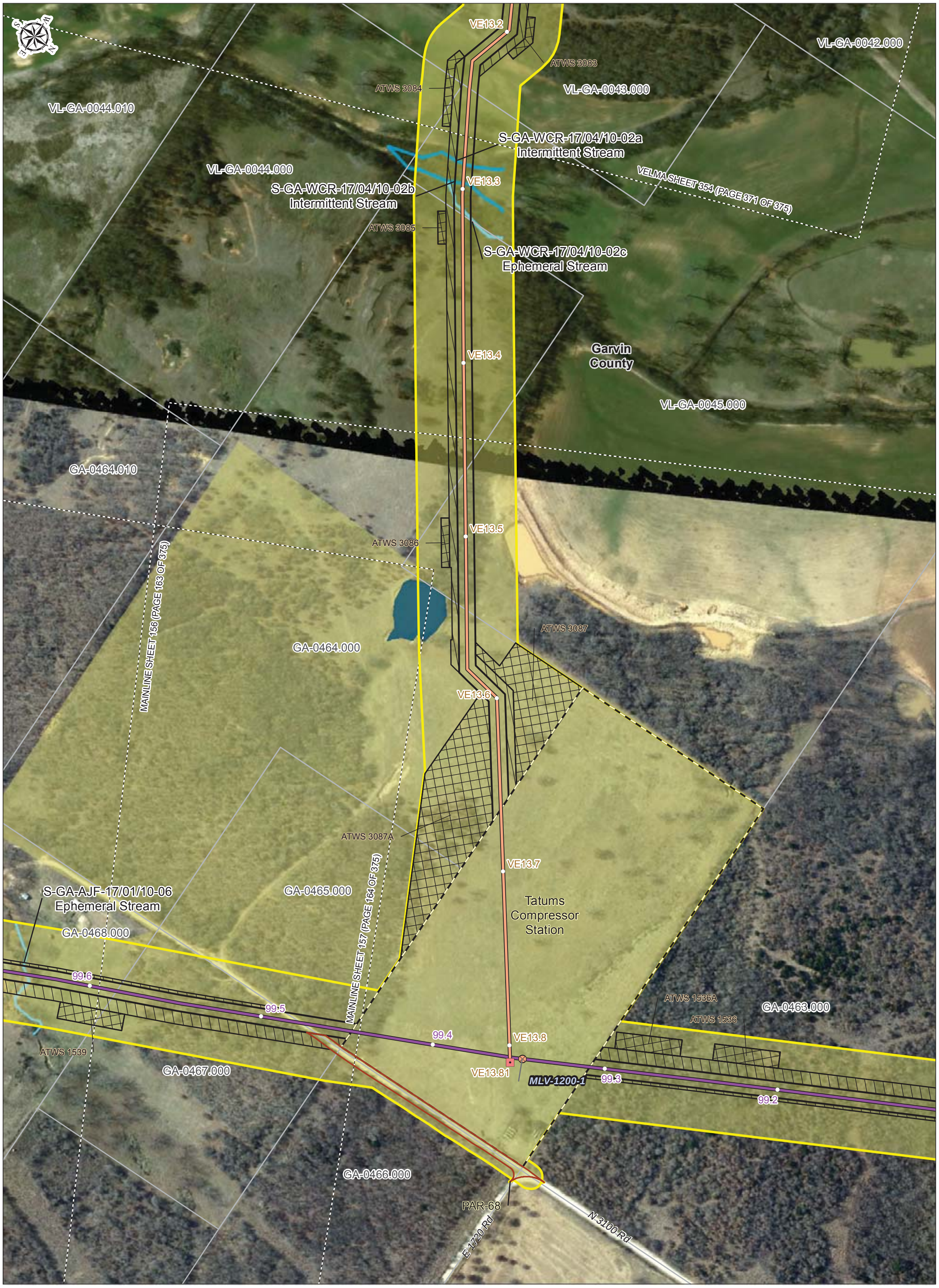
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

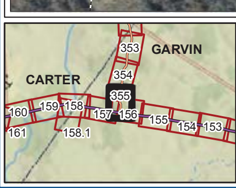
VELMA SHEET 354

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 371 of 375 DATE: APRIL 2018





Milepost (0.1)
Receiver
Valve
Midship Mainline
Chisholm Lateral
Velma Lateral
Permanent Easement
Temporary Workspace
ATWS
Access Road
Compressor Station
Adjacent Sheet
Ephemeral Stream
Intermittent Stream
Pond/Lake
Parcels
Survey Corridor
Not Surveyed Area
Surveyed Area
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

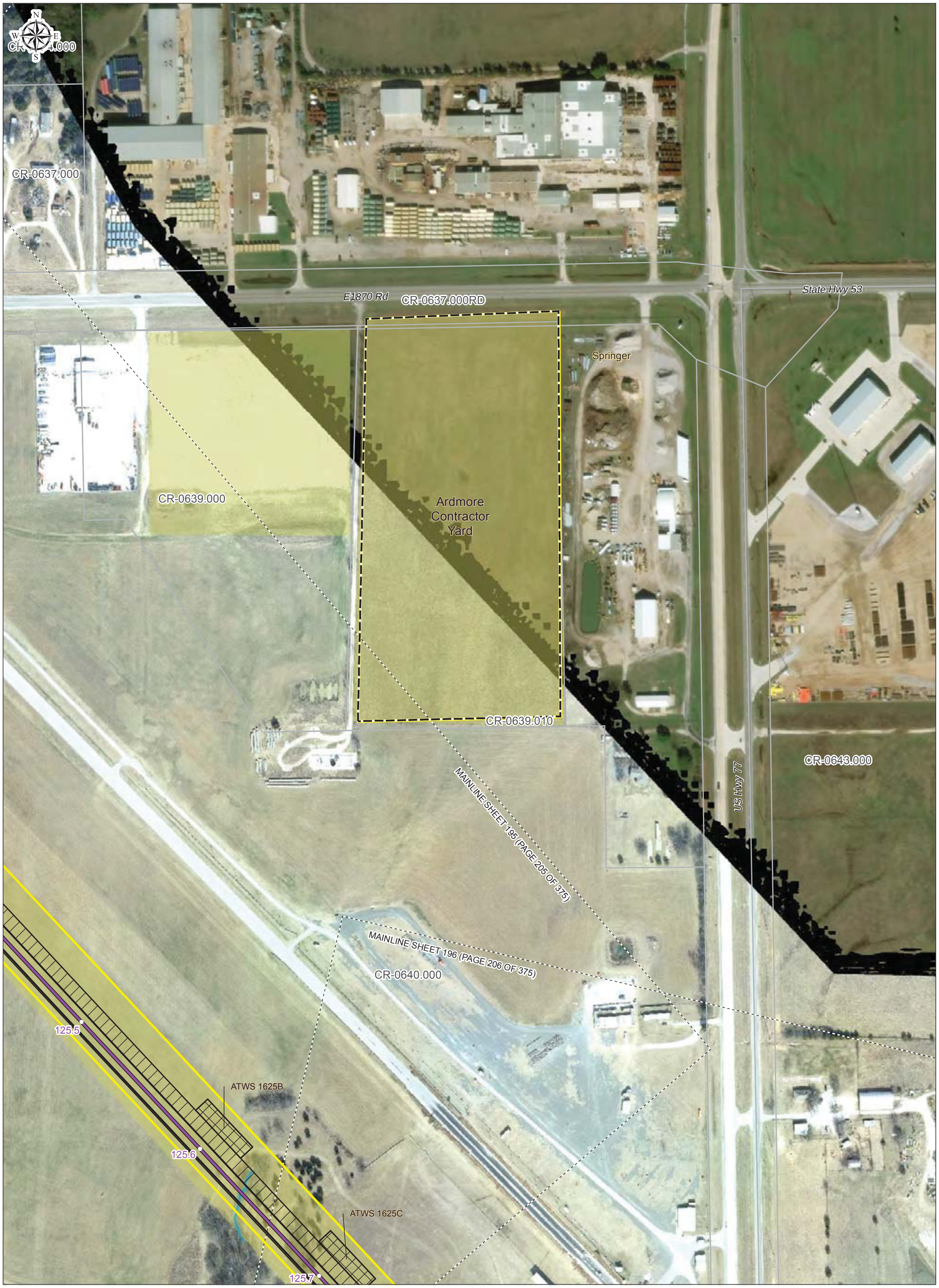
VELMA SHEET 355

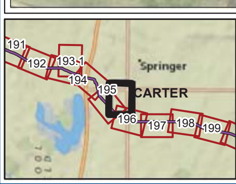
DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300
Feet

PAGE: 372 of 375 | DATE: APRIL 2018

CONTRACTOR YARDS





- Milepost (0.1)
- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Permanent Easement
- Temporary Workspace
- ATWS
- Contractor Yard
- Adjacent Sheet
- Intermittent Stream
- Parcels
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- Municipality
- County

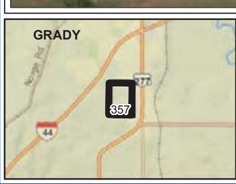
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CY SHEET 356

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 373 of 375 | **DATE:** APRIL 2018



- Midship Mainline
- Chisholm Lateral
- Velma Lateral
- Contractor Yard
- Survey Corridor
- Not Surveyed Area
- Surveyed Area
- Municipality
- County

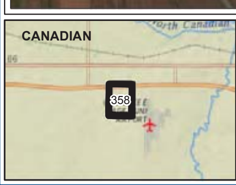
APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

CY SHEET 357

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 374 of 375 **DATE:** APRIL 2018



Midship Mainline
Chisholm Lateral
Velma Lateral
Access Road
Contractor Yard
Survey Corridor
Not Surveyed Area
Surveyed Area
Municipality
County

APPENDIX B
Midcontinent Supply Header Interstate Pipeline Project
Project Overview Maps

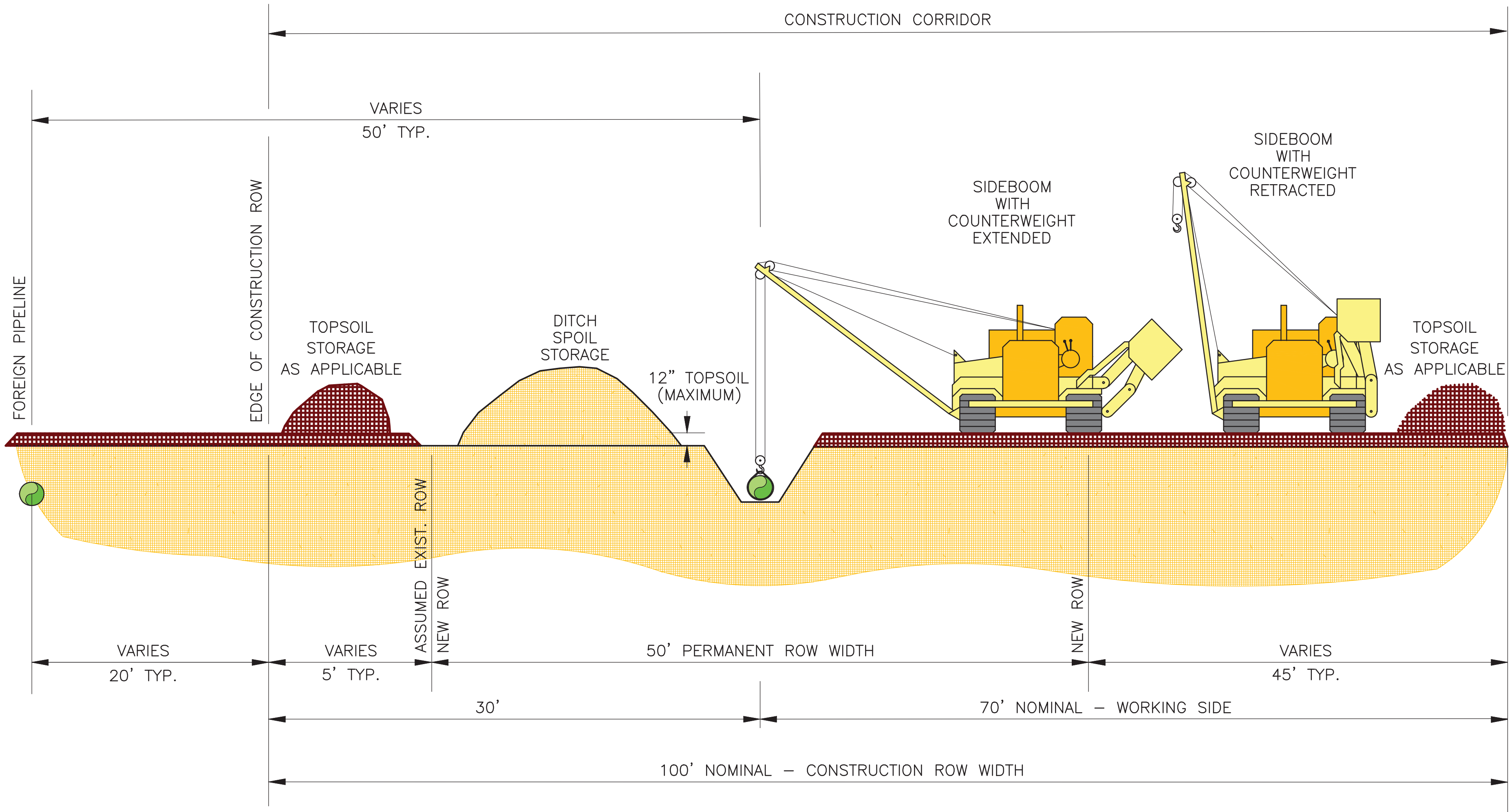
CY SHEET 358

DATA SOURCES: TRC, NHD, and NWI
BASE MAP SOURCES:
Aerials Feb 7-8, 2017, and Esri, 2016

0 50 100 200 300 Feet

PAGE: 375 of 375 **DATE:** APRIL 2018

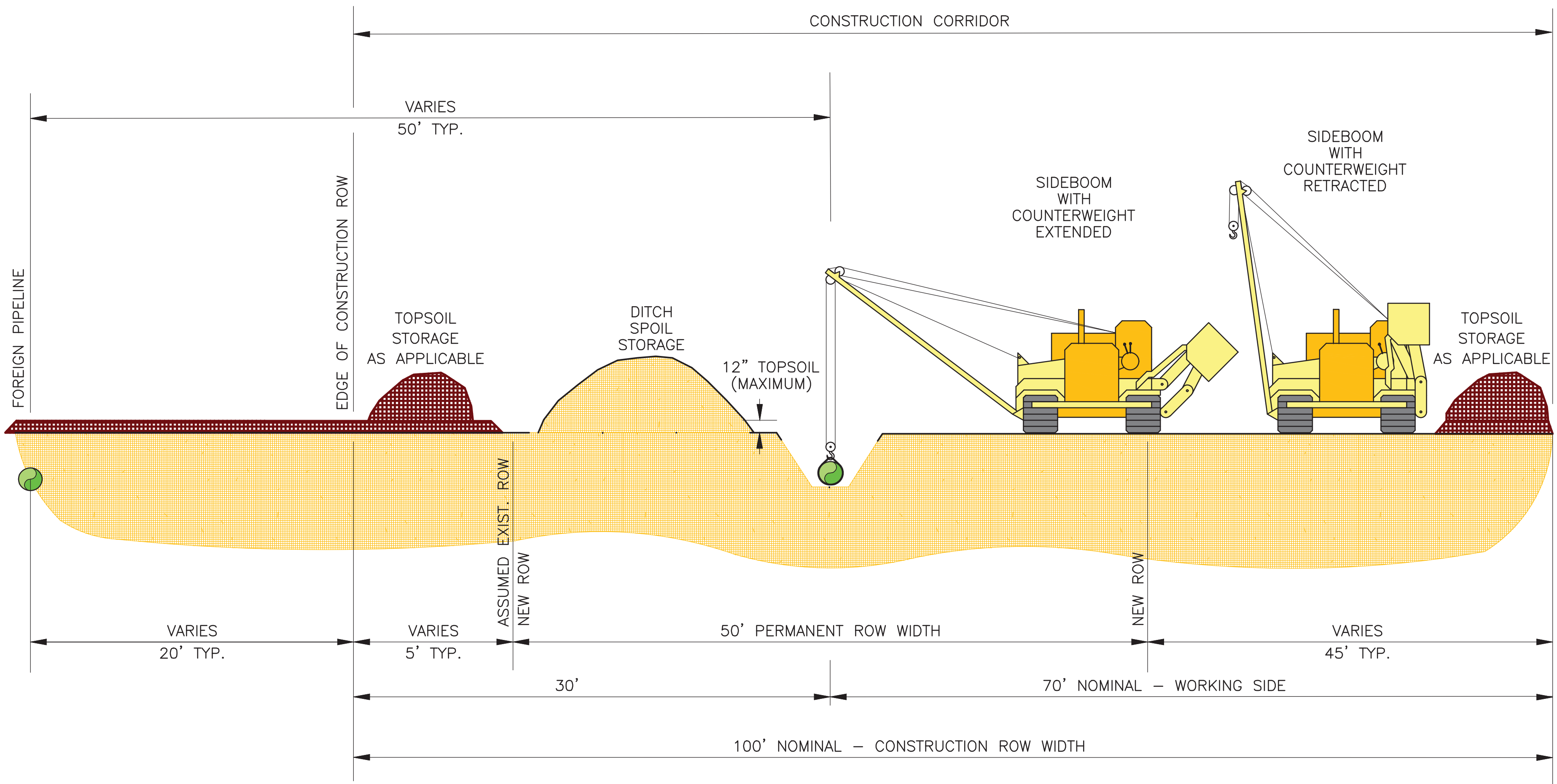
TYPICAL CONSTRUCTION DRAWINGS



NO.	REVISION	DATE	APPR.
A	ISSUED FOR PERMIT	05/15/17	NEW

TYPICAL MAINLINE CONSTRUCTION RIGHT–OF–WAY (ROW) CROSS SECTION
UPLANDS PARALLEL TO EXISTING PIPE
LIMITED TOPSOIL STRIPPING

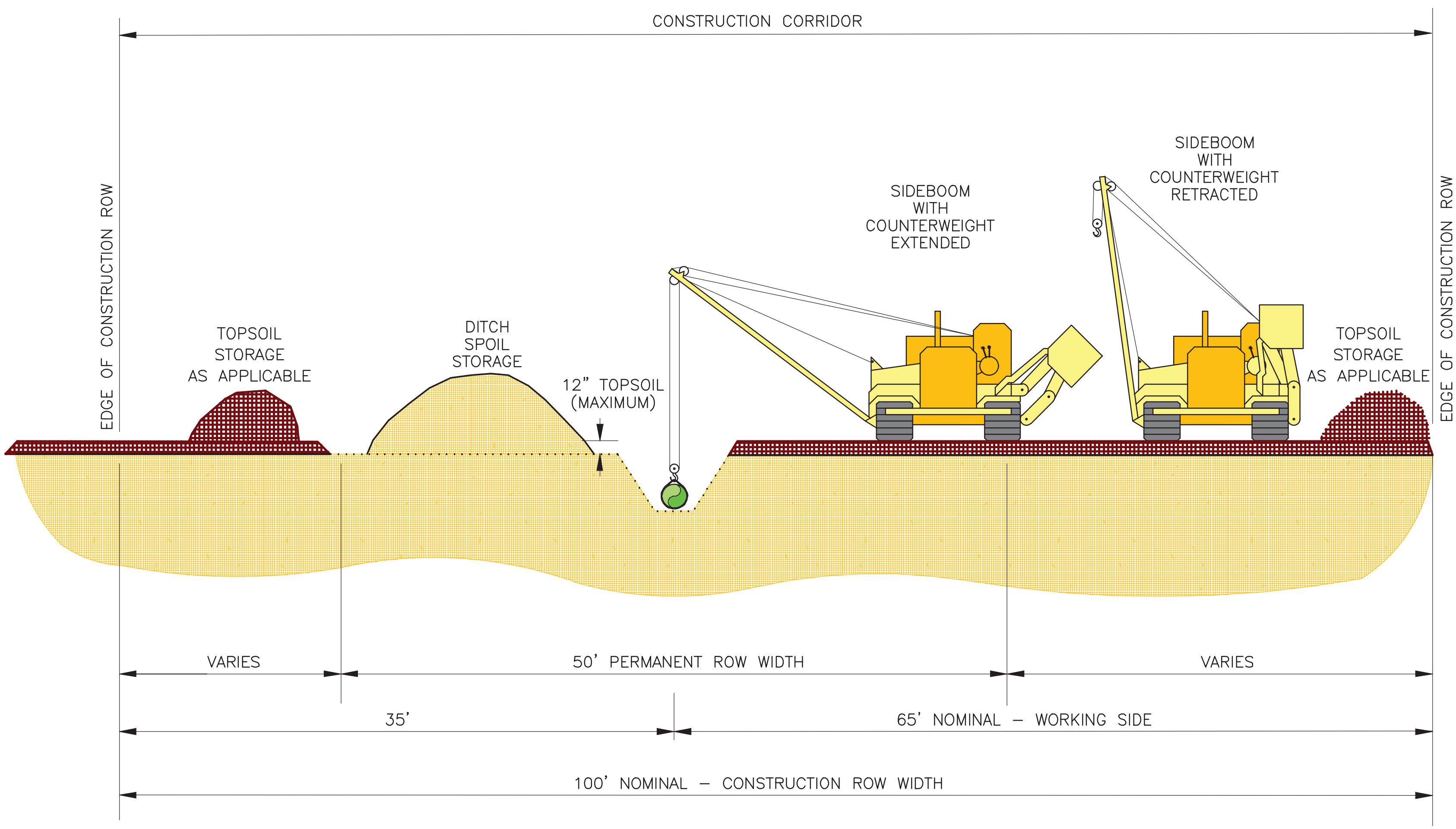
SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	11/29/16	SVM	PAD	NEW	265931	TYPICAL 1	1 OF 11



NO.	REVISION	DATE	APPR.
A	ISSUED FOR PERMIT	05/15/17	NEW

TYPICAL MAINLINE CONSTRUCTION
RIGHT–OF–WAY (ROW)
CROSS SECTION
UPLANDS PARALLEL TO EXISTING PIPELINE
FULL WIDTH TOPSOIL STRIPPING

SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	11/29/16	SVM	PAD	NEW	265931	TYPICAL 2	2 OF 11



WEI STANDARDS Landscape A-size (11x8.5)

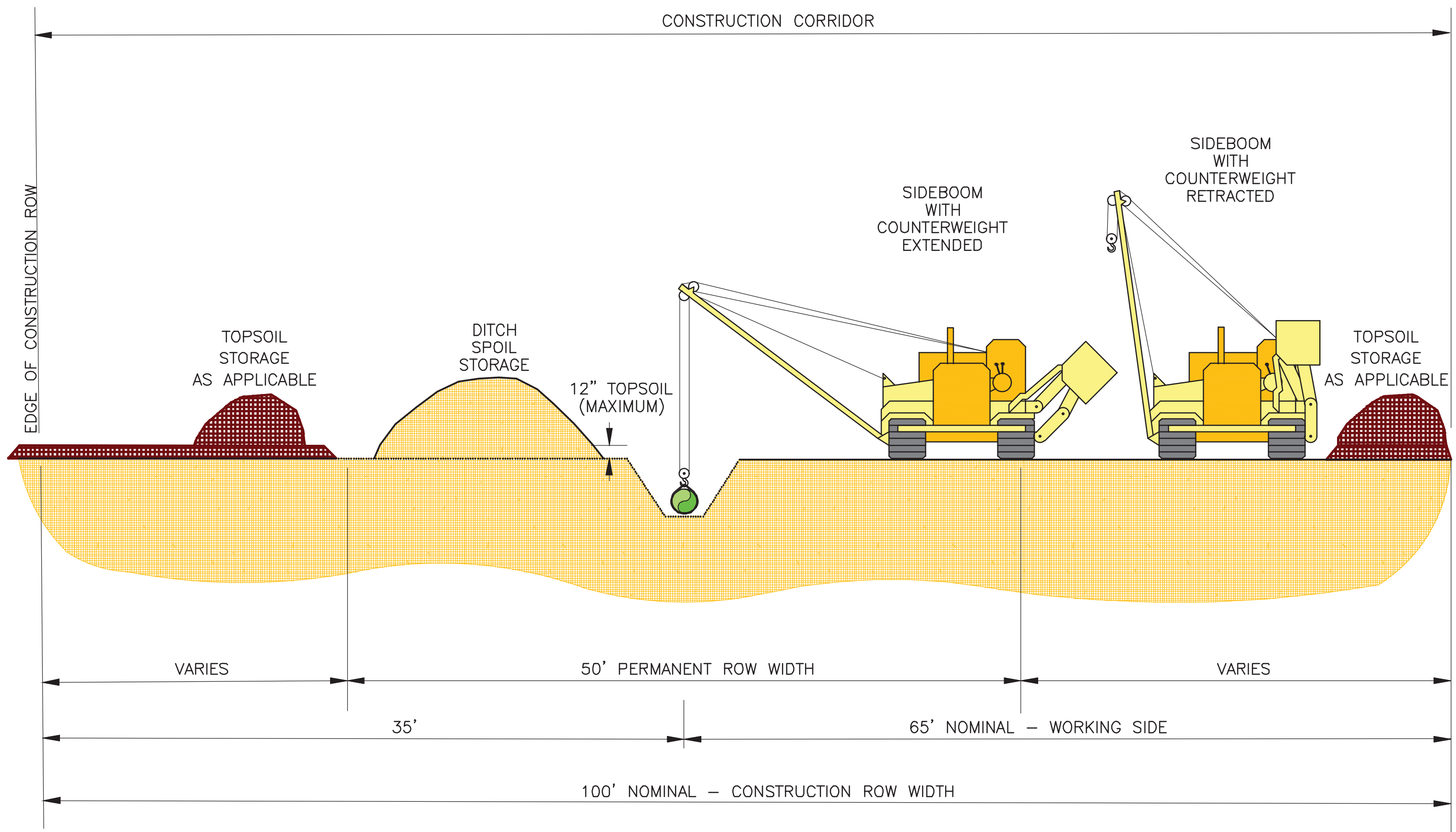
NO.	REVISION	DATE	APPR.

SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	11/29/16	SVM	PAD		265931	TYPICAL 3	3 OF 11

TYPICAL MAINLINE CONSTRUCTION
RIGHT–OF–WAY (ROW)
CROSS SECTION
UPLANDS LIMITED TOPSOIL
STRIPPING

29–Nov–2016 : 3:24 PM

svanmeter : TYPICAL3.dwg



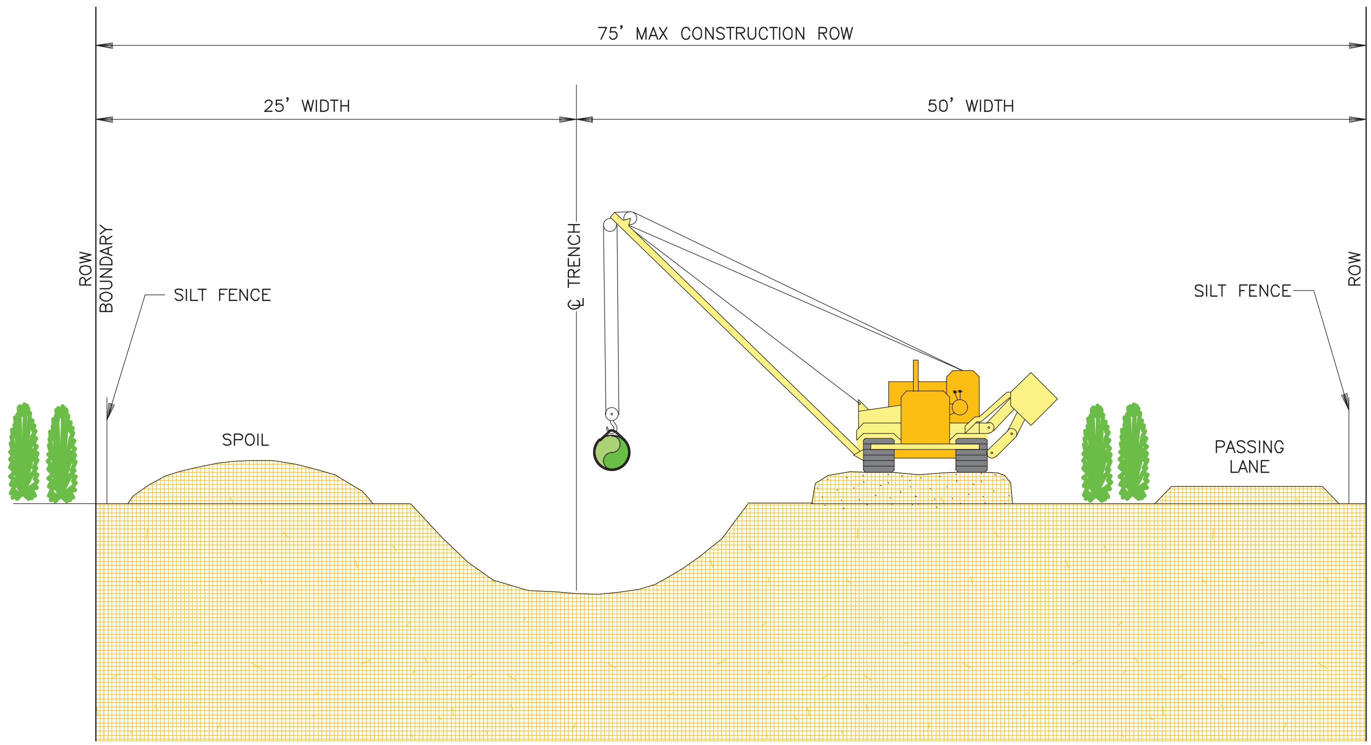
NO.	REVISION	DATE	APPR.

TYPICAL MAINLINE CONSTRUCTION RIGHT–OF–WAY (ROW) CROSS SECTION UPLANDS FULL WIDTH TOPSOIL STRIPPING

SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	11/30'16	SVM	PAD		265931	TYPICAL 4	4 OF 11

29–Nov–2016 : 3:31 PM
svanmeter : TYPICAL4.dwg

WEI STANDARDS Landscape A–size (11x8.5)

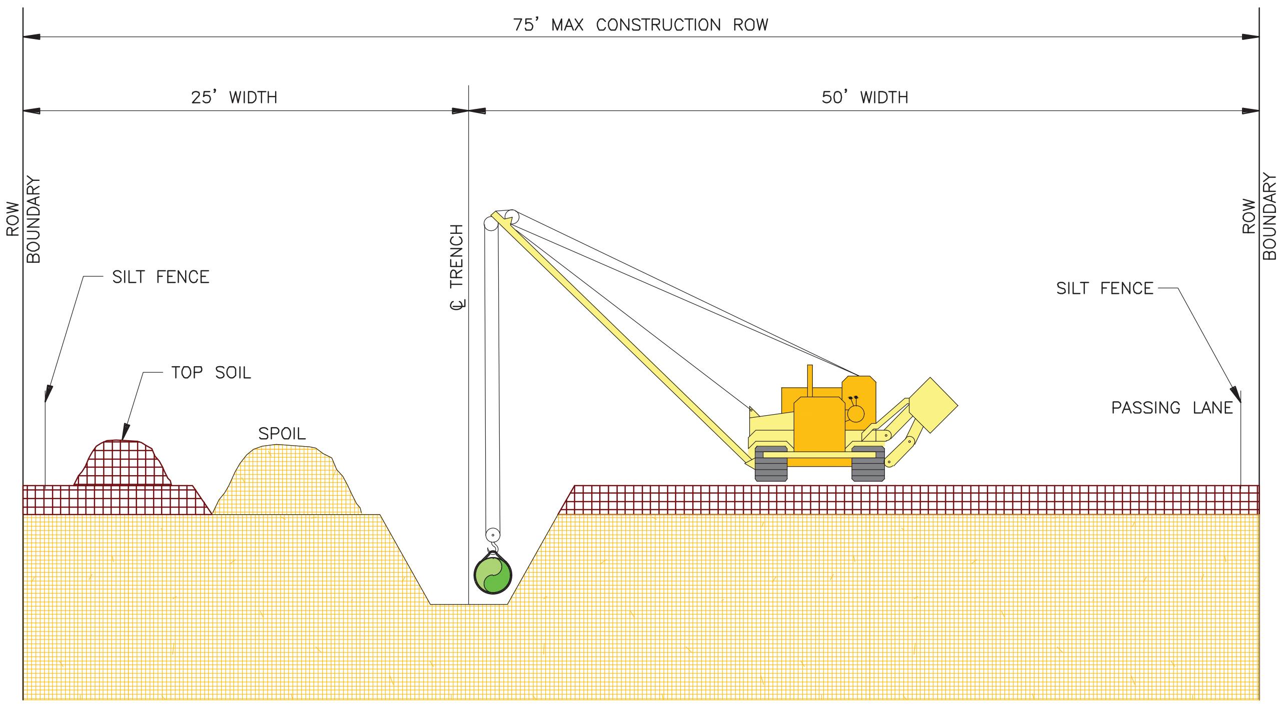


CROSS SECTION

NO.	REVISION		DATE	APPR.	TYPICAL 'WET' SATURATED OR FLOODED WETLAND CROSSING	
SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	11/30'16	SVM	PAD		265931	TYPICAL 5	5 OF 11

29-Nov-2016 : 3:31 PM
svanmeter : TYPICAL4.dwg

WEI STANDARDS Landscape A-size (11x8.5)



CROSS SECTION

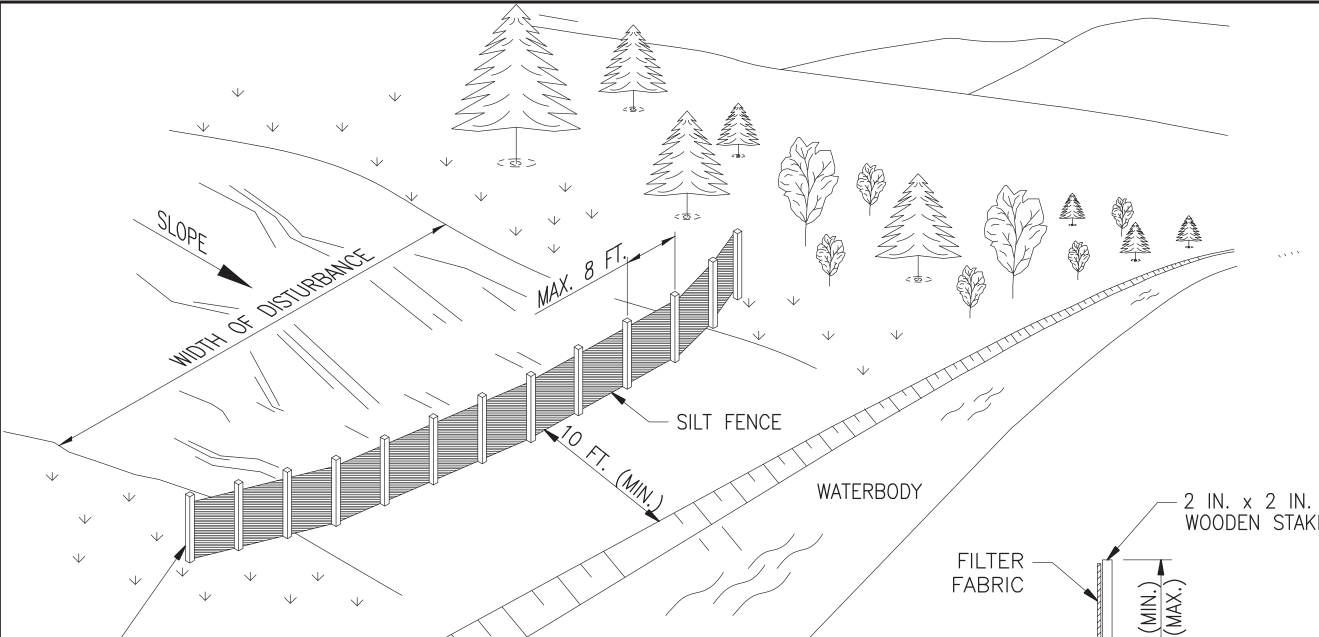
NO.	REVISION	DATE	APPR.

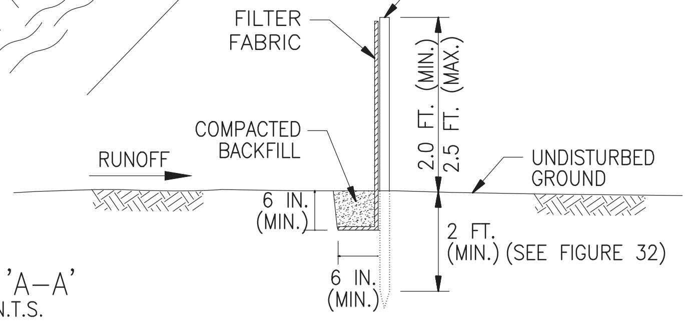
TYPICAL
'DRY' WETLAND CROSSING

SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	11/30'16	SVM	PAD		265931	TYPICAL 6	6 OF 11

29-Nov-2016 : 3:31 PM

svanmeter : TYPICAL4.dwg





SECTION 'A–A'
SCALE: N.T.S.

NOTES:

1. SILT FENCES ARE TO BE USED IN AREAS WHERE SHEET FLOW OR RELATIVELY SMALL VOLUMES OF WATER CAN BE EXPECTED TO OCCUR. FOR LARGER VOLUMES SUCH AS WITHIN A DEFINED CHANNEL, A CHECK DAM WILL BE REQUIRED. SILT FENCES WILL BE CONSTRUCTED AT THE EDGE OF THE ROW:
   - AT THE OUTFALL OF AN INTERCEPTOR DIKE IF NATURAL VEGETATION IS INSUFFICIENT TO FILTER THE SILT FROM THE RUN–OFF WATER.
   - AT THE BASE OF SLOPES ADJACENT TO ROADWAYS AND STREAMS WHEN THE NATIVE VEGETATION COVER HAS BEEN DISTURBED.
   - WHEN THE DISTANCE (IN AREAS OF GOOD VEGETATION COVER) OF THE ROW TO A BODY OF WATER IS EQUAL TO OR LESS THAN THE FOLLOWING SCHEDULE.

PERCENT SLOPE	DISTANCE
0 – 5%	25 FEET
5 – 15%	50 FEET
15 – 30%	75 FEET
OVER 30%	100 FEET

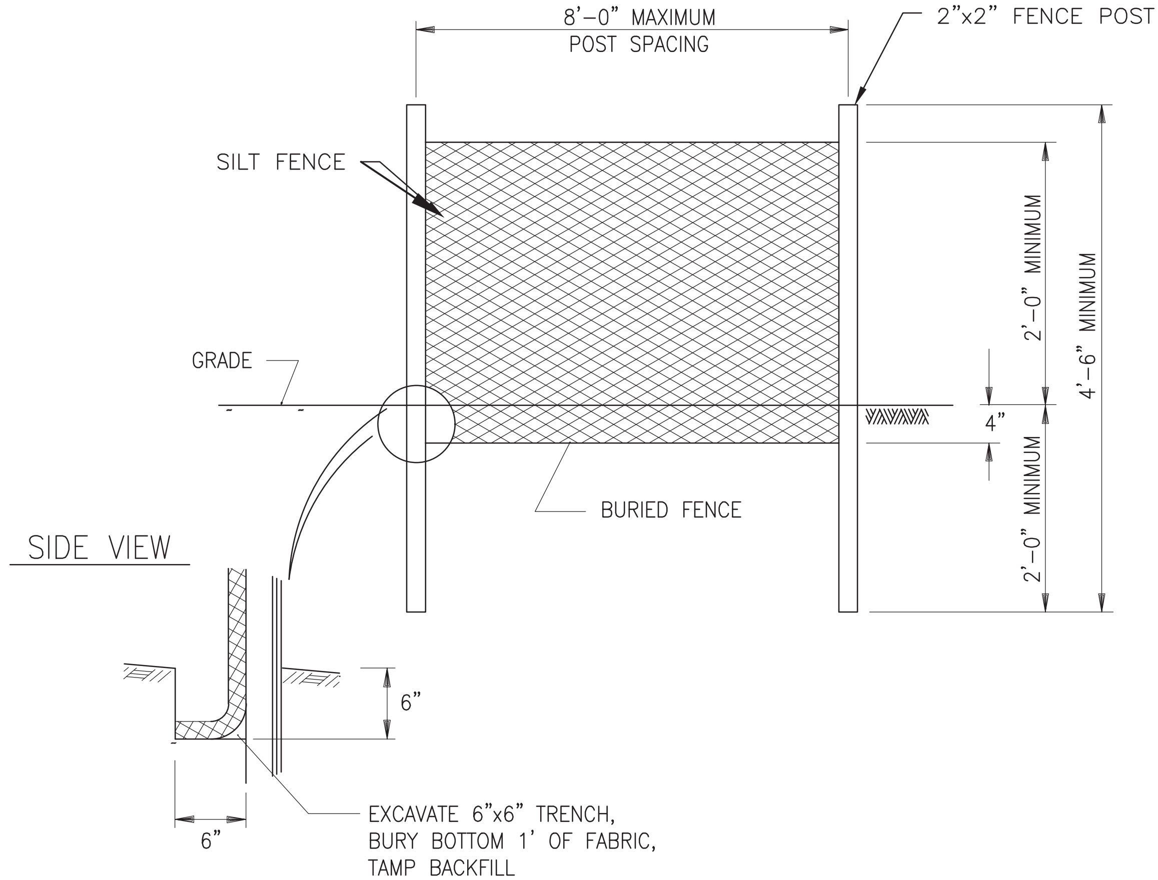
2. STAKES ARE TO BE PLACED EVERY EIGHT (8) FT. OR CLOSER AS CONDITIONS REQUIRE.
3. ATTACH FILTER FABRIC AT EACH POST AT A MINIMUM OF THREE (3) LOCATIONS
4. THE FILTER FABRIC (MIN. OF 1 FT.) IS TO BE ANCHORED IN A 6 INCH x 6 INCH TRENCH WITH WELL COMPACTED BACKFILL OVER THE FABRIC TO PREVENT UNDERMINING.
5. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF THE SILT FENCE SHALL BE TURNED AND EXTENDED UPSLOPE.
6. SILT FENCES ARE TO BE CHECKED AND MAINTAINED ON A REGULAR BASIS AND AFTER EACH RAIN EVENT. REMOVE ANY BUILD–UP OF SEDIMENT WHEN THE HEIGHT OF SEDIMENT EXCEEDS APPROXIMATELY 20% OF THE HEIGHT OF THE BARRIER.
7. MATERIAL SHOULD BE WOVEN GEOTEXTILE FABRIC SUCH AS EXXON GTF 180, MIRAFI 600X, OR AN APPROVED EQUIVALENT. SECONDARY REINFORCEMENT, SUCH AS A CONSTRUCTION BARRIER FENCE OR WIRE MESH CAN ALSO BE USED BEHIND THE FILTER FABRIC.
8. WHERE ANCHORING CONDITIONS FOR THE SILT FENCE ARE POOR, PLACE ANCHORED STRAW BALES ON DOWNSTREAM SIDE OF THE SILT FENCE.

NO.	REVISION	DATE	APPR.
A	ISSUED FOR PERMIT	05/15/17	NEW

SCALE	DATE	DRAWN	CHECKED	APPROVED
NTS	04/17/17	AWF	SSL	NEW

TYPICAL
SILT FENCE BARRIER

TRC PROJ. NO.	DRAWING NUMBER	SHEET
265931	TYPICAL 7	7 OF 11



NOTES:

1. SILT FENCES ARE CONSTRUCTED FROM SYNTHETIC MESH MATERIAL DESIGNED TO RETAIN SILT WHILE ALLOWING WATER TO PASS THROUGH.

2. SILT FENCES WILL BE CONSTRUCTED AT THE EDGE OF THE ROW:

   – AT THE OUTFALL OF AN INTERCEPTOR DIKE IF NATURAL VEGETATION IS INSUFFICIENT TO FILTER THE SILT FROM THE RUN–OFF WATER.

   – AT THE BASE OF SLOPES ADJACENT TO ROADWAYS AND STREAMS WHEN THE NATIVE VEGETATION COVER HAS BEEN DISTURBED.

   – WHEN THE DISTANCE (IN AREAS OF GOOD VEGETATION COVER) OF THE ROW TO A BODY OF WATER IS EQUAL TO OR LESS THAN THE FOLLOWING SCHEDULE.

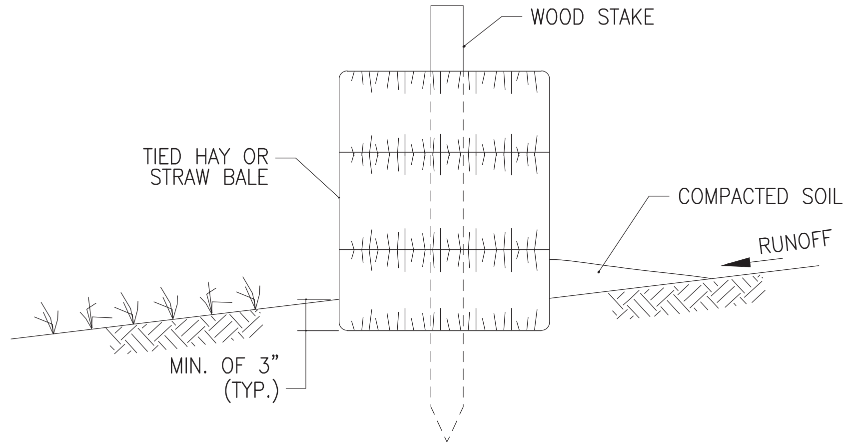
PERCENT SLOPE	DISTANCE
0 – 5%	25 FEET
5 – 15%	50 FEET
15 – 30%	75 FEET
OVER 30%	100 FEET

   – WHEN THE DISTANCE (IN AREAS OF POOR VEGETATION COVER) OF THE ROW TO A BODY OF WATER IS WITHIN 150 FEET AND THE AREA SLOPES TOWARD THE WATER.

NO.	REVISION	DATE	APPR.
A	ISSUED FOR PERMIT	05/15/17	NEW

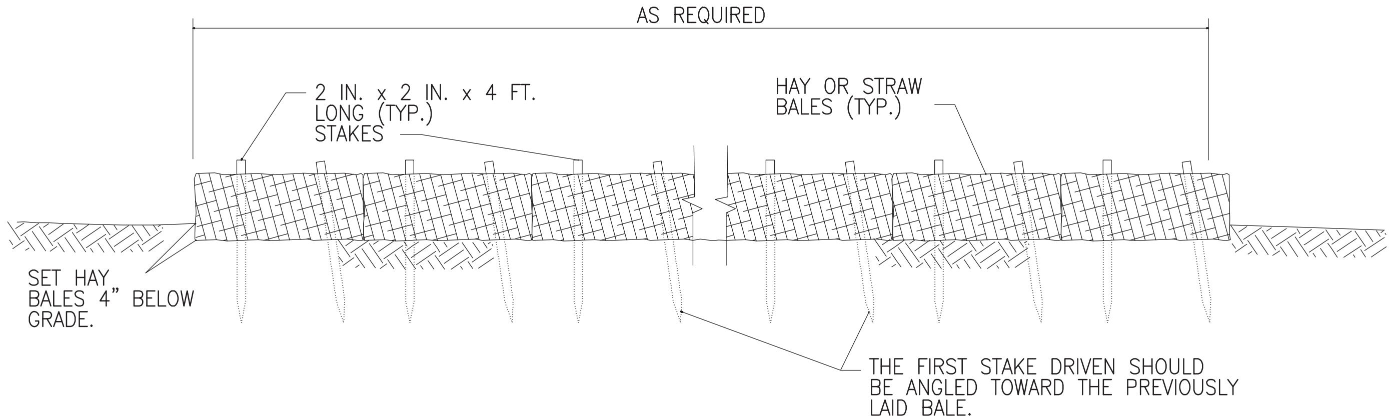
TYPICAL
PIPELINE STANDARD EROSION
CONTROL SILT FENCE

SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	04/17/17	AWF	SSL	NEW	265931	TYPICAL 8	8 OF 11



SECTION

SCALE: N.T.S.



NOTES:

1. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF THE STRAW BALE BARRIER SHOULD BE TURNED AND EXTENDED UPSLOPE. IMBED BALES IN EARTH APPROXIMATELY FOUR (4) INCHES.

2. EACH BALE SHOULD BE SECURED BY AT LEAST TWO (2) STAKES. THE FIRST STAKE IN EACH BALE SHALL BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER. ANY GAPS CAN BE FILLED IN BY WEDGING LOOSE STRAW BETWEEN THE BALES. STAKES SHOULD BE DRIVEN A MINIMUM OF 18 INCHES INTO THE GROUND.

3. COMPACT EXCAVATED SOIL AS NECESSARY AGAINST THE UPHILL SIDE OF THE BARRIER TO PREVENT WATER TUNNELLING UNDER THE BALES.

4. STRAW BALE BARRIERS REQUIRE CONTINUAL MAINTENANCE TO REMOVE COLLECTED SEDIMENT AND REPLACE DAMAGED BALES. PAY CLOSE ATTENTION TO THE REPAIR OF DAMAGED BALES, END RUNS AND UNDERCUTTING BENEATH BALES.

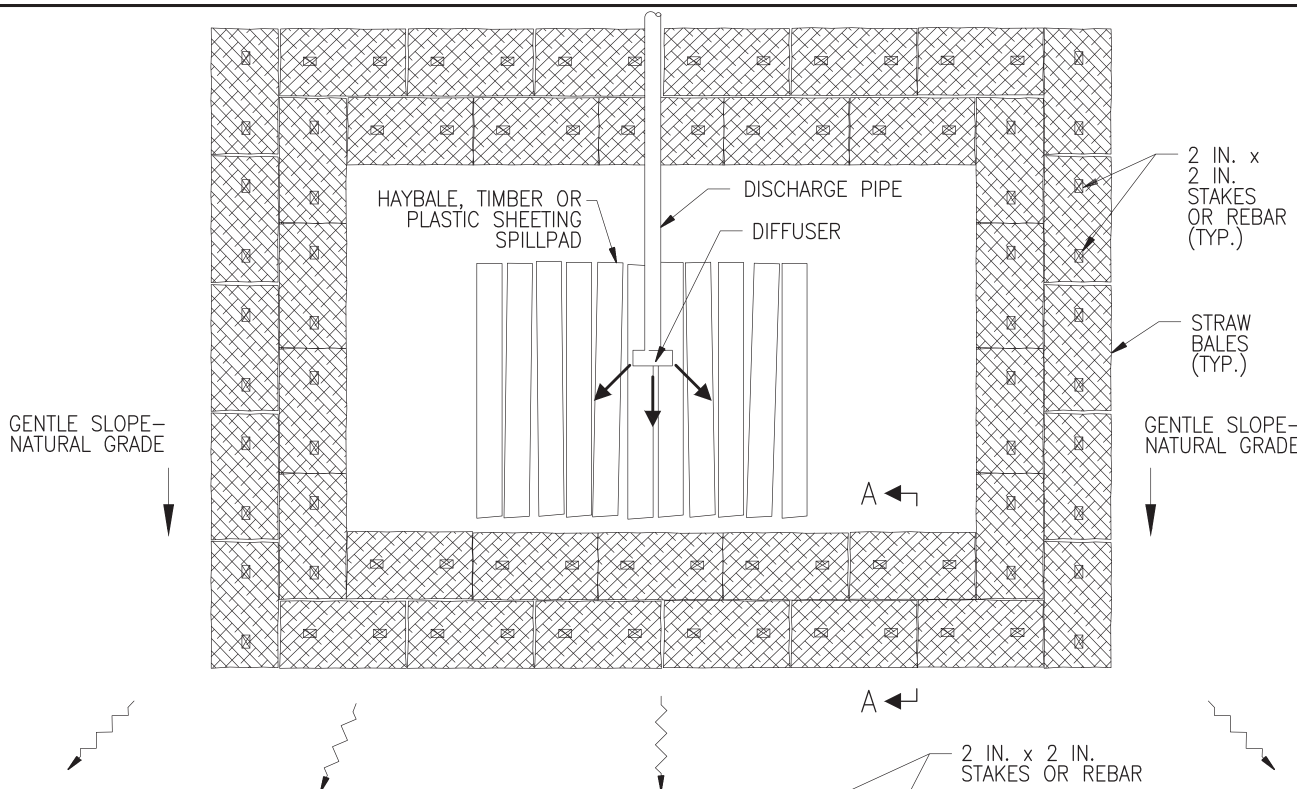
5. SEDIMENT DEPOSITS SHOULD BE REMOVED AFTER EACH RAINFALL. THEY MUST BE REMOVED WHEN THE LEVEL OF DEPOSITION REACHES APPROXIMATELY ONE-HALF THE HEIGHT OF THE BARRIER.

6. UTILIZE STRAW BALE BARRIERS ONLY IN LIEU OF A SILT FENCE WHERE FREQUENT ACCESS IS REQUIRED OR WHEN DIRECTED BY THE ENVIRONMENTAL INSPECTOR.

NO.	REVISION	DATE	APPR.
A	ISSUED FOR PERMIT	05/15/17	NEW

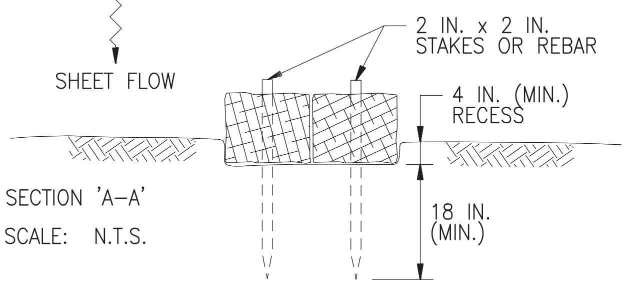
TYPICAL
STRAW BALE BARRIER

SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	04/17/17	AWF	SSL	NEW	265931	TYPICAL 9	9 OF 11



PLAN

SCALE: N.T.S.



SECTION 'A–A'

SCALE: N.T.S.

NOTES:

1. INSTALL A STRAW BALE DEWATERING STRUCTURE WHEREVER IT IS NECESSARY AND AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR TO PREVENT THE FLOW OF HEAVILY SILT LADEN WATER INTO WATERBODIES OR WETLANDS. ALL DEWATERING ACTIVITIES SHALL BE IN ACCORDANCE WITH ENVIRONMENTAL SPECIFICATION AND RELEVANT PERMITS.

2. DISCHARGE SITE SHOULD BE WELL VEGETATED AND LOCATED AT LEAST 50 FEET FROM ANY WATERCOURSE. THE TOPOGRAPHY OF THE SITE SHOULD BE SUCH THAT WATER WILL FLOW INTO THE DEWATERING STRUCTURE AND AWAY FROM ANY WORK AREAS. THE AREA DOWNSLOPE FROM THE WATERING SITE MUST BE REASONABLY FLAT OR STABILIZED BY VEGETATION OR OTHER MEANS TO ALLOW THE FILTERED WATER TO CONTINUE AS SHEET FLOW.

3. DIRECT THE PUMPED WATER ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL, WEIGHTED TIMBERS, OR A WOVEN GEOTEXTILE STAKED TO THE GROUND SURFACE, SUCH AS MIRAFI 600X, TERRAFIX 400W, OR A COMPANY APPROVED EQUIVALENT. BEYOND THE SPILL PAD FORCE THE DISCHARGE WATER INTO SHEET FLOW USING STRAW BALES AND THE NATURAL TOPOGRAPHY.

4. DISCHARGE RATES SHOULD BE SUCH THAT THE CAPACITY OF THE STRUCTURE WILL NOT BE EXCEEDED.

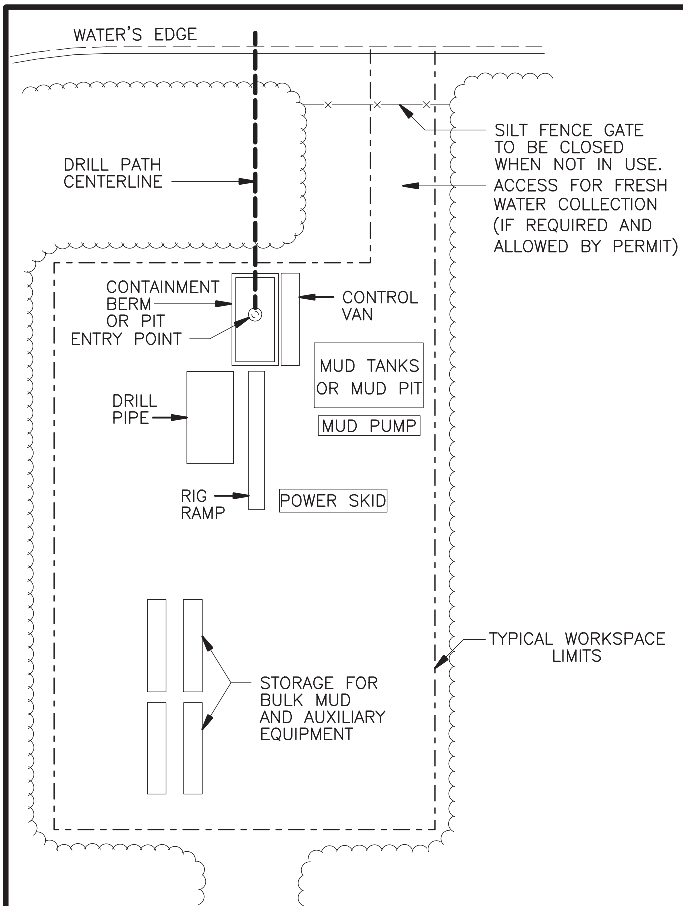
5. DISCHARGE WATER SHALL BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD USING A COMBINATION OF STRAW BALES AND THE NATURAL TOPOGRAPHY. RECESS STRAW BALES A MIN. OF FOUR (4) INCHES. DRIVE TWO (2) STAKES OR REBAR INTO EACH BALE TO ANCHOR THEM IN PLACE.

6. MANUFACTURED FILTER BAGS ARE A SUITABLE ALTERNATIVE TO STRAW BALE STRUCTURES FOR TRENCH DEWATERING. FILTER BAGS SHALL BE INSTALLED AS SPECIFIED BY THE MANUFACTURER. DISPOSE OF FULL FILTER BAGS AT AN APPROVED OFF–SITE FACILITY.

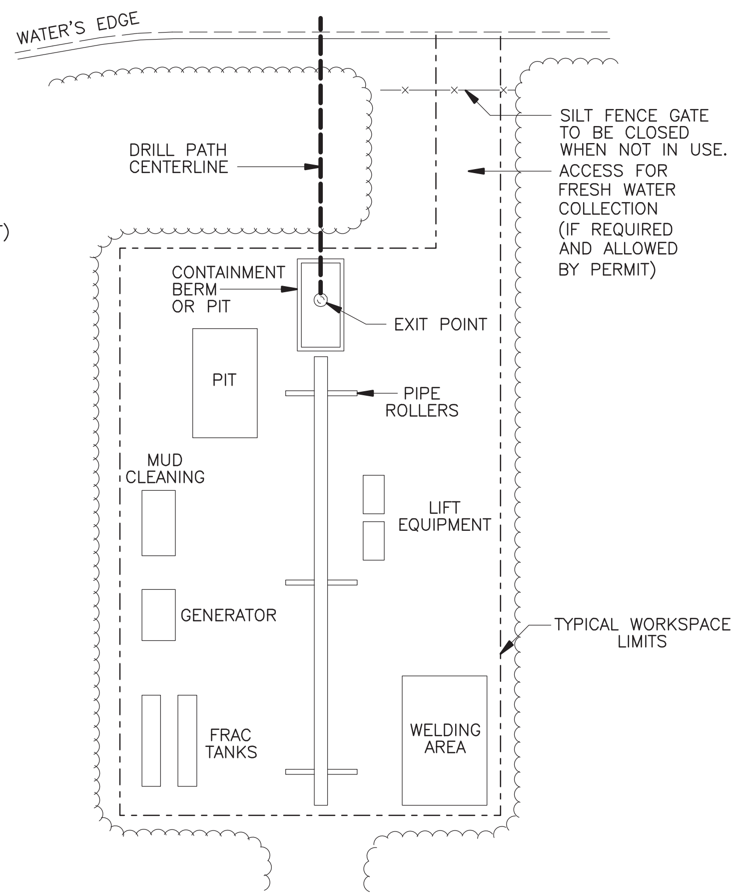
NO.	REVISION	DATE	APPR.
A	ISSUED FOR PERMIT	05/15/17	NEW

TYPICAL STRAW BALE DEWATERING STRUCTURE

SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	04/17/17	AWF	SSL	NEW	265931	TYPICAL 10	10 OF 11



SITE PLAN
ENTER SIDE

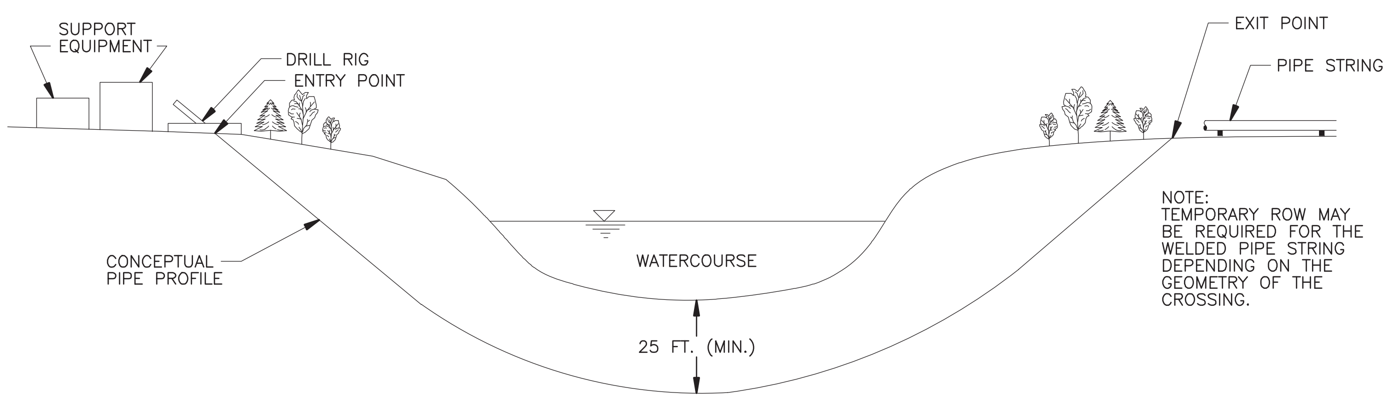


SITE PLAN
EXIT SIDE

EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.

SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED.

THE EQUIPMENT SHOWN MAY NOT BE REQUIRED FOR SOME HDD'S OR MAY BE ARRANGED DIFFERENTLY.



FOR ACTUAL WORKSPACE DIMENSIONS REFER TO SITE-SPECIFIC DRAWINGS

PROFILE

NO.	REVISION	DATE	APPR.

SCALE	DATE	DRAWN	CHECKED	APPROVED	TRC PROJ. NO.	DRAWING NUMBER	SHEET
NTS	04/17/17	AWF	SSL		265931	TYPICAL 11	11 OF 11

TYPICAL
HORIZONTAL DIRECTIONAL DRILL
(HDD SITE PLAN AND PROFILE)

17-Apr-2017 : 4:50 PM

afritz : Typicals 7-10.dwg

APPENDIX C

SUMMARY OF EXISTING RIGHTS-OF-WAY COLLOCATED WITH THE MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT PIPELINES

APPENDIX C

Summary of Existing Rights-of-Way Collocated with the Midcontinent Supply Header Interstate Pipeline Project Pipelines [a]

Pipeline Route/ Collocated Utility	Utility Type	Begin Milepost	End Milepost	Direction to Existing Right-of-Way [b]	Paralleled Length (miles)
Mainline					
Phillips 66	Pipeline	0.0	0.1	South	0.1
Canadian County (N27300)	Road	9.6	9.7	West	0.2
EnLink	Pipeline	9.7	9.8	East	0.1
Canadian County (N27300)	Road	9.8	10.7	East	1.0
ONEOK	Pipeline	10.7	11.1	East	0.4
ONEOK	Pipeline	11.4	11.6	North	0.2
Enogex	Pipeline	11.6	12.3	West	0.7
EnLink	Pipeline	12.3	12.8	West	0.4
EnLink	Pipeline	12.8	13.3	Northeast	0.6
Plains	Pipeline	13.3	13.6	Northeast	0.2
Enable Midstream	Pipeline	13.8	13.9	Southwest	0.1
Unknown	Overhead Utility	16.0	16.3	West	0.3
Enable Midstream	Pipeline	16.3	17.2	West	0.9
ONEOK	Pipeline	17.2	17.3	North	0.1
ONEOK	Pipeline	17.3	17.5	South	0.2
EnLink	Pipeline	18.7	19.2	East	0.5
Unknown	Overhead Utility	19.3	19.4	South	0.1
Devon	Pipeline	19.6	19.7	South	0.1
DCP	Pipeline	29.1	29.2	East	0.1
DCP	Pipeline	31.7	31.7	West	0.1
Grady County (N28800)	Road	45.4	45.9	East	0.5
Enable Midstream	Pipeline	50.0	50.2	Southwest	0.2
Velocity	Pipeline	71.9	72.2	South	0.3
Enable Midstream	Pipeline	72.2	72.7	East	0.5
Velocity	Pipeline	72.7	73.5	West	0.8
Enable Midstream	Pipeline	73.5	73.8	West	0.3
Velocity	Pipeline	74.6	75.0	West	0.4
Velocity	Pipeline	75.2	75.5	East	0.3
UK	Powerline	76.3	76.4	North	0.1
OGE	Pipeline	77.8	78.4	South	0.6
Targa	Pipeline	79.2	79.3	West	0.1
DCP	Pipeline	80.2	80.3	East	0.1
Targa	Pipeline	80.3	80.3	North	0.1
Mobil	Pipeline	81.0	82.1	East	1.0
Velocity	Pipeline	83.8	83.9	West	0.1
Enogex	Pipeline	83.9	84.4	Northeast	0.5
DCP	Pipeline	84.8	84.9	Northeast	0.1
Enable Midstream	Pipeline	84.9	85.5	Northeast	0.6
Unknown	Powerline	86.3	86.4	East	0.1
Newfield	Pipeline	86.9	87.2	East	0.4
Newfield	Pipeline	87.2	87.6	West	0.4
DCP	Pipeline	89.4	89.5	East	0.1
Enable Midstream	Pipeline	89.5	89.7	Northeast	0.2
Unknown	Pipeline	94.9	94.9	West	0.1
Unknown	Pipeline	95.2	95.3	East	0.1
Citation	Pipeline	103.1	103.5	Southwest	0.4

APPENDIX C (cont'd)

Summary of Existing Rights-of-Way Collocated with the Midcontinent Supply Header Interstate Pipeline Project Pipelines [a]

Pipeline Route/ Collocated Utility	Utility Type	Begin Milepost	End Milepost	Direction to Existing Right-of-Way [b]	Paralleled Length (miles)
Citation	Pipeline	103.5	103.7	Northeast	0.2
Bluenight	Pipeline	108.0	109.8	West	1.8
Kinder Morgan	Pipeline	109.8	111.8	Southwest	2.0
Kinder Morgan	Pipeline	112.2	115.0	Southwest	2.8
Kinder Morgan	Pipeline	115.0	115.3	Northeast	0.3
Atlas Energy	Pipeline	116.7	116.8	North	0.1
Kinder Morgan	Pipeline	118.1	122.9	Southwest	4.8
Kinder Morgan	Pipeline	122.9	123.4	Northeast	0.5
Kinder Morgan	Pipeline	123.9	124.8	North	0.8
Kinder Morgan	Pipeline	124.8	126.1	Southwest	1.3
Kinder Morgan	Pipeline	126.1	126.2	North	0.1
Kinder Morgan	Pipeline	126.2	129.3	South	3.1
Kinder Morgan	Pipeline	129.3	129.6	North	0.3
Kinder Morgan	Pipeline	129.6	134.0	South	4.5
Kinder Morgan	Pipeline	134.0	134.2	North	0.2
Kinder Morgan	Pipeline	134.2	134.7	South	0.5
Kinder Morgan	Pipeline	134.7	135.1	North	0.4
Unknown	Overhead power	135.1	136.2	North	1.2
Kinder Morgan	Pipeline	136.7	138.2	South	1.5
Kinder Morgan	Pipeline	138.2	140.1	Northwest	1.9
Kinder Morgan	Pipeline	140.1	141.0	South	0.9
OGE	Powerline	142.3	142.4	South	0.2
Kinder Morgan	Pipeline	142.4	142.4	South	0.1
Kinder Morgan	Pipeline	142.4	143.2	North	0.8
XTO	Pipeline	143.2	145.2	South	2.0
Unknown	Powerline	145.2	145.5	South	0.3
Unknown	Pipeline	145.5	145.7	South	0.2
XTO	Pipeline	145.7	146.0	North	0.4
Targa	Pipeline	146.0	146.3	North	0.3
Targa	Pipeline	146.3	146.5	South	0.2
Targa	Pipeline	146.6	146.8	West	0.2
Targa	Pipeline	146.8	148.0	North	1.2
Kinder Morgan	Pipeline	148.2	149.0	East	0.8
Kinder Morgan	Pipeline	149.0	149.9	North	0.9
Kinder Morgan	Pipeline	149.9	151.1	South	1.2
Kinder Morgan	Pipeline	151.4	154.2	South	2.8
Kinder Morgan	Pipeline	154.4	155.0	South	0.4
Kinder Morgan	Pipeline	155.0	155.2	East	0.2
Kinder Morgan	Pipeline	155.2	156.2	South	1.0
Kinder Morgan	Pipeline	156.5	165.6	South	9.1
Kinder Morgan	Pipeline	166.1	170.7	South	4.6
Kinder Morgan	Pipeline	170.7	170.8	North	0.1
Kinder Morgan	Pipeline	170.8	171.8	South	1.0
Kinder Morgan	Pipeline	172.1	173.5	South	1.4
Kinder Morgan	Pipeline	173.7	174.6	North	0.9
Kinder Morgan	Pipeline	174.6	176.2	South	1.6
Kinder Morgan	Pipeline	176.7	177.2	South	0.5

APPENDIX C (cont'd)

Summary of Existing Rights-of-Way Collocated with the Midcontinent Supply Header Interstate Pipeline Project Pipelines [a]

Pipeline Route/ Collocated Utility	Utility Type	Begin Milepost	End Milepost	Direction to Existing Right-of-Way [b]	Paralleled Length (miles)
Kinder Morgan	Pipeline	177.6	178.1	South	0.6
Kinder Morgan	Pipeline	178.1	179.1	North	0.9
Kinder Morgan	Pipeline	179.1	179.5	South	0.4
Kinder Morgan	Pipeline	179.8	181.0	South	1.2
Kinder Morgan	Pipeline	181.0	181.6	North	0.6
Kinder Morgan	Pipeline	181.6	185.1	South	3.6
Kinder Morgan	Pipeline	185.4	190.5	South	5.2
Kinder Morgan	Pipeline	190.5	191.0	North	0.5
Kinder Morgan	Pipeline	191.0	192.5	South	1.5
Kinder Morgan	Pipeline	192.5	192.6	North	0.2
Kinder Morgan	Pipeline	192.6	192.8	South	0.2
Kinder Morgan	Pipeline	193.3	199.0	South	5.8
Bryan County (N39400)	Road	199.0	199.6	East	0.6
			Subtotal		**97.8**
Chisholm Lateral					
ONEOK	Pipeline	CH0.0	CH0.1	West	0.1
ONEOK	Pipeline	CH0.1	CH0.9	North	0.8
Kingfisher County (E08600)	Road	CH1.4	CH2.1	North	0.7
Kingfisher County (E08600)	Road	CH2.2	CH2.9	North	0.7
Plains	Pipeline	CH2.9	CH3.3	South	0.4
Kingfisher County (E08600)	Road	CH3.3	CH4.2	South	0.9
Plains	Pipeline	CH4.2	CH5.9	South	1.8
EnLink	Pipeline	CH6.3	CH7.0	South	0.8
EnLink	Pipeline	CH7.0	CH7.4	North	0.4
EnLink	Pipeline	CH8.4	CH8.6	North	0.2
DCP	Pipeline	CH9.4	CH10.2	North	0.8
DCP	Pipeline	CH10.2	CH10.4	South	0.2
Enable Midstream	Pipeline	CH10.4	CH10.6	South	0.2
Enable Midstream	Pipeline	CH10.6	CH11.9	North	1.3
Enable Midstream	Pipeline	CH11.9	CH14.7	South	2.8
Kingfisher County (E0870)	Road	CH14.7	CH16.3	North	1.5
Enable Midstream	Pipeline	CH16.5	CH18.1	Northwest	1.6
DCP	Pipeline	CH18.1	CH20.2	North	2.1
			Subtotal		**17.3**
Velma Lateral					
Atlas Energy	Pipeline	VE0.0	VE0.2	North	0.2
Southern Star	Pipeline	VE0.2	VE0.6	East	0.3
Southern Star	Pipeline	VE0.6	VE2.4	North	1.8
Sunoco	Pipeline	VE2.9	VE3.4	North	0.5
Sunoco	Pipeline	VE3.6	VE5.0	North	1.4
DCP	Pipeline	VE5.0	VE5.2	West	0.2
DCP	Pipeline	VE5.2	VE6.0	North	0.8
County Utility	Powerline/Cable/Pipeline	VE6.0	VE6.1	North	0.1
County Utility/Southern Star	Powerline/Cable/Pipeline	VE6.1	VE6.5	South	0.4
DCP	Pipeline	VE6.5	VE6.6	East	0.2
Enable	Pipeline	VE6.9	VE7.0	West	0.1
County Utility/Enable	Powerline/Cable/Pipeline	VE7.0	VE7.0	East	0.1

APPENDIX C (cont'd)

Summary of Existing Rights-of-Way Collocated with the Midcontinent Supply Header Interstate Pipeline Project Pipelines [a]

Pipeline Route/ Collocated Utility	Utility Type	Begin Milepost	End Milepost	Direction to Existing Right-of-Way [b]	Paralleled Length (miles)
Southern Star	Pipeline	VE7.0	VE7.4	North	0.4
Southern Star	Pipeline	VE7.4	VE7.7	South	0.3
Southern Star	Pipeline	VE7.7	VE8.4	North	0.7
Southern Star	Pipeline	VE8.4	VE8.6	South	0.1
Southern Star	Pipeline	VE8.6	VE9.0	North	0.4
Southern Star	Pipeline	VE9.4	VE10.7	North	1.3
Williams	Pipeline	VE10.7	VE11.2	South	0.5
Williams	Pipeline	VE11.2	VE12.8	North	1.1
Williams	Pipeline	VE12.8	VE13.2	South	0.4
Williams	Pipeline	VE13.2	VE13.6	North	0.4
Williams	Pipeline	VE13.6	VE13.8	South	0.2
			Subtotal		**11.9**
PROJECT TOTAL					**127.0**

[a] Totals may not match the sum of addends due to rounding.

[b] The MIDSHIP Project right-of-way would abut existing rights-of-way to the maximum extent practicable.

APPENDIX D

ADDITIONAL TEMPORARY WORKSPACE ASSOCIATED WITH CONSTRUCTION OF THE MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT

APPENDIX D

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
MAINLINE						
Kingfisher						
1001	0.0	50 x 202	0.2	Agriculture, open land	Meter station construction	No
1002	0.2	25 x 200	0.1	Open land	Spoils for significant point of inflection (PI)	No
1003	0.3	25 x 250	0.1	Agriculture	Pipeline crossing	No
1004	0.4	50 x 225	0.3	Agriculture	Road crossing	No
Canadian						
1006	0.5	50 x 150	0.2	Agriculture, open land	Road crossing	No
1007	1.6	50 x 355	0.4	Agriculture, open land	Road crossing	No
1007A	1.6	50 x 150	0.1	Agriculture	Road crossing and staging area for parking/equipment	No
1008	1.6	50 x 150	0.2	Agriculture	Road crossing	No
1009	1.8	25 x 200	0.1	Agriculture	Pipeline crossing	No
1009A	2.1	50 x 200	0.3	Open land	Spoils for significant PI	No
1009B	2.3	50 x 200	0.3	Open land	Spoils for significant PI	No
1010	2.7	50 x 220	0.3	Open land	Road crossing and pipeline crossing	No
1011	2.8	50 x 200	0.2	Agriculture, open land	Road crossing	No
1012	3.8	50x 205	0.2	Agriculture, open land	Road crossing	No
1013	3.8	50 x 150	0.2	Open land	Road crossing	No
1014	4.4	25 x 200	0.1	Open land	Pipeline crossing	No
1015	4.8	50 x 150	0.2	Open land	Road crossing	No
1016	4.9	50 x 150	0.2	Developed land, open land	Road crossing	No
1017	5.0	25 x 200	0.1	Open land	Pipeline crossing	No
1018	5.9	50 x 150	0.2	Open land	Road crossing	No
1019	5.9	50 x 150	0.2	Agriculture	Road crossing	No
1020	6.0	50 x 250	0.3	Open land	Road crossing	No
1021	6.0	50 x 265	0.4	Agriculture	Road crossing	No
1022	6.7	50 x 200	0.2	Open land	Stream crossing	No
1023	6.7	50 x 200	0.2	Open land	Stream crossing	No
1024	6.9	25 x 200	0.1	Open land	Pipeline crossing	No
1025	6.9	50 x 320	0.4	Developed land, open land	Road crossing	No
1026	7.0	25 x 185	0.2	Developed land, open land	Pipeline crossing	No
1027	7.0	50 x 350	0.4	Developed land, open land	Pipeline crossing	No
1029	7.3	25 x 400	0.2	Agriculture, Open land	Stream crossing	No
1031	7.5	50 x 200	0.2	Agriculture	Horizontal directional drill (HDD) – North Canadian River	No
1031A	7.5	50 x 200	0.2	Agriculture	HDD – North Canadian River	No
1032	7.8	50 x 200	0.2	Agriculture	HDD – North Canadian River	No
1032A	7.8	50 x 200	0.2	Agriculture, Open Land	HDD – North Canadian River	No
1033	8.0	125 x 350	1.0	Agriculture, open land	HDD and Road crossing	No
1034	8.1	50 x 150	0.2	Agriculture	Road crossing	No
1034A	8.8	50 x 200	0.3	Agriculture	Spoils for significant PI	No
1035	9.2	50 x 200	0.3	Residential	Road crossing	No
1036	9.2	50 x 150	0.2	Agriculture	Road crossing	No
1037	9.3	75 x 150	0.2	Agriculture	Railroad/highway crossing	No
1038	9.3	75 x 150	0.3	Open land	Road crossing	No
1038A	9.4	50 x 200	0.3	Open land	Spoils for significant PI	No
1039	9.5	50 x 200	0.2	Open land	Stream crossing	No
1040	9.5	50 x 188	0.2	Open land	Stream crossing	No
1041	9.7	35 x 150	0.1	Open land	Road crossing and pipeline crossing	No
1042	9.7	50 x 246	0.3	Agriculture, open land	Pipeline crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1043	10.2	50 x 157	0.2	Agriculture, open land	Road crossing and pipeline crossing	No
1044	10.3	50 x 150	0.2	Agriculture, open land	Road crossing	No
1045	10.5	25 x 200	0.1	Developed land	Pipeline crossing	No
1046	10.7	150 x 61	0.2	Developed land, open land	Pipeline crossing, meter station construction	No
1045A	10.7	25 x 115	0.1	Developed land	Meter station construction	No
1047	11.1	50 x 260	0.4	Agriculture	Road crossing and pipeline crossing	No
1047A	11.2	50 x 150	0.2	Agriculture, open land	Road crossing	No
1047B	11.3	50 x 200	0.3	Agriculture	Spoils for significant PI	No
1048	11.4	50 x 150	0.2	Agriculture, open land	Road crossing and pipeline crossing	No
1048A	11.4	50 x 150	0.2	Agriculture	Road crossing	No
1049	11.5	50 x 200	0.3	Agriculture	Road crossing and pipeline crossing	No
1051	11.6	50 x 250	0.3	Agriculture	Pipeline crossing	No
1052	11.7	25 x 200	0.1	Agriculture	Pipeline crossing	No
1053	12.2	50 x 200	0.2	Agriculture, open land	Stream crossing	No
1054	12.3	50 x 200	0.2	Agriculture, open land	Stream crossing	No
1055	12.3	25 x 200	0.1	Agriculture	Pipeline crossing	No
1056	12.5	50 x 385	0.5	Agriculture, open land	Pipeline crossing	No
1058	12.5	50 x 150	0.2	Agriculture, open land	Road crossing and pipeline crossing	No
1059	12.8	50 x 200	0.3	Agriculture	Pipeline crossing	No
1060	12.8	25 x 227	0.1	Agriculture	Pipeline crossing	No
1061	12.9	50 x 200	0.2	Agriculture	Stream crossing	No
1062	12.9	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1063	13.2	50 x 265	0.3	Agriculture, open land	Stream crossing	No
1064	13.3	50 x 375	0.4	Open land	Stream crossing	No
1065	13.5	50 x 200	0.2	Agriculture	Road crossing	No
1066	13.7	50 x 215	0.3	Agriculture	Road crossing	No
1067	13.7	50 x 250	0.3	Agriculture, open land	Road crossing	No
1068	13.7	64 x 188	0.1	Agriculture, open land	Road crossing and pipeline crossing	No
1069	13.9	50 x 320	0.4	Agriculture, open land	Road crossing and pipeline crossing	No
1070	14.0	50 x 150	0.2	Agriculture, open land	Road crossing	No
1072	14.1	50 x 200	0.2	Agriculture	Pipeline crossing	No
1072A	14.3	50 x 200	0.3	Agriculture	Spoils for significant PI	No
1073	14.6	50 x 460	0.5	Open land	Pipeline crossing	No
1074	14.9	50 x 200	0.2	Developed land	Stream crossing	No
1075	15.0	50 x 200	0.2	Developed land	Stream crossing	No
1076	15.1	50 x 150	0.2	Developed land, open land	Road crossing	No
1077	15.2	50 x 150	0.2	Developed land, open land	Road crossing	No
1078	15.3	50 x 200	0.2	Developed land	Pipeline crossing	No
1080	15.4	50 x 200	0.2	Agriculture, developed land	Stream crossing	No
1081	15.5	50 x 200	0.2	Agriculture	Wetland crossing	No
1083	15.8	50 x 122	0.1	Agriculture	Road crossing	No
1083A	15.8	38 x 200	0.1	Agriculture, open land	HDD – Interstate 40 (Historic Route 66)/Trib. to North Canadian River	No
1083B	15.8	100 x 100	0.2	Agriculture, open land, open water	Water access for hydrostatic testing	AS-CN-NWI-PUBHh-336
1083C	15.8	50 x 52	0.1	Agriculture	Road crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1084	16.0	35 x 250	0.2	Agriculture, open land	Stream crossing	No
1085	16.1	35 x 265	0.2	Open land	Stream crossing	No
1087	16.2	50 x 150	0.2	Agriculture, forest, open land	Road crossing	No
1088	16.3	25 x 310	0.2	Agriculture	Pipeline crossing	No
1088A	16.3	50 x 365	0.4	Agriculture	Pipeline crossing and spoils for significant PI	No
1088B	16.7	50 x 200	0.2	Open land	Spoils for significant PI	No
1089	16.8	50 x 200	0.2	Forest, open land	Stream crossing	No
1090	16.9	50 x 200	0.2	Agriculture, forest, open land	Stream crossing	No
1091	17.1	50 x 430	0.5	Agriculture	Pipeline crossing	No
1092	17.2	35 x 200	0.2	Agriculture, forest, open land	Wetland crossing	No
1093	17.3	50 x 250	0.2	Agriculture, forest, open land	Pipeline crossing/wetland crossing	No
1093A	17.4	50 x 200	0.2	Agriculture, forest, open land	Road and environmental feature crossing	No
1095	17.7	50 x 1168	1.3	Agriculture, developed land, open land	Road crossing	No
1097	17.7	593 x 1135	15.3	Agriculture, developed land	Compressor station	No
1097A	17.8	50 x 200	0.3	Agriculture	Spoils for significant PI	No
1098	18.2	50 x 200	0.2	Open land	Wetland crossing/stream crossing	No
1099	18.3	50 x 200	0.2	Agriculture, forest	Wetland crossing/stream crossing	No
1100	18.4	25 x 200	0.1	Agriculture	Pipeline crossing	No
1102	19.2	50 x 260	0.4	Agriculture	Road crossing and pipeline crossing	No
1103	19.3	50 x 120	0.1	Open land	Road crossing/wetland crossing	No
1104	19.3	50 x 200	0.2	Forest, open land	Wetland crossing/stream crossing	No
1105	19.6	25 x 200	0.1	Agriculture	Pipeline crossing	No
1106	19.9	50 x 200	0.2	Open land	Stream crossing	No
1108	20.0	50 x 350	0.4	Developed land, open land	Road crossing/stream crossing	No
1110	20.0	50 x 150	0.2	Open land	Road crossing	No
1111	20.7	50 x 200	0.3	Agriculture, open land	Road crossing	No
1112	20.8	50 x 200	0.3	Agriculture, open land	Temporary soil storage	No
1114	21.3	50 x 200	0.2	Agriculture	Road crossing and pipeline crossing	No
1116	21.4	50 x 350	0.4	Agriculture, open land	Pipeline crossing	No
1117	21.7	25 x 200	0.1	Agriculture	Pipeline crossing	No
1118	22.5	50 x 575	0.7	Open land	Road crossing and pipeline crossing	No
1119	22.5	50 x 150	0.2	Agriculture, open land	Road crossing	No
1120	22.7	50 x 200	0.3	Agriculture	Road crossing	No
1121	22.8	50 x 250	0.3	Agriculture, open land	Road crossing and pipeline crossing	No
1122	23.1	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1123	23.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1124	23.2	25 x 220	0.1	Open land	Pipeline crossing	No
1125	23.8	50 x 250	0.3	Agriculture, open land	Road crossing and pipeline crossing	No
1126	23.9	50 x 150	0.2	Agriculture	Road crossing	No
1127	24.1	25 x 200	0.1	Agriculture	Pipeline crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1128	24.2	50 x150	0.2	Agriculture, open land	Road crossing	No
1129	24.3	50 x 150	0.1	Agriculture	Road crossing	No
1131	24.6	50 x 200	0.2	Open land	Stream crossing	No
1131A	24.7	35 x 200	0.2	Agriculture, forest, open land	Environmental feature crossing	No
1131B	25.1	50 x 150	0.2	Agriculture, open land	Road crossing	No
1133	25.2	50 x 150	0.2	Agriculture	Road crossing	No
1134	25.5	35 x 200	0.2	Agriculture, forest	Stream crossing	No
1135	25.6	35 x 200	0.2	Forest, open land	Stream crossing	No
1137	26.1	50 x 225	0.3	Agriculture, forest	Road crossing	No
1138	26.1	50 x 200	0.3	Agriculture, open land	Road crossing	No
1139	26.3	50 x 150	0.2	Agriculture, open land	Road crossing and pipeline crossing	No
1140	26.3	50 x 150	0.2	Agriculture	Road crossing	No
1141	26.4	25 x 200	0.1	Agriculture	Pipeline crossing	No
1142	27.3	50 x 150	0.2	Agriculture, open land	Road crossing	No
1144	27.3	50 x 150	0.2	Agriculture	Road crossing	No
1144A	27.6	35 x 200	0.2	Agriculture	Stream crossing	No
1144B	27.7	35 x 200	0.2	Agriculture, open land	Stream crossing	No
1145	27.8	25 x 200	0.1	Agriculture	Pipeline crossing	No
1146	28.0	50 x 200	0.2	Agriculture	HDD – Canadian River	No
1146A	28.0	50 x 200	0.2	Agriculture, forest	HDD – Canadian River	No
Grady						
1147	28.7	50 x 200	0.2	Agriculture	HDD – Canadian River	No
1147A	28.8	35 x 200	0.2	Agriculture, open land	Stream crossing	No
1147B	28.8	35 x 200	0.2	Agriculture, open land	Stream crossing	No
1147C	28.7	50 x 200	0.2	Agriculture, open land	HDD – Canadian River	No
1148	29.2	25 x 200	0.1	Agriculture	Pipeline crossing	No
1149	29.3	50 x 150	0.2	Agriculture	Road crossing	No
1150	29.3	50 x 150	0.2	Agriculture, open land	Road crossing	No
1153	29.6	25 x 200	0.1	Agriculture	Pipeline crossing	No
1154	29.8	25 x 200	0.1	Agriculture	Pipeline crossing	No
1155	30.0	50 x 230	0.3	Agriculture, forest	Stream crossing	No
1156	30.1	50 x 460	0.6	Agriculture, forest	Stream crossing and PI	No
1158	30.4	50 x 150	0.2	Agriculture, open land	Road crossing	No
1159	30.5	50 x 150	0.2	Agriculture, open land	Road crossing	No
1160	30.6	50 x 150	0.2	Agriculture, open land	Road crossing	No
1161	30.6	50 x 150	0.1	Agriculture, open land	Road crossing	No
1162	30.7	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1163	30.8	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1164	30.9	25 x 200	0.1	Agriculture	Pipeline crossing	No
1165	31.0	50 x 200	0.2	Agriculture	Stream crossing/road crossing	No
1166	31.1	50 x 200	0.2	Agriculture, open land	Stream crossing	No
1168	31.7	50 x 150	0.2	Agriculture	Road crossing and pipeline crossing	No
1169	31.7	50 x 150	0.2	Agriculture, open land	Road crossing	No
1171	32.0	25 x 200	0.1	Agriculture	Pipeline crossing	No
1172	32.1	35 x 200	0.2	Agriculture, open land	Stream crossing	No
1173	32.2	35 x 275	0.2	Open land	Pipeline crossing/stream crossing	No
1173A	32.5	50 x 208	0.3	Agriculture, developed land	Road crossing	No
1174	33.4	50 x 184	0.2	Agriculture, open land	Road crossing	No
1175	33.4	50 x 150	0.2	Agriculture, open land	Road crossing	No
1176	34.5	50 x 145	0.2	Agriculture	Stream crossing	No
1175A	34.5	50 x 200	0.3	Agriculture	Spoils for significant PI	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1177	34.6	50 x 150	0.2	Open land	Stream crossing	No
1176A	34.6	50 x 196	0.3	Agriculture, open land	Spoils for significant PI and parking/equipment, stream crossing	No
1178	34.7	50 x 200	0.2	Agriculture, open land	Wetland crossing	No
1178A	34.7	50 x 237	0.3	Agriculture, open land	Spoils for significant PI	No
1179	34.8	50 x 300	0.4	Agriculture	Stream crossing	No
1181	35.2	50 x 150	0.2	Agriculture, open land	Road crossing	No
1180	35.3	50 x 150	0.2	Open land	Road crossing	No
1182	35.3	50 x 400	0.5	Open land, residential	Road crossing	No
1184	35.4	50 x 200	0.2	Agriculture	Stream crossing	No
1185	35.6	25 x 285	0.2	Agriculture	Pipeline crossing	No
1186	36.0	25 x 200	0.1	Agriculture	Pipeline crossing	No
1187	36.4	246 x 226	1.2	Agriculture, developed land, open land	Stream crossing	No
1189	36.4	50 x 200	0.3	Agriculture	Road crossing	No
1190	36.5	47 x 209	0.2	Agriculture	Road crossing	No
1190A	36.5	100 x 150	0.5	Agriculture, open land	Road crossing	No
1191	36.7	65 x 200	0.3	Agriculture	HDD – Oklahoma Kansas and Texas Railroad	No
1191A	36.7	35 x 200	0.2	Agriculture	HDD – Oklahoma Kansas and Texas Railroad	No
1192	37.0	65 x 200	0.3	Open land	HDD – Oklahoma Kansas and Texas Railroad	No
1192A	37.0	35 x 200	0.2	Open land	HDD – Oklahoma Kansas and Texas Railroad	No
1192B	37.1	75 x 1744	2.8	Open land	Spoils for significant PI	No
1192C	37.3	50 x 200	0.2	Developed land, open land	Staging area for parking/equipment	No
1193	37.4	25 x 200	0.1	Agriculture	Pipeline crossing	No
1194	37.8	50 x 150	0.2	Open land	Road crossing	No
1195	37.8	50 x 150	0.2	Open land	Road crossing	No
1197	38.2	50 x 150	0.2	Open land	Road crossing	No
1198	38.2	50 x 150	0.2	Agriculture, open land	Road crossing	No
1199	38.8	25 x 200	0.1	Agriculture	Pipeline crossing	No
1200	38.9	50 x 200	0.3	Agriculture, open land	Road crossing	No
1201	38.9	50 x 150	0.2	Agriculture	Road crossing	No
1201A	39.1	50 x 197	0.2	Open land	Staging area for parking/equipment	No
1202	39.3	50 x 143	0.2	Open land	Stream crossing	No
1203	39.4	50 x 74	0.1	Forest, open land	Stream crossing	No
1204	40.0	50 x 150	0.2	Agriculture, open land	Road crossing	No
1205	40.0	50 x 150	0.2	Agriculture	Road crossing	No
1206	40.7	50 x 150	0.2	Open land	Road crossing	No
1207	40.8	50 x 257	0.2	Agriculture, open land	Road crossing	No
1208	41.1	50 x 200	0.2	Open land	Stream crossing	No
1209	41.1	50 x 200	0.2	Forest	Stream crossing	No
1210	42.2	50 x 150	0.2	Open land	Road crossing	No
1211	42.2	50 x 107	0.1	Open land	Road crossing/stream crossing	No
1212	42.3	50 x 108	0.2	Agriculture, forest	Stream crossing	No
1213	43.7	50 x 200	0.2	Open land	Stream crossing	No
1214	43.7	50 x 117	0.1	Forest, open land	Stream crossing	No
1215	43.7	50 x 151	0.2	Open land	Stream crossing	No
1216	44.0	50 x 150	0.2	Open land	Road crossing	No
1217	44.1	50 x 150	0.2	Open land	Road crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1217A	44.5	50 x 290	0.3	Open land	Road crossing	No
1218	44.9	100 x 150	0.4	Agriculture, open land	Road crossing	No
1219	45.0	100 x 150	0.3	Agriculture	Road crossing	No
1220	45.4	50 x 150	0.2	Agriculture, open land	Road crossing	No
1222	45.4	50 x 140	0.1	Open land	Road crossing	No
1223	45.7	50 x 190	0.2	open land	Stream crossing	No
1224	45.7	50 x 200	0.2	Forest, open land	Stream crossing	No
1225	45.9	50 x 200	0.3	Forest, open land	Road crossing	No
1226	45.9	157 x 72	0.3	Forest, open land	Road crossing	No
1229	46.4	50 x 100	0.1	Forest, open land	Stream crossing	No
1230	46.5	50 x 225	0.3	Forest, open land	Road crossing/stream crossing	No
1231	46.5	50 x 150	0.2	Agriculture, forest	Road crossing	No
1232	46.7	50 x 200	0.3	Agriculture	Temporary soil storage	No
1233	47.5	50 x 85	0.1	Agriculture	Meter Station Construction	No
1234	47.6	150 x 55	0.2	Agriculture	Pipeline crossing	No
1236	47.6	50 x 150	0.2	Open land	Road crossing	No
1237	48.7	50 x 150	0.2	Agriculture, open land	Road crossing	No
1238	48.7	50 x 150	0.2	Agriculture	Road crossing	No
1240	48.8	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1241	48.8	50 x 200	0.2	Open land	Stream crossing	No
1242	49.1	100 x 150	0.3	Open land	Road crossing	No
1243	49.2	50 x 264	0.3	Developed land, open land	Road crossing	No
1244	49.3	50 x 200	0.3	Agriculture	Road crossing	No
1243A	49.3	50 x 136	0.1	Agriculture, open land	Road crossing	No
1244A	49.9	50 x 200	0.3	Agriculture	Spoils for significant PI	No
1245	50.0	50 x 143	0.2	Agriculture	Road crossing	No
1246	50.0	50 x 150	0.1	Agriculture, developed land	Road crossing	No
1247	50.1	50 x 200	0.2	Agriculture, open land	Pipeline crossing	No
1248	50.4	50 x 268	0.3	Agriculture, forest	Pipeline crossing/stream crossing	No
1249	50.4	50 x 200	0.3	Forest, open land	Stream crossing	No
1249A	50.5	50 x 200	0.2	Forest, open land	Environmental feature crossing and spoils for significant PI	No
1250	50.8	50 x 200	0.2	Forest, open land	Stream crossing	No
1251	50.9	50 x 200	0.2	Open land	Stream crossing	No
1252	51.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1253	51.2	50 x 200	0.2	Open land	Stream crossing	No
1254	51.9	50 x 200	0.2	Forest, open land	Stream crossing	No
1255	51.9	50 x 200	0.2	Forest, open land	Stream crossing	No
1255A	52.1	50 x 200	0.2	Open land	Environmental feature crossing	No
1255B	52.1	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1256	52.2	50 x 150	0.2	Open land	Road crossing	No
1257	52.3	45 x 113	0.1	Developed land, open land	Road crossing	No
1256A	52.3	50 x 150	0.2	Developed land, open land	Road crossing	No
1258	52.7	35 x 200	0.2	Developed land, open land	Stream crossing	No
1259	52.7	35 x 200	0.2	Agriculture, forest	Stream crossing	No
1260	53.3	50 x 121	0.1	Open land	Road crossing	No
1259A	53.3	50 x 200	0.2	Forest, open land	Stream crossing	No
1261	53.4	50 x 150	0.2	Open land	Road crossing and pipeline crossing	No
1261A	53.6	50 x 200	0.2	Open land	Spoils for significant PI	No
1261B	53.7	50 x 206	0.2	Open land	Staging area for parking/equipment	No
1261C	53.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1261D	53.9	50 x 200	0.2	Open land	Environmental feature crossing	No

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1262	54.4	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1263	54.5	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1264	54.6	50 x 150	0.2	Agriculture	Road crossing	No
1265	54.6	50 x 150	0.2	Agriculture, forest	Road crossing	No
1266	55.4	25 x 200	0.1	Open land	Pipeline crossing	No
1267	55.4	25 x 200	0.1	Open land	Pipeline crossing	No
1268	55.6	100 x 200	0.4	Open land	Road crossing	No
1270	55.7	100 x 210	0.5	Open land, residential	Road crossing	No
1270A	56.0	50 x 135	0.2	Forest, open land	Stream crossing	No
1270B	56.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1271	56.5	50 x 189	0.2	Open land	Wetland crossing	No
1273	56.8	50 x 174	0.2	Open land	Pipeline crossing/stream crossing	No
1274	56.8	50 x 200	0.2	Forest, open land	Stream crossing	No
1271A	56.8	50 x 356	0.3	Forest, open land	Spoils for significant PI	No
1274A	56.9	50 x 150	0.2	Open land	Road crossing	No
1274B	56.9	50 x 150	0.2	Open land	Road crossing	No
1275	57.0	50 x 200	0.2	Forest, open land	Stream crossing	No
1276	57.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1278	57.4	50 x 200	0.2	Open land	Road crossing	No
1279	57.4	50 x 200	0.3	Open land	Road crossing	No
1280	57.5	50 x 200	0.2	Forest, open land	Stream crossing	No
1281	57.6	50 x 200	0.2	Forest, open land	Stream crossing	No
1282	57.7	50 x 200	0.2	Open land	Stream crossing	No
1283	58.1	35 x 200	0.2	Forest, open land	Stream crossing	No
1284	58.2	35 x 279	0.2	Open land	Stream crossing	No
1285	58.2	35 x 200	0.2	Open land	Stream crossing	No
1286	58.3	35 x 200	0.2	Open land	Stream crossing	No
1287	58.4	35 x 130	0.1	Open land	Stream crossing	No
1288	59.0	50 x 200	0.2	Open land	Road crossing	No
1289	59.0	50 x 106	0.1	Open land	Road crossing/stream crossing	No
1290	59.1	50 x 200	0.2	Open land	Stream crossing	No
1290A	59.1	50 x 205	0.3	Open land	Staging area for parking/equipment	No
1291	59.6	50 x 314	0.4	Forest, open land	Stream crossing	No
1292	59.7	50 x 200	0.2	Forest, open land	Stream crossing	No
1293	59.8	50 x 150	0.2	Open land	Road crossing	No
1294	59.9	50 x 200	0.3	Open land	Road crossing	No
1294A	59.9	50 x 150	0.2	Open land	Spoils for significant PI	No
1295	60.2	50 x 150	0.2	Open land	Road crossing	No
1296	60.2	50 x 220	0.2	Open land	Road crossing	No
1297	60.2	50 x 150	0.2	Forest, open land	Road crossing	No
1297A	60.4	50 x 200	0.3	Open land	Spoils for significant PI	No
1297B	60.5	100 x 100	0.2	Open land	Water access for hydrostatic testing	AS-GR-NHD-WB-335
1298	60.8	50 x 150	0.2	Open land	Stream crossing	No
1299	60.9	50 x 200	0.2	Agriculture, open land	Stream crossing	No
1298A	60.9	50 x 200	0.3	Agriculture	Spoils for significant PI	No
1299A	60.9	50 x 200	0.2	Agriculture, open land	Environmental feature crossing	No
1300	61.0	50 x 375	0.5	Developed land, open land	Stream crossing	No
1299B	61.0	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1301	61.1	50 x 200	0.2	Open land	Stream crossing	No
1302	61.3	25 x 200	0.1	Open land	Pipeline crossing	No
1303	61.5	50 x 150	0.2	Open land	Road crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1304	61.6	50 x 150	0.2	Forest, open land	Road crossing	No
1305	61.9	20 x 200	0.1	Forest, open land	Stream crossing	No
1306	61.9	20 x 200	0.1	Forest	Stream crossing	No
1307	62.4	25 x 200	0.1	Developed land, open land	Pipeline crossing	No
1308	62.5	50 x 150	0.2	Developed land, open land	Road crossing	No
1309	62.6	50 x 146	0.2	Open land	Road crossing	No
1309A	62.7	50 x 200	0.2	Open land	Environmental feature crossing	No
1309B	62.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1310	63.3	99 x 200	0.2	Developed land, forest, open land	Stream crossing	No
1311	63.4	25 x 519	0.4	Developed land, forest, open land	Stream crossing	No
1313	63.6	79 x 127	0.1	Developed land, open land	Road crossing	No
1314	63.6	50 x 150	0.2	Open land	Road crossing	No
1315	63.8	50 x 200	0.2	Open land	Stream crossing	No
1316	63.9	50 x 200	0.2	Open land	Stream crossing	No
1316A	64.4	50 x 150	0.2	Open land	Environmental feature crossing	No
1316B	64.5	50 x 150	0.2	Open land	Environmental feature crossing	No
1317	64.6	50 x 150	0.2	Forest, open land	Road crossing	No
1318	64.6	50 x 150	0.2	Forest, open land	Road crossing	No
1319	64.8	75 x 200	0.3	Open land	HDD – Washita River	No
1319A	64.8	30 x 200	0.1	Open land	HDD – Washita River	No
1320	65.1	75 x 200	0.3	Agriculture	HDD – Washita River	No
1320A	65.2	50 x 420	0.4	Agriculture	HDD – Washita River	No
1320B	65.9	50 x 200	0.2	Agriculture	Staging area for parking/equipment	No
1323	66.1	50 x 150	0.2	Agriculture, open land	Road crossing	No
1324	66.2	50 x 150	0.2	Agriculture	Road crossing and pipeline crossing	No
1327	66.5	50 x 200	0.2	Agriculture	Temporary soil storage	No
1327A	66.9	50 x 200	0.2	Agriculture, forest	Environmental feature crossing	No
1330	67.0	50 x 200	0.2	Open land	Stream crossing	No
1330A	67.0	50 x 204	0.2	Open land	Staging area for parking/equipment	No
1331	67.3	100 x 186	0.4	Open land	Road crossing	No
1332	67.3	100 x 150	0.4	Open land	Road crossing	No
1333	67.4	25 x 200	0.1	Open land	Pipeline crossing	No
1334	67.9	25 x 200	0.1	Forest, open land	Pipeline crossing	No
1335	68.0	25 x 200	0.1	Forest, open land	Pipeline crossing	No
1335A	68.2	50 x 200	0.2	Open land	Stream crossing	No
1335B	68.2	50 x 200	0.2	Open land	Stream crossing	No
1336	68.4	50 x 200	0.2	Open land	Stream crossing	No
1337	68.5	50 x 200	0.3	Open land	Stream crossing	No
1338	68.5	25 x 200	0.1	Developed land, open land	Pipeline crossing	No
1339	68.7	50 x 200	0.2	Forest, open land	Stream crossing	No
1340	68.8	50 x 141	0.2	Forest, open land	Stream crossing	No
1341	68.8	25 x 200	0.1	Open land	Pipeline crossing	No
1341A	68.9	50 x 200	0.2	Open land	Staging area for parking/equipment	No
1342	69.1	50 x 200	0.3	Open land	Temporary soil storage	No
1342A	69.2	50 x 203	0.2	Developed land, open land	Road crossing	No
1343	69.3	50 x 334	0.4	Forest, open land	Pipeline crossing/stream crossing	No
1344	69.4	50 x 200	0.2	Forest, open land	Stream crossing	No
1345	69.4	25 x 200	0.1	Open land	Pipeline crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1343A	69.4	50 x 146	0.2	Forest, open land	Pipeline crossing/stream crossing	No
1346	69.8	50 x 228	0.3	Open land	Road crossing and pipeline crossing	No
1347	69.9	50 x 200	0.2	Agriculture	Road crossing and pipeline crossing	No
1349	71.0	35 x 107	0.1	Agriculture	Stream crossing	No
1350	71.1	60 x 200	0.3	Agriculture, developed land, open land	Stream crossing	No
1351	71.9	50 x 266	0.3	Agriculture, forest	Stream crossing	No
1350A	71.9	50 x 222	0.3	Agriculture	Pipeline crossing and spoils for significant PI	No
1352	72.0	50 x 196	0.2	Forest, open land	Pipeline crossing/stream crossing	No
1353	72.2	50 x 300	0.3	Developed land, open land	Road crossing and pipeline crossing	No
1352A	72.2	50 x 200	0.3	Open land	Spoils for significant PI	No
1353A	72.7	50 x 318	0.4	Forest, open land	Pipeline crossing and spoils for significant PI	No
1353B	72.7	50 x 286	0.3	Open land	Pipeline crossing/stream crossing	No
1356	73.3	51 x 159	0.2	Developed land, open land	Road crossing	No
1358	73.4	50 x 200	0.2	Forest, open land	Stream crossing	No
1359	73.5	25 x 200	0.1	Forest, open land	Pipeline crossing	No
1360	73.7	50 x 200	0.2	Forest, open land	Stream crossing	No
1361	73.8	50 x 200	0.2	Forest	Stream crossing	No
1361A	73.9	50 x 200	0.2	Open land	Spoils for significant PI	No
1361B	73.9	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1362	74.0	25 x 100	0.1	Developed land, open land	Road crossing	No
1363	74.0	58 x 215	0.2	Open land	Road crossing and pipeline crossing	No
1363A	74.1	25 x 222	0.1	Forest, open land	Spoils for significant PI	No
1363B	74.3	50 x 285	0.4	Developed land, forest, open land	Road crossing	No
1363C	74.3	50 x 200	0.2	Developed land, open land	Staging area for parking/equipment	W-GR-WCR-16/12/13-03
1365	74.5	25 x 255	0.2	Open land	Pipeline crossing	No
1366	74.6	50 x 252	0.3	Forest, open land	Pipeline crossing	No
1367	74.8	50 x 200	0.2	Forest	Stream crossing	No
1368	74.9	50 x 200	0.2	Forest, open land	Stream crossing	No
1369	75.1	25 x 200	0.1	Open land	Pipeline crossing	No
1371	75.2	50 x 200	0.3	Open land	Stream crossing	No
1371A	75.2	25 x 137	0.1	Open land	Pipeline crossing and spoils for significant PI	No
1373	75.3	50 x 197	0.2	Forest, open land	Stream crossing	No
1371B	75.3	50 x 200	0.3	Open land	Spoils for significant PI	No
1374	75.4	50 x 223	0.3	Forest	Stream crossing	No
1374A	75.5	25 x 100	0.1	Forest	Spoils for significant PI	No
1375A	75.7	25 x 200	0.1	Forest	Pipeline crossing	No
1376	75.8	25 x 200	0.1	Forest, open land	Pipeline crossing	No
1377	76.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1378	76.2	50 x 200	0.2	Forest, open land	Stream crossing	No
1379	76.3	50 x 200	0.2	Open land	Stream crossing	No
1379A	76.3	50 x 146	0.2	Open land	Road crossing	No
1381	76.5	25 x 206	0.1	Open land	Pipeline crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1381A	76.8	50 x 549	0.6	Developed land, open land	Staging area for parking/equipment	No
1382	77.2	35 x 200	0.2	Forest, open land	Stream crossing	No
1383	77.3	50 x 140	0.2	Open land	Pipeline crossing/road crossing/stream crossing	No
1383A	77.8	50 x 200	0.3	Agriculture	Environmental feature crossing and spoils for significant PI	No
1387	77.9	50 x 187	0.2	Developed land, open land	Pipeline crossing	No
1389	78.2	25 x 200	0.1	Forest, open land	Pipeline crossing	No
Garvin						
1389A	78.4	25 x 200	0.1	Open land	Pipeline crossing and spoils for significant PI	No
1389B	78.4	50 x 200	0.3	Open land	Spoils for significant PI	No
1390	78.6	50 x 200	0.2	Open land	Stream crossing	No
1391	78.6	50 x 200	0.2	Open land	Stream crossing	No
1391A	78.7	50 x 200	0.2	Open land	Stream crossing	No
1391B	78.7	35 x 442	0.3	Open land	Staging area for parking/equipment	No
1391C	78.8	35 x 375	0.2	Open land	Staging area for parking/equipment	No
1391D	78.8	50 x 200	0.2	Open land	Stream crossing	No
1391E	79.0	50 x 206	0.3	Open land	Staging area for parking/equipment	No
1392	79.2	50 x 200	0.2	Open land	Pipeline crossing/stream crossing	No
1393	79.3	50 x 200	0.2	Open land	Stream crossing	No
1394	79.5	25 x 217	0.1	Open land	Pipeline crossing	No
1394A	79.7	50 x 200	0.2	Forest	Environmental feature crossing	No
1396	79.8	50 x 200	0.2	Forest, open land	Stream crossing	No
1398	80.0	50 x 200	0.2	Forest, open land	Stream crossing	No
1396A	80.0	50 x 200	0.3	Forest, open land	Spoils for significant PI	No
1398A	80.1	50 x 223	0.3	Open land	Spoils for significant PI	No
1398B	80.2	50 x 200	0.3	Developed land, open land	Road crossing	No
1398C	80.3	50 x 200	0.3	Forest, open land	Pipeline crossing and spoils for significant PI	No
1398D	80.3	50 x 150	0.2	Open land	Pipeline crossing and spoils for significant PI	No
1400	80.4	50 x 150	0.2	Open land	Road crossing and pipeline crossing	No
1401	80.4	25 x 200	0.1	Open land	Pipeline crossing	No
1400A	80.4	50 x 154	0.2	Open land	Road crossing and spoils for significant PI	No
1401A	80.6	50 x 194	0.2	Developed land, open land	Staging area for parking/equipment	No
1401B	80.9	50 x 200	0.2	Open land	Staging area for parking/equipment	No
1401C	81.0	50 x 200	0.2	Open land	Staging area for parking/equipment	No
1402	81.1	50 x 120	0.1	Open land	Road crossing and pipeline crossing	No
1403	81.1	50 x 165	0.2	Open land	Road crossing	No
1402A	81.1	16 x 50	<0.1	Open land	Pipeline crossing and parking/equipment	No
1404	81.2	50 x 100	0.1	Open land	Stream crossing	No
1405	81.3	50 x 100	0.1	Open land	Stream crossing	No
1406	81.3	50 x 100	0.1	Forest, open land	Stream crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1407	81.5	50 x 200	0.2	Forest, open land	Stream crossing	No
1408	81.6	50 x 200	0.2	Forest, open land	Stream crossing	No
1411	82.1	92 x 124	0.3	Open land	Pipeline crossing	No
1412	82.2	50 x 349	0.4	Open land	Pipeline crossing	No
1413	82.4	50 x 145	0.2	Open land	Road crossing and pipeline crossing	No
1414	82.4	50 x 165	0.2	Open land	Road crossing and pipeline crossing	No
1415	82.5	25 x 150	0.1	Open land	Pipeline crossing	No
1418	82.8	50 x 415	0.5	Forest, open land	Pipeline crossing	No
1419	82.9	50 x 150	0.2	Developed land, forest, open land	Road crossing	No
1420	83.0	50 x 150	0.2	Open land	Road crossing and pipeline crossing	No
1420A	83.1	50 x 200	0.2	Open land	Staging area for parking/equipment	No
1420B	83.7	50 x 200	0.3	Agriculture, developed land, open land	Road crossing and spoils for significant PI	No
1421	83.8	50 x 265	0.3	Forest, open land	Stream crossing	No
1422	83.9	50 x 625	0.7	Open land	Stream crossing	No
1422A	84.0	50 x 200	0.2	Developed land, open land	Spoils for significant PI	No
1424	84.1	50 x 296	0.3	Open land	Pipeline crossing/stream crossing	No
1425	84.1	50 x 200	0.2	Open land	Pipeline crossing/stream crossing	No
1426	84.5	50 x 171	0.2	Developed land, open land	Road crossing	No
1427	84.5	100 x 206	0.3	Developed land, open land	Road crossing and pipeline crossing	No
1428	84.5	50 x 213	0.3	Agriculture, open land	Road crossing and pipeline crossing	No
1429	84.8	50 x 486	0.4	Open land	Pipeline crossing	No
1431	84.9	50 x 200	0.2	Open land	Stream crossing	No
1432	85.0	25 x 200	0.1	Open land	Pipeline crossing	No
1435	85.1	50 x 195	0.2	Open land	Road crossing	No
Stephens						
1436	85.2	50 x 150	0.2	Open land	Road crossing	No
1437	85.5	82 x 2359	0.4	Developed land, forest, open land	Pipeline crossing	No
1437A	85.6	50 x 200	0.2	Forest, open land	Pipeline crossing and parking/equipment	No
1438	85.7	100 x 150	0.3	Forest, open land	Stream crossing	No
1440	85.7	50 x 189	0.2	Open land	Road crossing	No
1441	85.7	50 x 150	0.2	Open land	Road crossing	No
1442	85.8	50 x 200	0.2	Open land	Road crossing	No
1443	85.9	50 x 177	0.3	Developed land, open land	Stream crossing	No
1443A	86.1	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1443B	86.2	50 x 200	0.2	Open land	Environmental feature crossing	No
1445	86.3	25 x 205	0.1	Forest, open land	Pipeline crossing	No
1445A	86.3	50 x 200	0.26	Open land	Road crossing	No
1446	86.6	25 x 434	0.3	Open land	Pipeline crossing	No
1448	86.7	35 x 142	0.1	Developed land, open land	Road crossing	No
1449	86.8	35 x 300	0.2	Agriculture, forest, Developed Land	Road crossing	No
1451	86.9	35 x 200	0.2	Agriculture, Open Land, Forest	Stream crossing	No
1452	87.0	50 x 200	0.2	Agriculture	Stream crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1453	87.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1454	87.1	50 x 200	0.2	Open land	Stream crossing	No
1453A	87.0	50 x 200	0.2	Agriculture	Pipeline crossing/stream crossing	No
1455	87.2	50 x 200	0.2	Forest	Stream crossing	No
1455A	87.2	50 x 200	0.3	Forest	Spoils for significant PI	No
1456	87.3	25 x 200	0.1	Open land	Pipeline crossing	No
1457	87.7	25 x 200	0.1	Open land	Pipeline crossing	No
1458	87.9	50 x 260	0.3	Developed land, open land	Pipeline crossing	No
1459	88.1	25 x 200	0.1	Open land	Temporary soil storage	No
1460	88.2	25 x 200	0.1	Developed land, open land	Pipeline crossing	No
1461	88.4	25 x 268	0.1	Open land	Pipeline crossing	No
1462	88.5	50 x 215	0.3	Open land	Road crossing and pipeline crossing	No
1464	88.5	50 x 198	0.2	Open land	Road crossing	No
1466	88.8	50 x 200	0.2	Open land	Stream crossing	S-ST-WCR-17/10/26-01
1466A	88.8	100 x 100	0.2	Developed land, open land	Water access for hydrostatic testing	AS-ST-NHD-WB-334
1467	88.9	50 x 200	0.2	Open land	Stream crossing	No
1468	89.1	50 x 200	0.2	Open land	Stream crossing	No
1469	89.2	50 x 200	0.2	Forest, open land	Stream crossing	No
1470	89.4	50 x 200	0.2	Open land	Pipeline crossing	No
1470A	89.4	50 x 200	0.2	Open land	Spoils for significant PI	No
1471	89.6	50 x 200	0.3	Forest, open land	Pipeline crossing/stream crossing	No
1471A	89.6	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1472	89.7	50 x 200	0.2	Forest, open land	Pipeline crossing/stream crossing	No
Garvin						
1472A	89.7	50 x 205	0.2	Developed land, open land	Staging area for parking/equipment	No
1473	89.8	50 x 200	0.2	Forest, open land	Stream crossing	No
1472B	89.8	50 x 200	0.3	Open land	Spoils for significant PI	No
1474	89.9	50 x 303	0.4	Forest, open land	Stream crossing	No
1475	90.1	100 x 157	0.5	Open land	Road crossing	No
1476	90.1	100 x 192	0.5	Open land	Road crossing	No
1475A	90.1	50 x 150	0.1	Open land	Stream crossing	No
1478	90.3	25 x 200	0.1	Open land	Pipeline crossing	No
1479	90.4	35 x 200	0.2	Forest, open land	Stream crossing	No
1480	90.4	35 x 200	0.2	Forest, open land	Stream crossing	No
1481	90.6	50 x 170	0.2	Open land	Road crossing and pipeline crossing	No
1482	90.7	50 x 150	0.2	Open land	Road crossing	No
1483	90.9	35 x 200	0.2	Forest, open land	Stream crossing	No
1484	90.9	35 x 200	0.2	Forest	Stream crossing	No
1484A	91.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1485	91.2	50 x 388	0.4	Open land	Stream crossing	No
1486	91.3	35 x 200	0.2	Open land	Stream crossing	No
1487	91.5	25 x 200	0.1	Open land	Pipeline crossing	No
1487A	91.8	50 x 200	0.2	Open land	Stream crossing	No
1487B	91.9	50 x 200	0.2	Open land	Stream crossing	No
1488	92.3	35 x 160	0.1	Forest, open land	Stream crossing	No
1489	92.4	50 x 275	0.3	Open land	Stream crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1490	92.4	50 x 100	0.1	Open land	Stream crossing	No
1489A	92.4	100 x 100	0.2	Open land	Water access for hydrostatic testing	S-GA-TAS-17/10/27-02
1491	92.5	50 x 100	0.1	Open land	Stream crossing	No
1491A	92.6	50 x 154	0.2	Forest	Staging area for parking/equipment	No
1492	92.8	50 x 200	0.2	Forest	Stream crossing	No
1493	92.9	50 x 200	0.2	Forest, open land	Stream crossing	No
1494	93.0	50 x 200	0.2	Open land	Pipeline crossing	No
1493A	93.0	50 x 200	0.2	Open land	Road crossing	No
1495	93.1	50 x 200	0.2	Open land	Stream crossing	No
1496	93.2	50 x 200	0.2	Open land	Stream crossing	No
1497	93.5	50 x 150	0.1	Developed land, open land	Road crossing	No
1498	93.6	50 x 161	0.2	Developed land, open land	Road crossing	No
1499	93.6	50 x 150	0.2	Open land	Road crossing	No
1500	93.7	50 x 200	0.2	Open land	Stream crossing	No
1501	93.7	50 x 200	0.2	Open land	Stream crossing	No
1502	94.2	25 x 200	0.1	Open land	Pipeline crossing	No
1503	94.5	25 x 200	0.1	Open land	Pipeline crossing	No
1503A	94.7	50 x 260	0.3	Open land	Spoils for significant PI	No
1508	94.8	50 x 723	0.7	Forest, open land	Stream crossing	No
1510	94.9	35 x 200	0.2	Open land	Pipeline crossing/stream crossing	No
1511	95.0	35 x 200	0.2	Open land	Stream crossing	No
1511A	95.0	50 x 105	0.1	Developed land, open land	Road crossing	No
1511B	95.0	50 x 200	0.2	Open land	Staging area for parking/equipment	No
1512	95.2	50 x 200	0.2	Open land	Stream crossing	No
1513	95.3	50 x 200	0.2	Open land	Stream crossing	No
1515	95.4	50 x 372	0.3	Open land	Pipeline crossing/stream crossing	No
1516	95.5	50 x 200	0.2	Agriculture, open land	Stream crossing	No
1516A	95.7	50 x 190	0.2	Open land	Staging area for parking/equipment	No
1517	95.8	25 x 200	0.1	Agriculture, open land	Pipeline crossing	No
1518	95.9	50 x 200	0.2	Agriculture, developed land	Stream crossing	No
1518A	95.9	50 x 189	0.2	Agriculture	Environmental feature crossing	No
1518B	95.9	50 x 117	0.1	Open land	Pipeline crossing/stream crossing	No
1519	96.0	50 x 173	0.2	Open land	Pipeline crossing/stream crossing/road crossing	No
1520	96.0	50 x 183	0.2	Developed land, open land	Road crossing	No
1520A	96.2	50 x 213	0.2	Forest, open land	Staging area for parking/equipment	No
1521	96.3	50 x 200	0.2	Forest	Stream crossing	No
1522	96.4	50 x 200	0.2	Forest	Stream crossing	No
1523	96.5	50 x 200	0.2	Forest	Stream crossing	No
1523A	96.5	40 x 373	0.3	Forest	Environmental feature crossing	No
1524	96.6	50 x 352	0.4	Forest	Stream crossing	No
1526	96.7	50 x 169	0.2	Forest, open land	Stream crossing	No
1526B	96.7	25 x 111	0.1	Open land	Pipeline crossing	No
1526A	97.1	50 x 150	0.2	Developed land, forest, open land	Road crossing	No
1526C	97.1	50 x 150	0.2	Open land	Road crossing	No
1528	97.2	50 x 200	0.2	Open land	Temporary soil storage	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1528A	97.4	50 x 200	0.2	Open land	Stream crossing	No
1529	97.5	50 x 356	0.4	Forest, open land	Stream crossing	No
1530	97.6	50 x 200	0.2	Forest	Stream crossing	No
1531	97.7	25 x 250	0.1	Forest, open land	Pipeline crossing	No
1532	98.0	25 x 200	0.1	Open land	Pipeline crossing	No
1532A	98.2	50 x 150	0.2	Developed land, open land	Road crossing	No
1532B	98.2	50 x 150	0.2	Open land	Road crossing	No
1533	98.6	50 x 200	0.2	Forest	Stream crossing	No
1535	98.7	50 x 200	0.2	Forest	Stream crossing	No
1535A	99.0	50 x 200	0.2	Forest, open land	Stream crossing	No
1535B	99.0	50 x 200	0.2	Forest	Stream crossing	No
1536	99.2	50 x 200	0.2	Forest	Pipeline crossing	No
1536A	99.3	50 x 200	0.2	Forest	Pipeline crossing	No
1539	99.6	50 x 200	0.2	Open land	Stream crossing	No
1540	99.7	50 x 200	0.2	Open land	Pipeline crossing/stream crossing	No
1540A	100.1	50 x 200	0.2	Forest	Stream crossing	No
1540B	100.2	50 x 200	0.2	Forest, open land	Stream crossing	No
1541	100.4	100 x 150	0.3	Open land	Sandy bear creek	No
Carter						
1542	100.6	50 x 150	0.1	Open land	Sandy bear creek	No
1542A	100.6	50 x 280	0.3	Open land	HDD – Wildhorse Creek	No
1543	101.1	35 x 200	0.2	Agriculture, open land	Pipeline crossing	No
1543A	101.3	50 x 200	0.2	Agriculture, open land	Road crossing	No
1543B	101.4	50 x 150	0.2	Open land	Road crossing	No
1543C	101.8	50 x 150	0.2	Forest	Road crossing	No
1543D	101.8	50 x 150	0.2	Forest, open land	Road crossing	No
1544	102.0	50 x 150	0.2	Forest, open land	Road crossing	No
1543E	102.0	50 x 200	0.3	Forest, open land	Staging area for parking/equipment	No
1545	102.1	50 x 150	0.2	Forest	Road crossing	No
1545A	102.4	50 x 200	0.3	Open land	Staging area for parking/equipment	No
1545B	102.6	50 x 422	0.5	Open land	Pipeline crossing	No
1546	102.7	50 x 200	0.2	Forest	Pipeline crossing/stream crossing	No
1548	102.9	50 x 200	0.2	Forest	Stream crossing	No
1549	103.0	50 x 100	0.1	Forest, open land	Stream crossing/road crossing	No
1550	103.0	50 x 150	0.2	Forest, open land	Road crossing	No
1551	103.1	25 x 200	0.1	Open land	Pipeline crossing	No
1552	103.2	50 x 150	0.1	Forest, open land	Pipeline crossing	No
1553	103.3	50 x 150	0.2	Forest	Road crossing	No
1554	103.5	50 x 370	0.4	Open land	Road crossing	No
1554A	103.5	50 x 200	0.3	Forest, open land	Spoils for significant PI	No
1555	103.6	50 x 150	0.2	Forest, open land	Stream crossing	No
1556	103.6	50 x 150	0.2	Forest, open land	Stream crossing	No
1557	103.7	50 x 360	0.4	Open land	Pipeline crossing	No
1558	103.8	25 x 225	0.1	Forest, open land	Pipeline crossing	No
1558A	104.1	35 x 200	0.2	Open land	Stream crossing	No
1558B	104.2	40 x 200	0.2	Open land	Staging area for parking/equipment	No
1558C	104.2	35 x 200	0.2	Open land	Stream crossing	No
1559	104.3	35 x 150	0.1	Open land	Road crossing	No
1560	104.3	25 x 150	0.1	Open land	Road crossing	No
1561	104.6	50 x 200	0.2	Open land	Road crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1562	105.0	50 x 291	0.3	Open land	Road crossing	No
1563	105.1	50 x 200	0.2	Open land	Road crossing	No
1564	105.5	50 x 150	0.2	Open land	Road crossing	No
1565	105.5	50 x 150	0.2	Open land	Road crossing	No
1565A	105.7	50 x 200	0.3	Open land	Staging area for parking/equipment	No
1565B	105.8	35 x 150	0.1	Open land	Environmental feature crossing	No
1565C	105.8	35 x 150	0.1	Open land	Environmental feature crossing	No
1566	106.1	25 x 200	0.1	Agriculture, open land	Pipeline crossing	No
1566A	106.2	50 x 200	0.3	Open land	Staging area for parking/equipment	No
1567	106.7	25 x 155	0.1	Forest, open land	Road crossing	No
1568	106.7	25 x 125	0.1	Open land	Road crossing	No
1568A	106.8	50 x 138	0.2	Open land	Environmental feature crossing	No
1569	107.2	25 x 215	0.1	Open land	Pipeline crossing	No
1569A	107.5	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1570	107.6	48 x 225	0.2	Forest, open land	Road crossing	No
1571	107.7	50 x 200	0.2	Open land	Road crossing	No
1572	107.7	25 x 200	0.1	Open land	Pipeline crossing	No
1573	108.0	35 x 287	0.2	Open land	Pipeline crossing	No
1574	108.4	50 x 200	0.2	Open land	Stream crossing	No
1575	108.5	50 x 200	0.2	Open land	Stream crossing	No
1575A	108.7	50 x 200	0.2	Open land	Stream crossing	No
1575B	108.7	50 x 200	0.2	Open land	Stream crossing	No
1575C	108.8	50 x 200	0.2	Forest	Stream crossing	No
1575D	108.9	50 x 200	0.2	Open land	Stream crossing	No
1576	109.0	50 x 200	0.2	Forest, open land	Stream crossing	No
1577	109.0	50 x 200	0.2	Forest	Stream crossing	No
1577A	109.2	50 x 200	0.2	Open land	Environmental feature crossing	No
1578	109.3	50 x 200	0.2	Open land	Stream crossing	No
1578A	109.6	50 x 161	0.2	Forest, open land	Environmental feature crossing	No
1578B	109.6	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1578C	109.8	50 x 197	0.2	Open land	Spoils for significant PI	No
1578D	109.9	50 x 200	0.2	Open land	Environmental feature crossing	No
1578E	110.0	50 x 150	0.1	Open land	Environmental feature crossing	No
1578F	110.0	35 x 150	0.1	Open land	Environmental feature crossing	No
1578G	110.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1578H	110.9	50 x 175	0.2	Open land	Road crossing	No
5000T	110.9	63 x 170	0.2	Open land, open water	Staging area for parking/equipment	S-CR-RKT-17/06/28-02
1578J	111.3	50 x 150	0.2	Forest	Environmental feature crossing	No
1578K	111.4	50 x 150	0.2	Forest, open land	Environmental feature crossing	No
1578L	111.8	50 x 200	0.2	Forest, open land	Pipeline crossing/stream crossing	No
1578M	111.8	50 x 169	0.2	Forest, open land	Pipeline crossing/stream crossing	No
1578N	111.8	50 x 150	0.2	Open land	Environmental feature crossing	No
1578O	112.1	50 x 150	0.2	Open land	Environmental feature crossing	No
1578P	112.1	50 x 150	0.2	Agriculture	Environmental feature crossing	No
1579	112.2	50 x 200	0.3	Agriculture	Pipeline crossing	No
1580	112.8	50 x 200	0.2	Open land	Stream crossing	No
1581	112.8	50 x 200	0.2	Agriculture, open land	Stream crossing	No
1581A	113.0	50 x 200	0.2	Agriculture, open land	Stream crossing	No
1581B	113.1	50 x 337	0.4	Open land	Environmental feature crossing	No
1581C	113.2	50x 200	0.2	Open land	Environmental feature crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1581D	113.2	50 x 200	0.2	Open land	Road crossing	No
1581E	113.3	50 x 200	0.2	Open land	Environmental feature crossing	No
1581F	113.4	50 x 200	0.2	Open land	Environmental feature crossing	No
1581G	113.5	50 x 200	0.2	Open land	Environmental feature crossing	No
1581H	113.6	50 x 200	0.2	Open land	Stream crossing	No
1581J	113.7	50 x 200	0.2	Forest, open land	Stream crossing	No
1581K	113.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1581L	113.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1581M	114.1	25 x 200	0.2	Agriculture, forest	Environmental feature crossing	No
1582	114.2	50 x 150	0.2	Forest, open land	Stream crossing	No
1582A	114.5	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1582B	114.6	50 x 200	0.2	Open land	Environmental feature crossing	No
1583	115.0	50 x 200	0.3	Open land	Wetland crossing	No
1584	115.0	50 x 365	0.4	Open land	Stream crossing	No
1585	115.3	50 x 200	0.2	Open land	Pipeline crossing	No
1586	115.8	50 x 150	0.2	Forest, open land	Stream crossing	No
1587	115.8	50 x 150	0.2	Forest, open land	Stream crossing	No
1587A	116.1	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1587B	116.1	50 x 200	0.2	Open land	Environmental feature crossing	No
1588	116.3	50 x 200	0.2	Agriculture	Wetland crossing	No
1589	116.4	50 x 200	0.2	Open land	Wetland crossing	No
1589A	116.5	25 x 150	0.1	Open land	Environmental feature crossing	No
1590	116.7	25 x 166	0.1	Open land	Pipeline crossing	No
1590A	116.7	50 x 200	0.3	Open land	Spoils for significant PI	No
1590B	116.9	50 x 200	0.2	Open land	Environmental feature crossing	No
1591	117.0	50 x 200	0.2	Open land	Road crossing	No
1592	117.1	50 x 200	0.2	Open land	Road crossing/stream crossing	No
1592A	117.3	50 x 166	0.2	Open land	Environmental feature crossing and spoils for significant PI	No
1592B	117.3	50 x 200	0.2	Agriculture, open land	Environmental feature crossing	No
1593	117.7	25 x 150	0.1	Open land	Wetland crossing	No
1594	117.7	25 x 150	0.1	Open land	Wetland crossing	No
1596	118.2	50 x 200	0.2	Open land	Road crossing	No
1597	118.3	50 x 200	0.2	Open land	Pipeline crossing	No
1598	118.5	70 x 150	0.3	Open land	Road crossing	No
1599	118.6	90 x 308	0.5	Open land	Road crossing and pipeline crossing	No
1599A	118.7	50 x 200	0.2	Open land	Environmental feature crossing	No
1599B	118.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1600	119.1	50 x 432	0.6	Open Land	Road crossing	No
1601	119.2	50 x 156	0.2	Developed land, residential	Road crossing	No
1601A	119.4	25 x 100	0.1	Open land	Environmental feature crossing	No
1601B	119.4	50 x 150	0.2	Open land	Road crossing	No
1601C	119.4	50 x 150	0.2	Open land	Road crossing	No
1601D	119.7	50 x 150	0.2	Open land	Road crossing	No
1601E	119.7	50 x 156	0.2	Open land	Road crossing	No
1601F	119.8	35 x 200	0.2	Forest, open land	Environmental feature crossing	No
1601G	119.9	35 x 200	0.2	Open land	Environmental feature crossing	No
1602	120.1	100 x 200	0.5	Open land	HDD – Henry House Creek	No
1603	120.4	100 x 200	0.5	Open land	HDD – Henry House Creek	No
1604	121.2	50 x 150	0.2	Open land	Road crossing	No
1605	121.2	50 x 150	0.2	Open land	Road crossing	No
1606	121.3	25 x 200	0.1	Open land	Pipeline crossing	No
1607	121.4	50 x 200	0.3	Forest, open land	Stream crossing	No
1608	121.4	50 x 200	0.3	Open land	Stream crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1609	121.5	50 x 200	0.3	Open land	Stream crossing	No
1610	121.7	50 x 200	0.2	Forest	Stream crossing	No
1611	121.8	50 x 200	0.2	Open land	Stream crossing	No
1612	122.0	50 x 151	0.2	Open land	Stream crossing	No
1613	122.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1614	122.3	50 x 200	0.2	Open land	Road crossing	No
1615	122.3	50 x 295	0.4	Open land	Road crossing	No
1616	122.4	50 x 308	0.3	Open land	Road crossing	No
1616A	122.5	50 x 200	0.2	Open land	Environmental feature crossing	No
1616B	122.6	50 x 217	0.3	Open land	Staging area for parking/equipment	No
1616C	122.9	50 x 516	0.5	Agriculture, open land	Pipeline crossing and spoils for significant PI	No
1616D	122.9	50 x 200	0.2	Agriculture, open land	Spoils for significant PI	No
1616E	122.9	50 x 200	0.2	Agriculture, open land	Environmental feature crossing	No
1616F	123.0	50 x 200	0.2	Open land	Environmental feature crossing	No
1616G	123.2	50 x 116	0.1	Forest, open land	Environmental feature crossing	No
1616H	123.3	50 x 217	0.2	Forest	Environmental feature crossing	No
1616J	123.4	50 x 115	0.1	Forest, open land	Stream crossing	No
1616K	123.4	50 x 150	0.2	Forest, open land	Environmental feature crossing	No
1616L	123.5	50 x 200	0.2	Forest, open land	Spoils for significant PI	No
1616M	123.9	50 x 200	0.2	Open land	Spoils for significant PI	No
1617	124.2	50 x 200	0.2	Open land	Stream crossing	No
1618	124.3	50 x 200	0.2	Open land	Stream crossing	No
1618A	124.4	50 x 200	0.2	Open land	Environmental feature crossing and spoils for significant PI	No
1619	124.5	52 x 412	0.5	Forest, open land	Road crossing	No
1620	124.6	77 x 150	0.3	Forest, open land	Road crossing and pipeline crossing	No
1620A	124.7	50 x 200	0.2	Open land	Spoils for significant PI	No
1620B	124.8	50 x 367	0.4	Forest, open land, open water	Pipeline crossing/stream crossing	S-CR-LAG-17/01/05-02, S-JO-LAG-17/06/29-01
1620C	124.8	50 x 200	0.3	Forest, open land, open water	Environmental feature crossing and spoils for significant PI	S-CR-LAG-17/06/29-01
1621	124.9	50 x 200	0.2	Forest, open water	Pipeline crossing	S-CR-LAG-17/01/05-02b, S-CR-LAG-17/01/05-02
1622	124.9	100 x 150	0.4	Developed land, forest, open land	Road crossing and pipeline crossing	No
1623	125.0	186 x 154	0.6	Developed land, open land	Road crossing	No
1624	125.1	126 x 250	0.5	Developed land, open land	Road crossing and pipeline crossing	No
1625	125.3	50 x 178	0.2	Open land	Pipeline crossing	No
1625A	125.4	50 x 150	0.2	Agriculture	Road crossing	No
1625B	125.6	50 x 200	0.2	Agriculture, open land	Environmental feature crossing	No
1625C	125.7	50 x 200	0.2	Open land	Environmental feature crossing	No
1626	126.0	113 x 150	0.4	Open land	Road crossing	No
1627	126.1	135 x 150	0.5	Developed land, open land	Road crossing	No
1628	126.1	50 x 430	0.5	Open land	Wetland crossing	No
1627A	126.1	61 x 254	0.4	Developed land, open land	Water access for hydrostatic testing	S-CR-LAG-17/01/05-89

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1629	126.2	50 x 395	0.5	Open land	Wetland crossing	No
1630	126.5	50 x 200	0.2	Forest, open land	Wetland crossing	No
1631	126.6	50 x 200	0.2	Open land	Wetland crossing	No
1632	126.6	50 x 200	0.2	Forest, open land	Stream crossing	No
1633	126.7	50 x 200	0.2	Forest, open land	Stream crossing	No
1634	126.9	50 x 150	0.2	Forest, open land	Wetland crossing	No
1635	127.0	50 x 150	0.2	Agriculture, forest	Stream crossing	No
1634A	127.0	50 x 136	0.2	Forest	Environmental feature crossing	No
1636	127.4	50 x 200	0.3	Agriculture	Stream crossing	No
1637	127.5	50 x 200	0.2	Agriculture	Stream crossing	No
1638	127.8	50 x 150	0.2	Agriculture, open land	Stream crossing	No
1639	127.9	50 x 152	0.2	Agriculture	Stream crossing	No
1640	128.1	50 x 155	0.2	Agriculture	Road crossing	No
1641	128.1	50 x 57	0.1	Open land	Road crossing	No
1642	128.6	50 x 150	0.2	Open land	Road crossing	No
1642A	128.6	50 x 150	0.2	Open land	Road crossing	No
1642B	128.8	50 x 150	0.2	Forest	Environmental feature crossing	No
1642C	128.9	50 x 150	0.2	Forest	Environmental feature crossing	No
1642D	129.0	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1642E	129.1	50 x 200	0.2	Forest	Environmental feature crossing	No
1642F	129.2	50 x 300	0.3	Forest	Environmental feature crossing	No
1643	129.3	50 x 200	0.3	Forest, open land	Pipeline crossing	No
1644	129.3	50 x 272	0.4	Forest, open land	Pipeline crossing	No
1645	129.4	25 x 220	0.1	Forest, open land	Pipeline crossing	No
1646	129.4	25 x 200	0.1	Forest, open land	Pipeline crossing	No
1647	129.6	50 x 412	0.4	Forest, open land	Pipeline crossing	No
1648	129.7	50 x 200	0.2	Forest, open land	Pipeline crossing	No
1648A	129.7	50 x 188	0.2	Open land	Environmental feature crossing	No
1648B	129.8	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1649	130.0	50 x 200	0.2	Open land	Stream crossing	No
1650	130.1	50 x 95	0.1	Open land	Wetland crossing/stream crossing	No
1651	130.1	50 x 200	0.2	Open land	Wetland crossing	No
1652	130.2	50 x 143	0.2	Forest, open land	Wetland crossing/pipeline crossing/road crossing	No
1653	130.2	50 x 293	0.3	Open land	Road crossing/stream crossing	No
1654	131.1	50 x 200	0.2	Forest, open land	Stream crossing	No
1654A	131.1	50 x 150	0.2	Open land	Environmental feature crossing	No
1655	131.2	50 x 255	0.3	Open land	Road crossing	No
1656	131.3	50 x 150	0.2	Open land	Road crossing	No
1656A	131.4	50 x 200	0.3	Forest, open land	Stream crossing	No
1657	131.6	77 x 150	0.3	Open land	Railroad crossing	No
1656B	131.6	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1658	131.7	275 x 313	1.9	Open land	Railroad crossing	No
1658B	131.8	50 x 200	0.2	Forest, open land	Environmental feature crossing and spoils for significant PI	No
1658C	131.9	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1659	132.0	50 x 500	0.6	Forest, open land	Road crossing	No
1660	132.0	83 x 197	0.4	Open land	Road crossing	No
1660A	132.4	50 x 210	0.2	Forest, open land	Road crossing	No
1661	132.5	25 x 338	0.2	Forest, open land	Pipeline crossing	No
1661A	132.6	50 x 200	0.2	Forest	Environmental feature crossing	No
1661B	132.7	50 x 498	0.6	Forest, open land	Environmental feature crossing	No
1661C	132.8	50 x 271	0.3	Forest	Environmental feature crossing	No
1661D	132.8	50 x 150	0.2	Forest	Environmental feature crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1661E	133.1	50 x 200	0.2	Open land	Environmental feature crossing	No
1661F	133.2	50 x 200	0.2	Open land	Environmental feature crossing	No
1662	133.4	25 x 304	0.2	Open land	Pipeline crossing	No
1662A	133.6	25 x 93	0.1	Open land	Road crossing	No
1662B	133.6	50 x 200	0.3	Forest, open land	Road crossing	No
1662C	133.9	50 x 200	0.2	Forest	Stream crossing	No
1662D	133.9	50 x 200	0.2	Forest	Stream crossing	No
1663	134.0	50 x 255	0.2	Forest, open land	Stream crossing	No
1663A	134.0	50 x 400	0.4	Forest, open land	Pipeline crossing and spoils for significant PI	No
1664	134.2	50 x 357	0.3	Forest, open land	Stream crossing	No
1663B	134.2	50 x 400	0.4	Forest, open land	Pipeline crossing and spoils for significant PI	No
1664A	134.7	50 x 200	0.2	Open land	Spoils for significant PI	No
1664B	134.7	50 x 163	0.2	Agriculture, open land	Road crossing	No
1664C	134.8	25 x 200	0.1	Agriculture	Pipeline crossing	No
1664D	135.1	40 x 432	0.3	Agriculture	Spoils for significant PI	No
1664E	135.1	50 x 350	0.4	Agriculture, open land	Spoils for significant PI	No
1665	135.7	100 x 200	0.5	Open land	HDD – Washita River	No
1666	136.1	100 x 200	0.5	Agriculture	HDD – Washita River	No
1665B	136.1	123 x 142	0.4	Agriculture, developed land	Pipeline crossing	No
1667	136.3	50 x 200	0.2	Open land	Stream crossing	No
1667A	136.4	50 x 200	0.2	Open land	Environmental feature crossing	No
1668	136.5	100 x 150	0.3	Open land	Road crossing	No
1667B	136.5	100 x 253	0.6	Forest, open land	Stream crossing	No
1669	136.8	25 x 429	0.3	Forest, open land	Stream crossing	No
1670	136.9	50 x 311	0.2	Forest, open land	Stream crossing	No
1671	137.1	50 x 200	0.2	Forest, open land	Pipeline crossing	No
1671A	137.2	50 x 136	0.2	Forest	Environmental feature crossing	No
1671B	138.2	50 x 400	0.5	Forest, open land	Pipeline crossing and spoils for significant PI	No
1671C	138.2	40 x 281	0.2	Open land	Pipeline crossing and spoils for significant PI	No
1671D	138.6	50 x 200	0.3	Developed land, open land	Staging area for parking/equipment	No
1672	138.7	25 x 200	0.1	Open land	Pipeline crossing	No
Johnston						
1673	139.4	50 x 200	0.2	Forest, open land	Pipeline crossing	No
1673A	139.5	50 x 200	0.2	Forest	Environmental feature crossing	No
1674	140.0	50 x 150	0.2	Open land	Pipeline crossing	No
1675	140.1	50 x 390	0.5	Open land	Pipeline crossing	No
1675A	140.1	50 x 193	0.1	Open land	Pipeline crossing and spoils for significant PI	No
1675B	140.2	50 x 200	0.2	Open land	Environmental feature crossing	No
1675C	140.3	50 x 200	0.2	Open land	Environmental feature crossing	No
1676	140.4	50 x 250	0.3	Open land	Pipeline crossing	No
1676A	140.6	50 x 200	0.2	Developed land, forest, open land	Road crossing	No
1676B	140.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1676C	140.9	50 x 200	0.2	Open land	Stream crossing	No
1676D	141.0	50 x 350	0.4	Open land	Stream crossing	No
1676E	141.1	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1676F	141.2	50 x 150	0.2	Forest	Environmental feature crossing	No
1676G	141.3	50 x 200	0.3	Forest	Environmental feature crossing	No
1676H	141.3	50 x 200	0.2	Forest	Environmental feature crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1677	141.4	50 x 166	0.2	Forest	Stream crossing	No
1677A	141.5	50 x 87	0.1	Forest	Stream crossing	No
1677B	141.5	50 x 200	0.2	Forest	Stream crossing	No
1677C	141.6	50 x 200	0.2	Forest	Stream crossing	No
1677D	141.7	50 x 200	0.2	Forest	Stream crossing	No
1677E	141.7	50 x 200	0.2	Forest	Stream crossing	No
1677F	141.8	50 x 200	0.2	Forest	Stream crossing	No
1677G	141.9	50 x 200	0.2	Forest	Stream crossing	No
1677H	142.0	50 x 425	0.5	Forest	Stream crossing	No
1677I	142.1	50 x 196	0.2	Forest	Stream crossing	No
1677J	142.2	50 x 222	0.3	Forest	Stream crossing	No
1678	142.4	50 x 240	0.3	Forest	Wetland crossing	No
1679	142.4	50 x 200	0.3	Forest	Pipeline crossing	No
1679A	143.0	50 x 200	0.2	Forest	Stream crossing	No
1679B	143.1	50 x 200	0.2	Open land	Stream crossing	No
1679C	143.2	50 x 200	0.2	Open land	Spoils for significant PI	No
1679D	143.4	50 x 200	0.2	Open land	Spoils for significant PI	No
1679E	143.5	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1679F	143.6	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1680	144.1	14 x 732	0.2	Forest, open land	Stream crossing	No
1680A	144.2	50 x 200	0.3	Open land	Staging area for parking/equipment	No
1681	144.4	14 x 692	0.2	Developed land, forest	Stream crossing	No
1680B	144.4	38 x 30	<0.1	Forest, open land	Equipment access from access road to temporary workspace	No
1680C	144.6	47 x 30	<0.1	Developed land, open land	Equipment access from access road to temporary workspace	No
1680D	144.8	42 x 200	0.2	Developed land, open land	Staging area for parking/equipment	No
1681A	144.9	29 x 340	0.2	Developed land, forest, open land	Stream crossing	No
1680E	145.0	27 x 30	<0.1	Developed land, forest, open land	Equipment access from access road to temporary workspace	No
1681B	145.0	33 x 300	0.2	Developed land, forest	Stream crossing	No
1681C	145.2	41 x 244	0.2	Developed land, forest, open land	Spoils for significant PI	No
1681D	145.2	50 x 200	0.2	Open land	Spoils for significant PI	No
1681E	145.2	50 x 300	0.3	Forest	Environmental feature crossing	No
1681F	145.4	50 x 300	0.3	Forest	Stream crossing	No
1682	145.6	50 x 200	0.3	Forest, open land	Pipeline crossing	No
1682A	145.7	50 x 200	0.3	Developed land, open land	Road crossing and spoils for significant PI	No
1683	145.9	50 x 200	0.2	Forest	Stream crossing	No
1684	146.0	50 x 200	0.2	Forest	Stream crossing	No
1685	146.3	50 x 425	0.5	Developed land, forest, open land	Pipeline crossing	No
1685A	146.4	50 x 200	0.3	Developed land, forest, open land	Stream crossing	No
1685B	146.5	50 x 193	0.2	Forest	Stream crossing	No
1686	146.6	50 x 200	0.3	Forest	Pipeline crossing	No
1685C	146.6	40 x 204	0.2	Developed land, forest, open land	Pipeline crossing and spoils for significant PI	No
1686A	146.8	50 x 200	0.2	Forest	Spoils for significant PI	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1686B	147.6	50 x 200	0.3	Open land	Staging area for parking/equipment	No
1687	148.0	50 x 139	0.2	Forest, open land	Pipeline crossing	No
1687A	148.0	96 x 151	0.3	Forest, open land	Pipeline crossing/stream crossing	No
1687B	148.2	50 x 200	0.2	Forest	Environmental feature crossing	No
1687C	148.3	50 x 225	0.3	Forest	Environmental feature crossing and spoils for significant PI	No
1687D	148.4	50 x 200	0.2	Forest	Road crossing	No
1687E	148.5	50 x 200	0.2	Forest, open land	Stream crossing	No
1687F	148.5	50 x 200	0.2	Forest, open land	Stream crossing	No
1687G	148.6	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1687H	148.7	50 x 200	0.2	Forest	Environmental feature crossing	No
1687J	148.8	50 x 200	0.2	Forest	Stream crossing	No
1687K	148.9	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1688	149.0	50 x 140	0.2	Open land	Pipeline crossing	No
1688A	149.1	50 x 200	0.2	Open land	Environmental feature crossing	No
1688B	149.2	50 x 200	0.2	Open land	Staging area for parking/equipment	No
1688C	149.3	50 x 103	0.1	Open land	Environmental feature crossing	No
1689	149.5	100 x 150	0.4	Agriculture, forest, open land	Pipeline crossing	No
1690	149.6	100 x 150	0.4	Open land	Road crossing	No
1691	149.9	50 x 150	0.3	Open land	Road crossing	No
1692	149.9	40 x 200	0.2	Developed land, forest, open land	Pipeline crossing	No
1693	149.9	50 x 200	0.3	Forest, open land	Road crossing	No
1694	150.1	50 x 180	0.2	Forest	Road crossing	No
1695	150.1	50 x 218	0.2	Open land	Road crossing	No
1696	150.3	50 x 200	0.2	Forest	Stream crossing	No
1697	150.3	50 x 210	0.2	Open land	Stream crossing	No
1698	150.6	50 x 200	0.2	Forest, open land	Wetland crossing	No
1699	150.7	50 x 200	0.2	Forest, open land	Wetland crossing	No
1699A	151.1	30 x 1131	0.8	Developed land, forest, open land, open water, residential	False row required for pull-back string for Rock Creek HDD	S-JO-LAG-17/01/10-06
1699B	151.2	50 x 200	0.2	Open land	Spoils for significant PI	No
1699C	151.3	40 x 425	0.4	Forest, open land	Environmental feature crossing	No
1699D	151.5	130 x 200	0.6	Developed land, forest	HDD – Rock Creek	No
1701	152.1	130 x 200	0.6	Forest, open land	Road crossing and pipeline crossing	No
1702	152.6	50 x 200	0.2	Open land	Stream crossing	No
1703	152.6	50 x 211	0.2	Forest, open land	Stream crossing	No
1704	152.8	50 x 200	0.2	Forest	Road crossing	No
1705	152.8	50 x 200	0.2	Forest, open land	Road crossing and pipeline crossing	No
1706	153.1	50 x 200	0.2	Forest	Road crossing	No
1707	153.3	50 x 293	0.4	Open land	Road crossing	No
1708	153.6	113 x 1057	2.7	Forest, open land, open water	False row required for pull-back string for Pennington HDD	S-JO-AJF-17/01/11-02, S-JO-LAG-17/01/11-01
1709	153.9	100 x 200	0.5	Open land	Stream crossing	No
1710	154.4	50 x 305	0.4	Forest, open land	HDD – Pennington Creek	No
1710A	154.3	40 x 240	0.2	Residential	HDD – Pennington Creek	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1711	154.4	50 x 204	0.2	Forest, residential	Stream crossing	No
1712	154.5	50 x 200	0.2	Forest	Stream crossing	No
1713	154.7	50 x 95	0.1	Forest	Stream crossing	No
1714	154.8	50 x 200	0.2	Forest	Stream crossing	No
1715	154.9	50 x 200	0.3	Open land	Stream crossing	No
1716	155.2	50 x 200	0.3	Forest, residential	Road crossing	No
1717	155.2	50 x 249	0.3	Forest, residential	Road crossing and pipeline crossing	No
1718	155.4	25 x 233	0.1	Residential	Road crossing	No
1719	155.5	125 x 205	0.5	Forest, open land	Road crossing	No
1719A	155.9	50 x 200	0.2	Forest	Environmental feature crossing and spoils for significant PI	No
1719B	156.0	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1719C	156.2	50 x 200	0.2	Open land	Spoils for significant PI	No
1719D	156.3	50 x 200	0.3	Open land	Pipeline crossing and spoils for significant PI	No
1719F	156.3	20 x 82	<0.1	Open land	Spoils for significant PI	No
1719E	156.5	25 x 248	0.1	Open land	Spoils for significant PI	No
1720	156.6	50 x 200	0.2	Forest, open land	Road crossing	No
1721	156.6	50 x 222	0.3	Forest	Road crossing	No
1722	156.8	50 x 412	0.5	Forest	Stream crossing	No
1723	156.9	50 x 200	0.2	Forest	Stream crossing	No
1724	157.6	50 x 200	0.2	Forest	Wetland crossing	No
1725	157.7	50 x 193	0.2	Forest	Wetland crossing/stream crossing	No
1725A	157.8	50 x 414	0.5	Forest, open water	Environmental feature crossing	S-JO-EHK-17/01/13-10a, S-JO-EHK-17/01/13-10b, S-JO-EHK-17/01/13-10d
1725B	157.9	50 x 200	0.2	Forest	Environmental feature crossing	S-JO-EHK-17/01/13-10a
1726	158.3	50 x 200	0.2	Forest	Wetland crossing	No
1727	158.4	50 x 200	0.2	Forest	Stream crossing	No
1728	158.7	50 x 200	0.2	Forest, open land	Wetland crossing	No
1729	158.7	50 x 200	0.2	Forest	Wetland crossing	No
1730	158.8	50 x 225	0.2	Forest	Road crossing	No
1731	158.9	50 x 171	0.2	Agriculture	Road crossing	No
1732	159.0	50 x 200	0.2	Agriculture, open land	Road crossing	No
1733	159.0	100 x 184	0.4	Forest, open land	Road crossing/stream crossing	No
1733A	159.2	35 x 208	0.2	Forest, open land	Stream crossing	No
1733B	159.4	50 x 155	0.2	Forest, open land	Stream crossing	No
1733C	159.5	50 x 200	0.2	Forest, open land	Stream crossing	No
1733D	159.9	35 x 100	0.1	Open land	Stream crossing	No
1733E	160.0	35 x 200	0.2	Forest, open land	Environmental feature crossing	No
1733F	161.2	50 x 200	0.2	Forest	Environmental feature crossing	No
1733G	161.2	50 x 200	0.2	Forest	Environmental feature crossing	No
1734	161.4	50 x 200	0.2	Forest, open land	Stream crossing	No
1735	161.6	50 x 200	0.2	Open land	Stream crossing	No
1736	161.7	25 x 130	0.1	Open land	Wetland crossing	No
1737	161.9	50 x 200	0.2	Agriculture, open land	Wetland crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1737A	161.9	50 x 185	0.2	Agriculture	Staging area for parking/equipment	No
1738	162.0	50 x 445	0.5	Agriculture, developed land	Wetland crossing	No
1739	162.1	50 x 200	0.2	Open land	Road crossing	No
1740	162.2	50 x 200	0.2	Forest, open land	Stream crossing	No
1741	162.3	50 x 200	0.2	Open land	Stream crossing	No
1741A	162.9	50 x 200	0.2	Open land	Environmental feature crossing and spoils for significant PI	No
1741B	163.0	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1741C	163.2	25 x 200	0.1	Forest	Environmental feature crossing	No
1741D	163.3	25 x 200	0.1	Forest	Environmental feature crossing	No
1742	163.4	50 x 173	0.2	Open land	Road crossing	No
1743	163.4	50 x 225	0.2	Agriculture, forest	Road crossing	No
1743A	163.5	50 x 238	0.3	Agriculture	Spoils for significant PI	No
1743B	163.6	50 x 200	0.2	Agriculture	Road crossing	No
1744	163.9	50 x 200	0.2	Agriculture, forest	Road crossing	No
1745	164.0	50 x 187	0.2	Forest, open land	Road crossing	No
1746	164.2	50 x 200	0.2	Open land	Stream crossing	No
1747	164.3	50 x 200	0.2	Open land	Stream crossing	No
1747A	164.7	50 x 200	0.2	Open land	Environmental feature crossing	No
1747B	164.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1748	164.9	50 x 245	0.3	Open land	Road crossing	No
1749	164.9	50 x 242	0.3	Agriculture	Road crossing	No
1750	165.1	50 x 200	0.2	Agriculture	Road crossing	No
1751	165.1	50 x 211	0.2	Open land	Road crossing	No
1752	166.4	50 x 215	0.2	Open land	Road crossing	No
1753	166.5	50 x 200	0.2	Open land	Road crossing	No
1753A	166.9	35 x 200	0.2	Open land	Stream crossing	No
1754	167.1	50 x 150	0.2	Open land	Road crossing	No
1755	167.2	50 x 150	0.2	Open land	Road crossing	No
1756	167.4	50 x 150	0.2	Open land	Road crossing	No
1757	167.4	50 x 125	0.2	Open land	Road crossing	No
1759	168.6	25 x 523	0.3	Forest, open land	Pipeline crossing	No
1760	168.7	25 x 337	0.2	Open land	Pipeline crossing	No
1761	169.5	50 x 200	0.2	Forest	Stream crossing	No
1762	169.5	50 x 200	0.2	Open land	Stream crossing	No
1763	169.6	50 x 138	0.2	Forest, open land	Road crossing	No
1764	169.6	50 x 125	0.2	Forest	Road crossing	No
1765	169.8	50 x 150	0.2	Forest	Stream crossing	No
1766	169.9	50 x 264	0.3	Forest	Stream crossing	No
1767	170.0	50 x 200	0.2	Forest	Stream crossing	No
Bryan						
1767A	170.4	50 x 200	0.2	Open land	Environmental feature crossing	No
1768	170.5	50 x 200	0.2	Open land	Stream crossing	No
1769	170.7	50 x 125	0.2	Open land	Stream crossing	No
1770	170.8	50 x 184	0.2	Agriculture, open land	Stream crossing/road crossing	No
1769B	170.8	50 x 200	0.3	Agriculture	Spoils for significant PI	No
1771	170.9	50 x 150	0.2	Agriculture	Road crossing	No
1772	171.6	86 x 150	0.3	Forest, open land	Road crossing	No
1773	171.6	92 x 232	0.4	Open land	Road crossing	No
1774	171.7	50 x 203	0.2	Open land	Stream crossing	No
1775	171.8	50 x 200	0.2	Forest	Stream crossing	No
1776	171.9	50 x 80	0.1	Forest	Stream crossing	No
1776A	171.9	50 x 85	0.1	Forest	Stream crossing	No
1777	172.0	50 x 353	0.4	Forest, open land	Road crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1778	172.1	50 x 156	0.2	Forest, open land	Road crossing	No
1779	172.1	50 x 205	0.2	Forest, open land	Stream crossing	No
1779A	172.7	50 x 200	0.2	Open land	Environmental feature crossing	No
1779B	172.8	50 x 188	0.2	Open land	Environmental feature crossing	No
1779C	172.9	50 x 220	0.3	Open land	Environmental feature crossing	No
1779D	172.9	50 x 220	0.3	Open land	Environmental feature crossing	No
1779E	173.0	50 x 220	0.3	Forest, open land	Environmental feature crossing	No
1780	173.1	50 x 215	0.2	Forest, open land	Road crossing	No
1781	173.1	50 x 150	0.2	Open land	Road crossing	No
1781A	173.2	35 x 200	0.2	Open land	Environmental feature crossing	No
1781B	173.2	35 x 200	0.2	Open land	Environmental feature crossing	No
1781C	173.4	50 x 200	0.2	Open land	Staging area for parking/equipment	No
1782	173.6	50 x 200	0.2	Agriculture	Stream crossing	No
1783	173.6	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1783A	173.7	50 x 423	0.5	Agriculture, forest, open land	Pipeline crossing and spoils for significant PI	No
1784	173.8	50 x 734	0.9	Forest, open land	Wetland and water crossing and PI	S-BR-TAS-17/10/25-04
1785	174.2	100 x 200	0.5	Forest	Stream crossing	No
1785A	174.3	89 x 1169	2.5	Forest, open land	HDD pullback area	No
1785B	174.6	125 x 126	0.4	Forest, open land	Water access for hydrostatic testing	S-BR-TAS-17/01/16-02
1785C	174.6	50 x 298	0.3	Open land	Environmental feature crossing and spoils for significant PI	No
1785D	174.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1785E	174.9	50 x 200	0.2	Open land	Environmental feature crossing	No
1786	175.1	70 x 152	0.2	Open land	Road crossing	No
1787	175.2	50 x 212	0.3	Open land	Road crossing	No
1788	175.5	50 x 125	0.2	Open land	Road crossing	No
1789	175.5	50 x 184	0.2	Open land	Road crossing	No
1790	175.8	50 x 200	0.2	Open land	Road crossing	No
1790A	175.9	50 x 200	0.2	Forest, open land	Environmental feature crossing	S-BR-AAL-17/01/14-02
1791	176.1	50 x 200	0.2	Open land	Stream crossing	No
1791A	176.2	27 x 192	0.1	Open land	Environmental feature crossing	No
1791B	176.3	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1791C	177.5	25 x 100	0.1	Open land	Environmental feature crossing	No
1791D	177.5	25 x 100	0.1	Open land	Environmental feature crossing	No
1792	177.7	50 x 200	0.2	Open land	Waterbody crossing	No
1793	177.8	50 x 200	0.2	Open land	Waterbody crossing	No
1794	178.1	50 x 529	0.6	Open land	Road crossing	No
1795	178.1	50 x 200	0.3	Open land	Road crossing	No
1795A	178.1	15 x 126	<0.1	Open land	Pipeline crossing and spoils for significant PI	No
1796	178.4	50 x 150	0.2	Open land	Road crossing	No
1797	178.5	50 x 350	0.4	Open land	Road crossing	No
1798	178.6	50 x 200	0.2	Open land	Pipeline crossing	No
1799	178.7	25 x 155	0.1	Open land	Pipeline crossing	No
1799A	179.0	50 x 347	0.3	Open land	Pipeline crossing and parking/equipment	No
1799B	179.3	50 x 200	0.2	Open land	Environmental feature crossing	No
1800	179.4	50 x 511	0.6	Open land	Road crossing	No
1801	179.5	100 x 230	0.5	Open land	Road crossing	No
1801A	179.8	50 x 110	0.1	Open land	Spoils for significant PI	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1801B	179.9	50 x 200	0.2	Open land	Environmental feature crossing	No
1801C	180.1	50 x 200	0.2	Open land	Environmental feature crossing	No
1801D	180.2	50 x 200	0.2	Open land	Environmental feature crossing	No
1802	180.7	89 x 222	0.4	Open land	Railroad crossing	No
1803	180.8	80 x 220	0.4	Forest, open land	Railroad crossing	No
1803A	180.9	50 x 200	0.2	Forest, open land	Stream crossing	No
1804	181.0	50 x 200	0.3	Open land	Pipeline crossing	No
1803B	181.0	50 x 200	0.3	Forest, open land	Stream crossing	No
1804A	181.5	50 x 200	0.3	Open land, residential	Spoils for significant PI	No
1805	181.6	50 x 500	0.6	Forest, open land	Road crossing	No
1804B	181.6	50 x 200	0.2	Residential	Road crossing	No
1805A	181.7	50 x 200	0.2	Open land	Environmental feature crossing	No
1806	181.9	50 x 200	0.2	Forest, open land	Road crossing	No
1807	182.0	50 x 168	0.2	Open land	Road crossing	No
1808	182.5	50 x 200	0.2	Forest, open land	Stream crossing	No
1809	182.6	50 x 200	0.2	Forest, open land	Stream crossing	No
1810	182.7	50 x 153	0.2	Open land	Road crossing	No
1811	182.8	50 x 346	0.4	Open land	Road crossing	No
1811A	182.9	50 x 200	0.2	Open land	Environmental feature crossing	No
1811B	183.3	50 x 200	0.2	Open land	Environmental feature crossing	No
1811C	183.4	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1812	184.0	50 x 150	0.2	Open land	Road crossing	No
1813	184.0	50 x 352	0.4	Open land	Road crossing	No
1813A	184.1	50 x 200	0.2	Open land	Stream crossing	No
1814	184.5	50 x 150	0.2	Open land	Road crossing	No
1815	184.5	50 x 45	0.1	Open land	Road crossing	No
1815A	184.6	50 x 150	0.2	Open land	Environmental feature crossing	No
1815B	185.0	50 x 200	0.2	Agriculture	Environmental feature crossing	No
1815C	185.5	25 x 200	0.1	Forest, open land	Stream crossing	No
1815D	185.6	25 x 200	0.1	Open land	Stream crossing	No
1816	186.0	50 x 200	0.2	Agriculture, forest	Stream crossing	No
1817	186.2	50 x 200	0.2	Open land	Stream crossing	S-BR-TAS-17/01/12-97b
1817A	186.7	50 x 200	0.2	Open land	Environmental feature crossing	No
1817B	186.8	50 x 200	0.2	Open land	Environmental feature crossing	No
1818	187.0	25 x 100	0.1	Open land	Wetland crossing/stream crossing	No
1819	187.0	25 x 100	0.1	Open land	Wetland crossing/stream crossing	No
1820	187.6	50 x 150	0.2	Open land	Road crossing	No
1821	187.7	50 x 150	0.2	Forest, open land	Road crossing	No
1822	188.0	50 x 200	0.2	Forest, open land	Road crossing	No
1823	188.0	50 x 340	0.4	Forest, open land	Road crossing	No
1824	188.3	50 x 162	0.2	Open land	Road crossing	No
1825	188.3	50 x 150	0.2	Forest, open land	Road crossing	No
1826	188.9	50 x 150	0.2	Forest	Road crossing	No
1827	188.9	50 x 150	0.2	Open land	Road crossing	No
1828	189.0	50 x 150	0.2	Forest, open land	Road crossing	No
1829	189.0	50 x 185	0.2	Open land	Road crossing	No
1830	190.0	100 x 180	0.4	Open land	Road crossing	No
1831	190.1	52 x 346	0.4	Open land	Road crossing	No
1831A	190.2	25 x 171	0.1	Residential	Stream crossing	No
1831B	190.5	50 x 200	0.2	Open land	Spoils for significant PI	No
1831C	190.8	50 x 200	0.2	Forest, open land	Environmental feature crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1831D	190.9	50 x 432	0.5	Forest, open land	Spoils for significant PI	No
1831E	191.0	50 x 270	0.3	Open land	Pipeline crossing and spoils for significant PI	No
1831F	191.2	25 x 125	0.1	Open land	Stream crossing	No
1832	191.4	50 x 150	0.2	Forest, open land	Road crossing	No
1833	191.4	50 x 158	0.1	Developed land, open land	Road crossing	No
1834	191.5	50 x 200	0.2	Open land	Stream crossing	No
1835	191.6	50 x 200	0.2	Forest, open land	Stream crossing	No
1836	191.8	50 x 200	0.2	Open land	Stream crossing	No
1837	191.9	50 x 200	0.2	Forest, open land	Stream crossing	No
1837A	192.3	50 x 200	0.2	Forest, open land	Stream crossing	No
1837B	192.4	50 x 472	0.5	Forest	Environmental feature crossing and spoils for significant PI	No
1837C	192.5	50 x 185	0.2	Agriculture, forest	Pipeline crossing/stream crossing	No
1837D	192.5	50 x 200	0.2	Forest	Environmental feature crossing	No
1837E	192.6	50 x 200	0.3	Forest	Spoils for significant PI	No
1837F	192.6	50 x 447	0.6	Agriculture, forest	Pipeline crossing/stream crossing	No
1838	193.5	50 x 150	0.2	Open land	Road crossing	No
1839	193.5	50 x 150	0.2	Agriculture, open land	Road crossing	No
1839A	193.8	50 x 200	0.3	Agriculture	Spoils for significant PI	No
1840	194.0	75 x 150	0.3	Agriculture	Railroad crossing/road crossing	No
1841	194.1	70 x 256	0.3	Agriculture, forest	Railroad crossing/road crossing	No
1842	194.2	50 x 150	0.2	Agriculture	Road crossing	No
1843	194.2	50 x 310	0.3	Agriculture	Road crossing	No
1844	194.4	50 x 200	0.2	Forest, open land	Wetland crossing	No
1845	194.6	50 x 200	0.2	Open land	Wetland crossing	No
1845A	194.6	50 x 200	0.2	Forest, open land	Environmental feature crossing	No
1845B	194.9	50 x 195	0.2	Open land	Staging area for parking/equipment	No
1846	195.4	50 x 293	0.4	Forest, open land	Stream crossing	No
1847	195.5	50 x 200	0.3	Forest, open land	Stream crossing	No
1847A	195.6	50 x 150	0.2	Forest, open land	Stream crossing	AW-BR-NWI-PEM1F-195
1847B	195.7	50 x 150	0.2	Forest	Stream crossing	No
1847C	195.9	50 x 200	0.3	Open land	Temporary soil storage	No
1847D	195.9	50 x 390	0.4	Open land	Spoils for significant PI	No
1847E	196.3	50 x 200	0.2	Forest	Environmental feature crossing	No
1847F	196.4	50 x 106	0.1	Developed land, open land	Road crossing	No
1847G	196.5	50 x 150	0.2	Forest, open land	Temporary spoils	No
1848	197.0	50 x 150	0.2	Open land	Road crossing	No
1849	197.1	25 x 214	0.1	Forest, open land	Road crossing	No
1849A	197.5	50 x 200	0.2	Forest, open land	Temporary soil storage	No
1850	198.0	83 x 151	0.3	Agriculture	Road crossing	No
1851	198.1	84 x 150	0.3	Forest, open land	Road crossing	No
1851B	198.3	40 x 933	0.9	Open land	Compressor station	No
1851A	198.3	40 x 182	0.2	Forest, open land	Compressor station	No
1851C	198.5	338 x 262	2.1	Forest, open land	Compressor station	No
1851D	198.6	50 x 200	0.2	Open land	Environmental feature crossing	No
1851E	198.7	50 x 200	0.2	Agriculture, forest, open land	Environmental feature crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
1851G	198.5	442 x 653	6.8	Open Land	Compressor station	No
1851H	198.5	84 x 385	0.7	Open land	Compressor station	No
1851F	199.0	50 x 200	0.3	Agriculture	Pipeline crossing and spoils for significant PI	No
1854	199.1	50 x 150	0.2	Agriculture, developed land	Road crossing	No
1855	199.1	50 x 150	0.2	Open land	Road crossing	No
1856	199.2	50 x 200	0.2	Forest, open land	Wetland crossing	No
1857	199.3	50 x 200	0.2	Forest, open land	Wetland crossing	No
1858	199.6	50 x 620	0.8	Open land	Pipeline crossing	No
Subtotal			318.5			
CHISHOLM LATERAL						
Kingfisher						
2000A	CH0.0	50 x 305	0.4	Agriculture	Meter station construction	No
2000	CH0.1	50 x 150	0.2	Agriculture, open land	Road crossing	No
2001	CH0.2	50 x 354	0.5	Agriculture	Road crossing and pipeline crossing	No
2002	CH0.2	50 x 150	0.2	Open land	Road crossing and pipeline crossing	No
2003	CH0.3	25 x 200	0.1	Open land	Pipeline crossing	No
2004	CH1.2	50 x 150	0.2	Open land	Road crossing	No
2005	CH1.2	50 x 285	0.3	Open land	Pipeline crossing/road crossing/stream crossing	No
2006	CH1.3	50 x 150	0.2	Open land	Stream crossing	No
2006A	CH1.8	50 x 150	0.2	Agriculture, developed land	Road crossing	No
2007	CH2.1	50 x 262	0.4	Agriculture, open land	Road crossing	No
2008	CH2.2	50 x 361	0.5	Agriculture, open land	Road crossing	No
2009	CH2.4	25 x 200	0.1	Agriculture	Pipeline crossing	No
2010	CH2.6	50 x 197	0.2	Agriculture	Pipeline crossing	No
2010A	CH2.7	50 x 210	0.2	Agriculture	Spoils for significant PI	No
2011	CH2.9	50 x 150	0.2	Agriculture	Temporary soil storage	No
2012	CH2.9	50 x 330	0.4	Agriculture, open land	Temporary soil storage	No
2013	CH3.2	50 x 150	0.2	Open land	Road crossing	No
2014	CH3.3	50 x 244	0.3	Open land	Road crossing and pipeline crossing	No
2015	CH3.4	50 x 200	0.2	Open land	Stream crossing	No
2016	CH3.5	50 x 200	0.2	Open land	Stream crossing	No
2017	CH3.9	50 x 200	0.2	Agriculture	Stream crossing	No
2018	CH3.9	50 x 200	0.2	Agriculture	Pipeline crossing/stream crossing	No
2019	CH4.1	50 x 200	0.2	Agriculture	Stream crossing	No
2020	CH4.2	50 x 200	0.2	Agriculture	Stream crossing	No
2021	CH4.3	50 x 200	0.2	Agriculture	Stream crossing	No
2022	CH4.4	50 x 200	0.2	Agriculture	Stream crossing	No
2023	CH5.0	50 x 150	0.2	Agriculture	Temporary soil storage	No
2024	CH5.1	50 x 150	0.2	Agriculture	Temporary soil storage	No
2025	CH5.2	50 x 150	0.2	Agriculture, open land	Road crossing	No
2026	CH5.2	50 x 150	0.2	Agriculture, open land	Road crossing	No
2027	CH5.7	55 x 265	0.3	Agriculture, open land	Pipeline crossing	No
2028	CH5.9	50 x 200	0.2	Agriculture, open land	Stream crossing	No
2029	CH5.9	50 x 219	0.3	Agriculture, developed land	Stream crossing	No
2030	CH6.0	50 x 331	0.4	Agriculture, open land	Pipeline crossing	No
2031	CH6.1	50 x 244	0.3	Agriculture, open land	Stream crossing	No
2032	CH6.2	50 x 200	0.2	Forest, open land	Stream crossing	No
2033	CH6.3	25 x 195	0.1	Open land	Road crossing	No
2034	CH6.3	50 x 257	0.4	Developed land, open land	Road crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
2035	CH6.5	50 x 115	0.1	Forest, open land	Stream crossing	No
2036	CH6.5	50 x 162	0.2	Open land	Stream crossing	No
2038	CH6.8	25 x 277	0.2	Agriculture, open land	Pipeline crossing	No
2039	CH6.9	25 x 200	0.1	Agriculture	Pipeline crossing	No
2042	CH7.0	50 x 150	0.2	Agriculture, Open Land	Road crossing	No
2040	CH7.0	34 x 94	0.1	Agriculture, developed land, open land	Temporary soil storage	No
2041	CH7.0	25 x 275	0.3	Agriculture, developed land, open land	Road crossing and pipeline crossing	No
2042A	CH7.1	100 x 100	0.2	Open land	Water access for hydrostatic testing	S-KI-WCR-17/10/24-01
2044	CH7.3	50 x 91	0.1	Agriculture, open land	Road crossing	No
2045	CH7.4	50 x 150	0.2	Agriculture, open land	Road crossing	No
2046	CH7.6	50 x 200	0.2	Agriculture, open land	Stream crossing	No
2048	CH7.7	50 x 150	0.2	Open land	Temporary soil storage	No
2049	CH7.7	25 x 200	0.1	Open land	Pipeline crossing	No
2050	CH7.8	50 x 200	0.2	Open land	Stream crossing	No
2051	CH7.9	50 x 200	0.2	Agriculture, open land	Stream crossing	No
2052	CH8.1	35 x 200	0.2	Agriculture, forest	Stream crossing	No
2053	CH8.2	35 x 200	0.2	Agriculture, open land	Stream crossing	No
2054	CH8.4	50 x 150	0.2	Agriculture	Road crossing and pipeline crossing	No
2056	CH8.4	50 x 150	0.2	Open land	Road crossing and pipeline crossing	No
2059	CH8.6	50 x 150	0.2	Agriculture, open land	Wetland crossing	No
2059A	CH8.7	50 x 200	0.2	Agriculture	Spoils for significant PI	No
2062	CH9.4	50 x 300	0.4	Agriculture	Road crossing	No
2063	CH9.4	50 x 149	0.2	Agriculture	Road crossing	No
2065	CH9.5	50 x 200	0.2	Agriculture	Stream crossing	No
2066	CH9.5	50 x 200	0.2	Agriculture, open land	Stream crossing	No
2066A	CH9.7	50 x 200	0.2	Agriculture	Environmental feature crossing	No
2066B	CH9.8	50 x 200	0.2	Agriculture	Environmental feature crossing and spoils for significant PI	No
2066C	CH9.9	50 x 150	0.2	Agriculture	Spoils for significant PI	No
2066D	CH10.2	25 x 200	0.1	Agriculture	Pipeline crossing	No
2066E	CH10.2	50 x 150	0.2	Agriculture, open land	Pipeline crossing/stream crossing	No
2067	CH10.4	50 x 180	0.3	Agriculture	Stream crossing	No
2067A	CH10.4	50 x 157	0.2	Agriculture	Pipeline crossing and spoils for significant PI	No
2068	CH10.5	50 x 112	0.1	Agriculture, open land	Stream crossing	No
2067B	CH10.5	57 x 146	0.2	Developed land, open land	Road crossing	No
2067C	CH10.5	57 x 347	0.5	Agriculture	Pipeline crossing and spoils for significant PI	No
2069	CH11.0	50 x 189	0.2	Agriculture, developed land, open land	Road crossing	No
2070	CH11.0	50 x 150	0.2	Agriculture	Road crossing	No
2071	CH11.6	50 x 150	0.2	Agriculture, open land	Road crossing	No
2072	CH11.6	50 x 150	0.2	Agriculture	Road crossing	No
2073	CH11.8	50 x 200	0.3	Agriculture, open land	Pipeline crossing	No
2074	CH11.9	50 x 296	0.4	Agriculture, open land	Stream crossing	No
2075	CH11.9	50 x 150	0.2	Open land	Stream crossing	No
2076	CH12.2	25 x 229	0.1	Agriculture	Pipeline crossing	No
2077	CH12.6	100 x 200	0.4	Agriculture	Railroad crossing/road crossing	No
2076A	CH12.6	50 x 200	0.2	Agriculture	Pipeline crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
2078	CH12.7	100 x 200	0.5	Agriculture, open land	Pipeline crossing/railroad crossing/road crossing	No
2078A	CH12.8	50 x 200	0.2	Agriculture	Pipeline crossing	No
2078B	CH13.3	50 x 150	0.2	Agriculture, open land	Environmental feature crossing	No
2078C	CH13.4	50 x 150	0.2	Open land	Environmental feature crossing	No
2079	CH13.6	50 x 150	0.2	Agriculture, open land	Road crossing	No
2080	CH13.7	50 x 150	0.2	Agriculture, open land	Road crossing	No
2081	CH14.2	25 x 200	0.1	Agriculture	Pipeline crossing	No
2082	CH14.6	50 x 182	0.2	Open land	Road crossing	No
2081A	CH14.6	50 x 150	0.2	Open land	Environmental feature crossing	No
2083	CH14.7	50 x 344	0.4	Open land	Road crossing and pipeline crossing	No
2085	CH14.8	50 x 150	0.2	Agriculture, open land	Road crossing	No
2086	CH15.1	25 x 140	0.1	Agriculture	Pipeline crossing	No
2086A	CH15.1	25 x 43	<0.1	Agriculture	Temporary soil storage	No
2087	CH15.2	50 x 150	0.2	Agriculture, open land	Stream crossing	No
2088	CH15.3	50 x 150	0.2	Open land	Stream crossing	No
2089	CH15.6	50 x 200	0.2	Open land	Wetland crossing/road crossing	No
2090	CH15.7	50 x 132	0.2	Developed land, open land	Wetland crossing	No
2091	CH15.8	50 x 150	0.2	Agriculture	Road crossing	No
2092	CH16.3	50 x 200	0.2	Open land	Stream crossing	No
2093	CH16.4	50 x 200	0.2	Agriculture	Stream crossing	No
2093A	CH16.5	50 x 339	0.4	Agriculture	Spoils for significant PI	No
2093B	CH16.5	50 x 277	0.3	Agriculture	Spoils for significant PI	No
2094	CH17.1	25 x 200	0.1	Agriculture	Pipeline crossing	No
2095	CH17.3	25 x 200	0.1	Agriculture	Pipeline crossing	No
2096	CH17.8	50 x 150	0.2	Agriculture, open land	Road crossing	No
2097	CH17.9	50 x 150	0.2	Agriculture	Road crossing	No
2098	CH18.1	50 x 379	0.4	Agriculture	Pipeline crossing	No
2099	CH18.2	50 x 150	0.2	Open land	Road crossing	No
2100	CH18.3	50 x 150	0.2	Open land	Road crossing	No
2100A	CH18.5	35 x 200	0.2	Agriculture	Stream crossing	No
2100B	CH18.6	35 x 200	0.2	Open land	Stream crossing	No
2101	CH18.9	35 x 150	0.1	Agriculture	Temporary soil storage	No
2103	CH19.2	50 x 200	0.2	Open land	Stream crossing	No
2104	CH19.3	50 x 297	0.4	Open land	Road crossing and pipeline crossing	No
2105	CH19.3	50 x 150	0.2	Open land	Road crossing	No
2105A	CH19.8	50 x 394	0.4	Agriculture, open land	Spoils for significant PI	No
2108	CH19.9	50 x 200	0.2	Agriculture, open land	Stream crossing	No
2109	CH19.9	50 x 200	0.2	Open land	Stream crossing	No
2110	CH20.3	50 x 250	0.2	Agriculture	Pipeline crossing	No
2110A	CH20.4	50 x 200	0.3	Agriculture	Road crossing and pipeline crossing	No
Subtotal			**27.2**			
VELMA LATERAL						
Stephens						
3000	VE0.0	25 x 196	0.1	Developed land, open land	Temporary soil storage	No
3001	VE0.1	25 x 278	0.2	Open land	Temporary soil storage	No
3002	VE0.2	25 x 560	0.3	Forest, open land, open water	Stream crossing and facility construction	S-ST-WCR-17/04/11-01
3002A	VE0.2	25 x 209	0.1	Forest, open land	Environmental feature crossing and spoils for significant PI	No
3003	VE0.3	25 x 100	0.1	Forest, open land	Stream crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
3004	VE0.3	25 x 138	0.1	Forest, open land	Road crossing	No
3005	VE0.4	25 x 164	0.1	Developed land, forest, open land	Road crossing	No
3005A	VE0.5	25 x 684	0.4	Developed land, open land	Pipeline crossing	No
3006	VE0.6	25 x 476	0.3	Developed land, open land	Pipeline crossing/stream crossing	No
3007	VE0.7	25 x 251	0.1	Open land	Stream crossing	S-ST-WCR-17/04/11-03
3008	VE0.8	25 x 100	0.1	Agriculture	Pipeline crossing/stream crossing	No
3009	VE0.9	25 x 100	0.1	Agriculture	Stream crossing	No
3010	VE1.0	25 x 100	0.1	Open land	Stream crossing	S-ST-WCR-17/04/11-02
3011	VE1.5	25 x 125	0.1	Open land	Road crossing	No
3012	VE1.5	25 x 100	0.1	Open land	Road crossing	No
3013	VE1.8	25 x 200	0.1	Open land	Pipeline crossing	No
3014	VE1.9	25 x 100	0.1	Open land	Stream crossing	No
3015	VE2.0	25 x 100	0.1	Forest, open land	Stream crossing	S-ST-WCR-17/04/11-04
3015A	VE2.1	25 x 142	0.1	Forest	Spoils for significant PI	No
3016	VE2.2	25 x 100	0.1	Forest	Stream crossing	No
3017	VE2.3	25 x 100	0.1	Forest, open land	Stream crossing	No
3018	VE2.5	25 x 100	0.1	Open land	Stream crossing	No
3019	VE2.6	25 x 200	0.1	Agriculture, open land	Stream crossing	No
3020	VE2.7	25 x 200	0.1	Open land	Pipeline crossing	No
3021	VE2.8	25 x 200	0.1	Agriculture	Pipeline crossing	No
3021A	VE2.9	25 x 301	0.2	Agriculture	Pipeline crossing	No
3022	VE3.3	25 x 100	0.1	Agriculture, open land	Stream crossing	No
3023	VE3.4	25 x 131	0.1	Open land	Stream crossing	No
3023A	VE3.5	25 x 100	0.1	Open land	Environmental feature crossing	No
3023B	VE3.5	25 x 277	0.2	Open land	Environmental feature crossing	No
3024	VE3.7	25 x 421	0.3	Forest, open land	Road crossing	No
3025	VE3.8	25 x 175	0.1	Forest, open land	Road crossing	No
3027	VE4.3	25 x 177	0.1	Developed land, open land	Pipeline crossing	No
3028	VE4.4	25 x 433	0.2	Developed land, forest, open land	Environmental feature crossing and PI	W-ST-RKT-17/04/11-23
3029	VE4.5	25 x 140	0.1	Developed land, open land	Pipeline crossing	No
3029A	VE4.6	25 x 220	0.1	Agriculture, developed land	Pipeline crossing	No
3029B	VE4.7	25 x 196	0.1	Agriculture	Road crossing and pipeline crossing	No
3029C	VE4.7	25 x 125	0.1	Agriculture	Road crossing	No
3030	VE4.8	25 x 102	0.1	Agriculture, forest	Stream crossing	No
3031	VE4.9	25 x 100	0.1	Open land	Stream crossing	No
3031A	VE4.9	50 x 201	0.2	Open land	Pipeline crossing and parking/equipment	No
3032	VE5	25x664	0.5	Developed land, forest, open land	Pipeline crossing	No
3033	VE5.2	25 x 200	0.1	Forest, open land	Spoils for significant PI	No
3034	VE5.4	25 x 200	0.1	Open land	Pipeline crossing	No
3034A	VE5.5	25 x 200	0.1	Open land	Pipeline crossing	No
3034B	VE5.7	25 x 200	0.1	Forest, open land	Pipeline crossing	No
3035	VE5.8	25 x 200	0.1	Open land	Pipeline crossing	No
3035A	VE5.9	25 x 340	0.2	Open land	Pipeline crossing	No
3035B	VE6.0	25 x 243	0.2	Open land	Road crossing	No
3035C	VE6.0	25 x 93	0.1	Forest, open land	Road crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
3036	VE6.1	25 x 356	0.2	Forest, open land	Pipeline crossing	No
3037	VE6.2	25 x 144	0.1	Forest, open land	Pipeline crossing	No
3038	VE6.3	25 x 318	0.2	Forest, open land	Pipeline crossing	No
3038A	VE6.4	25 x 545	0.3	Forest, open land	Pipeline crossing	No
3038B	VE6.5	25 x 123	0.1	Forest, open land	Pipeline crossing	No
3038C	VE6.5	25 x 499	0.3	Developed land, forest, open land	Pipeline crossing	No
3038D	VE6.6	25 x 283	0.2	Open land	Pipeline crossing	No
3039	VE6.7	25 x 91	0.1	Open land	Pipeline crossing	No
3039A	VE6.7	25 x 128	0.1	Developed land, open land	Pipeline crossing	No
3040	VE6.8	25 x 237	0.1	Developed land, open land	Pipeline crossing	No
3041	VE6.8	25 x 165	0.1	Open land	Pipeline crossing	No
3042	VE6.9	25 x 197	0.1	Open land	Pipeline crossing	No
3043	VE7.0	25 x 430	0.3	Open land	Road crossing, pipeline crossing, and PI	S-ST-RFT-17/04/10-13
3044	VE7.1	25 x 314	0.2	Open land	Road crossing and pipeline crossing	No
3045	VE7.2	25 x 135	0.1	Open land	Road crossing	No
3046	VE7.2	25 x 111	0.1	Open land	Road crossing	No
3047	VE7.4	25 x 130	0.1	Open land	Pipeline crossing and spoils for significant PI	No
3048	VE7.4	25 x 240	0.2	Forest, open land	Spoils for significant PI	No
3049	VE7.6	25 x 100	0.1	Forest	Stream crossing	No
3050	VE7.7	25 x 100	0.1	Open land	Stream crossing	No
3051	VE7.7	25 x 150	0.1	Developed land, open land	Temporary soil storage	No
3052	VE7.8	25 x 200	0.1	Forest, open land	Temporary soil storage	No
3053	VE7.9	25 x 200	0.1	Forest, open land	Temporary soil storage	No
3053A	VE8.2	25 x 100	0.1	Forest	Temporary soil storage	No
3053B	VE8.3	25 x 100	0.1	Forest	Temporary soil storage	No
3054	VE8.4	25 x 129	0.1	Developed land, forest	Road crossing	No
Carter						
3055	VE8.4	25 x 158	0.1	Developed land, open land	Road crossing	No
3056	VE8.6	25 x 253	0.2	Open land	Pipeline crossing and spoils for significant PI	No
3057	VE8.9	25 x 552	0.3	Developed land, forest, open land	Pipeline crossing	No
3057A	VE9.0	825 x 200	0.1	Developed land, forest, open land	Pipeline crossing	No
3057B	VE9.1	25 x 200	0.1	Forest, open land	Pipeline crossing	No
3058	VE9.2	25 x 260	0.2	Forest, open land	Wetland crossing	No
3059	VE9.4	75 x 145	0.3	Open land	HDD PFO and road crossing	No
3061	VE9.5	10 x 145	0.0	Open land	HDD PFO and road crossing	No
3062	VE9.5	65 x 160	0.3	Open land	HDD PFO and road crossing	No
3063	VE9.7	25 x 239	0.1	Open land	Pipeline crossing	No
3063A	VE9.8	100 x 100	0.2	Forest, open land, open water	Water access for hydrostatic testing	S-CR-WCR-17/10/27-01
3066	VE10.7	25 x 100	0.1	Forest, open land	Stream crossing	No
3067	VE10.7	25 x 100	0.1	Agriculture, developed land	Stream crossing	No
3068	VE10.7	50 x 200	0.2	Agriculture, developed land	Pipeline crossing and parking/equipment	No
3070	VE10.8	25 x 150	0.1	Agriculture	Spoils for significant PI	No
3071	VE11.0	25 x 100	0.1	Agriculture	Temporary soil storage	No
3071A	VE11.1	25 x 100	0.1	Developed land, open land	Stream crossing	No
3073	VE11.4	50 x 209	0.2	Developed land, open land	HDD, road, and resource crossing	No

APPENDIX D (cont'd)

Additional Temporary Workspace (ATWS) Associated with Construction of the Midcontinent Supply Header Interstate Pipeline Project [a]

Project Facility/ County/ ATWS ID	Mile-post	Dimensions (feet) [b]	Area (acres) [b]	Land Use	Justification for ATWS	Within 50 Feet of Wetland or Waterbody [c]
3074	VE11.4	25 x 188	0.1	Developed land, open land	HDD, road, and resource crossing	
3075	VE11.5	25 x 73	<0.10	Forest, open land	HDD, road and pipeline crossing	No
3076	VE11.5	17 x 638	0.7	Forest, open land	HDD, road crossing, and PI	No
Garvin						
3077	VE11.8	25 x 152	0.1	Forest	Road crossing	No
3078	VE11.8	25 x 150	0.1	Agriculture	Road crossing	No
3078A	VE12.0	25 x 160	0.1	Agriculture	Spoils for significant PI	No
3078B	VE12.4	25 x 150	0.1	Forest	Spoils for significant PI	No
3079	VE12.6	25 x 100	0.1	Forest	Temporary soil storage	No
3080	VE12.7	25 x 73	<0.1	Forest, open land	Road crossing	No
3081	VE12.7	25 x 309	0.2	Forest	Road crossing and pipeline crossing	No
3082	VE12.8	25 x 220	0.1	Forest, open land	Spoils for significant PI	No
3081A	VE12.8	25 x 92	0.1	Forest, open land	Pipeline crossing/stream crossing	No
3083	VE13.2	25 x 134	0.1	Agriculture, forest, open land	Spoils for significant PI	No
3084	VE13.2	25 x 226	0.1	Agriculture	Stream crossing	No
3085	VE13.3	25 x 100	0.1	Forest, open land	Stream crossing	S-GA-WCR-17/04/10-02c
3086	VE13.5	25 x 150	0.1	Forest	Environmental feature crossing	Np
3087	VE13.6	160 x 290	1.2	Open land	Compressor station	No
3087A	VE13.6	367 x 296	2.4	Forest, open land	Compressor station	No
Subtotal			14.1			
TOTAL			**359.7**			

[a] ATWS for pipeline, compressor stations, and meter stations. Totals reflect ATWS for these components. New ATWS and changes in ATWS dimensions are due to additional review of constructability requirements.

[b] ATWS dimensions are reported as a long and short side measure; however, many ATWS are irregular in shape. These irregular ATWS were calculated using GIS data and not the generalized long and short side measurements shown.

[c] Wetland and/or waterbody ID provided for ATWS located within 50 feet.

APPENDIX E

TEMPORARY AND PERMANENT ACCESS ROADS ASSOCIATED WITH THE MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT

APPENDIX E

Temporary and Permanent Access Roads Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/ Road ID	Milepost	Length (feet)	Acres	New or Existing	Existing Road Type	Perm./ Temp.	Approx. Existing Width (feet)	Construction Width (feet)	Reason for Use [a]	Proposed Improve-ments [b]
MAINLINE										
Canadian										
TAR-15A	15.8	1,005	0.6	New	Agriculture	Temp.	0	25	D, F	3
Grady										
TAR-15	31.1	1,117	0.7	Existing	Gravel oil and gas lease road	Temp.	15	25	A, D, F	1, 2, 3
		375	0.2	New	Agriculture		0	25		
TAR-16	32.5	2,830	1.3	Existing	Gravel wind farm lease road	Temp.	15	20	E, F, H	1
TAR-17	34.6	2,441	1.4	Existing	Unimproved two-track/field road	Temp.	15	25	A, D, F, H	1, 2
TAR-18	36.5	37	<0.1	Existing	Unimproved two-track/field road	Temp.	15	27	D, F	2
TAR-20	37.3	3,502	2.0	Existing	Gravel wind farm lease road	Temp.	25	25	C, D, F	1
TAR-21	39.1	1,229	0.8	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	2
TAR-22	44.4	2,099	1.2	Existing	Gravel	Temp.	20	25	D, F	1
TAR-23	49.1	1,456	0.9	Existing	Unimproved two-track/field road	Temp.	15	28	A, B, D, F	1, 2
TAR-23A	52.3	141	0.1	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2, 3
TAR-26	53.7	3,397	2.0	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-30	59.1	618	0.4	Existing	Unimproved two-track/field road	Temp.	15	25	A, D, F	1, 2
TAR-15B	60.5	316	0.2	New	Open land	Temp.	0	25	D, F	3
TAR-30A	63.6	200	0.1	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2, 3
TAR-34	65.6	1,349	0.8	Existing	Gravel oil and gas lease road	Temp.	20	25	D, F	1
		256	0.2	New	Open land	Temp.	0	25	D, F	1, 2
TAR-35	66.5	3,346	1.9	Existing	Gravel oil and gas lease road	Temp.	15	25	A, E, F	1
		64	<0.1	New	Open land	Temp.	0	25	D, F	1, 2
TAR-36	67.1	1,360	0.8	Existing	Gravel to unimproved two-track	Temp.	15	25	A, F	1, 2
TAR-39A	68.9	5,257	3.0	Existing	Gravel oil and gas lease road	Temp.	15	25	E, F, H	1
TAR-41	71.1	1,054	0.6	Existing	Unimproved two-track/field road	Temp.	15	25	A, D, F	1, 2
TAR-43	74.3	3,780	2.2	Existing	Gravel oil and gas lease road	Temp.	15	25	B, E, F	1
TAR-44	75.4	2,909	1.7	Existing	Gravel oil and gas lease road	Temp.	15	25	E, F	1
TAR-45A	76.3	6,962	4.0	Existing	Gravel oil and gas lease road to unimproved two-track	Temp.	15	25	A, E, F, H	1, 2
TAR-45C	76.7	2,380	1.4	Existing	Gravel oil and gas lease road	Temp.	15	25	A, E, F, H	1
TAR-45D	76.8	489	0.3	Existing	Gravel oil and gas lease road	Temp.	15	25	E, F, H	1
TAR-46	77.9	3,229	1.9	Existing	Gravel oil and gas lease road	Temp.	15	25	A, E, F, H	1

APPENDIX E (cont'd)

Temporary and Permanent Access Roads Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/ Road ID	Milepost	Length (feet)	Acres	New or Existing	Existing Road Type	Perm./ Temp.	Approx. Existing Width (feet)	Construction Width (feet)	Reason for Use [a]	Proposed Improve-ments [b]
Garvin										
TAR-46A	79.0	563	0.3	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
TAR-48	80.2	714	0.3	Existing	Gravel oil and gas lease road	Temp.	15	25	A, D, F	1
TAR-49	81.1	2,824	1.6	Existing	Gravel	Temp.	15	25	D, F	1
TAR-51	83.1	586	0.4	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-53	84.5	1,990	1.2	Existing	Gravel oil and gas lease road	Temp.	20	25	A, D, F	1
Stephens										
TAR-54	85.5	997	0.7	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
TAR-55	85.9	4,464	2.6	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
TAR-56	87.0	1,262	0.7	Existing	Unimproved two-track to grass field	Temp.	15	25	D, F	1, 2
TAR-57	88.0	914	0.6	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
TAR-58	88.5	114	0.1	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1
TAR-15C	88.8	260	0.2	New	Open land	Temp.	0	25	D, F	3
Garvin										
TAR-59	89.7	3,869	2.2	Existing	Unimproved two-track and gravel oil and gas road	Temp.	15	25	A, D, F	1, 2
		505	0.3	New	Grass field		0	25		
TAR-15D	92.4	711	0.4	New	Open land	Temp.	0	25	D, F	3
TAR-60	92.6	2,655	1.5	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-61	94.5	649	0.4	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-64	95.0	726	0.4	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
TAR-65	95.7	2,168	1.3	Existing	Gravel oil and gas lease road	Temp.	20	25	A, E, F	1
TAR-66	96.0	1,774	1.0	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
		167	0.1	New	Open land		0	25	D, F	1, 2
TAR-67	97.2	464	0.3	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1
TAR-69	100.4	3,098	1.8	Existing	Unimproved two-track/field road	Temp.	15	25	A, E, F	1, 2
Carter										
TAR-70	101.9	1,413	0.8	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1, 2
TAR-71B	102.1	482	0.3	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1, 2

APPENDIX E (cont'd)

Temporary and Permanent Access Roads Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/ Road ID	Milepost	Length (feet)	Acres	New or Existing	Existing Road Type	Perm./ Temp.	Approx. Existing Width (feet)	Construction Width (feet)	Reason for Use [a]	Proposed Improve-ments [b]
TAR-71A	102.5	2,453	1.4	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
TAR-72	103.2	357	0.2	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
TAR-73	103.4	323	0.2	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-74	104.1	691	0.4	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-75	105.6	601	0.4	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-76	106.2	2,107	1.2	Existing	Gravel to unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-77	110.9	7,438	4.3	Existing	Gravel to unimproved two-track/field road	Temp.	15	25	E, F, H	1
TAR-77A	110.9	688	0.4	Existing	Gravel to unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-80	122.6	349	0.2	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-81	124.0	3,155	1.8	Existing	Gravel oil and gas lease road	Temp.	15	25	A, E, F, H	1
TAR-82	125.0	72	0.1	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1, 2
TAR-83	125.1	679	0.4	Existing	Gravel oil and gas lease road	Temp.	20	25	D, F	1, 2
TAR-84	125.9	475	0.3	Existing	Gravel oil and gas lease road	Temp.	20	25	B, E, F	1, 2
TAR-85	126.1	447	0.3	Existing	Gravel oil and gas lease road	Temp.	20	25	B, E, F	1, 2
TAR-86	126.4	1,398	0.8	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-88	132.4	1,134	0.7	Existing	Gravel oil and gas lease road	Temp.	15	25	E, F, H	1, 2
TAR-89	134.8	2,943	1.8	Existing	Gravel oil and gas lease road	Temp.	15	25	E, F, H	1, 2
TAR-90	136.0	5,355	3.1	Existing	Gravel oil and gas lease road	Temp.	15	25	A, E, F, H	1
TAR-91	138.7	4,422	2.6	Existing	Gravel oil and gas lease road	Temp.	15	25	E, F, H	1
Johnston										
TAR-92	140.0	2,405	1.4	Existing	Gravel oil and gas lease road	Temp.	15	25	E, F, H	1
TAR-92D	143.8	6,181	3.6	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1
TAR-92C	144.2	7,939	4.5	Existing	Unimproved two-track/field road	Temp.	15	25	B, D, F	1,2
TAR-92A	144.8	10,002	5.8	Existing	Gravel utility access road	Temp.	15	25	D, F	1
TAR-92B	147.6	3,945	2.3	Existing	Gravel utility access road	Temp.	20	25	D, F	1, 2
TAR-95	149.2	1,235	0.7	Existing	Unimproved two-track/field road	Temp.	15	25	B, E, F, H	1

APPENDIX E (cont'd)

Temporary and Permanent Access Roads Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/ Road ID	Milepost	Length (feet)	Acres	New or Existing	Existing Road Type	Perm./ Temp.	Approx. Existing Width (feet)	Construction Width (feet)	Reason for Use [a]	Proposed Improvements [b]
TAR-96	154.0	1,982	1.2	Existing	Unimproved two-track/field road	Temp.	15	25	A, E, F, H	1
TAR-97	158.7	1,119	0.6	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1, 2
TAR-98	161.9	677	0.4	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1, 2
Bryan										
TAR-100	173.4	2,026	1.2	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-101	179.0	861	0.5	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-102	194.9	412	0.2	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
Sub-Total		160,438	94.7							
CHISHOLM LATERAL										
Kingfisher										
TAR-2	CH1.8	64	<0.1	Existing	Gravel oil and gas lease road	Temp.	30	No change	F	1
TAR-4A	CH5.9	131	0.1	New	Gravel wind turbine access road	Temp.	20	25	D, F	1
TAR-5A	CH7.0	136	0.1	Existing	Unimproved two-track/field road	Temp.	20	25	D, F	1
TAR-5B	CH7.1	545	0.3	New	Agriculture	Temp.	0	25	B, D, F	3
TAR-6	CH7.7	1,866	1.1	Existing	Unimproved two-track/field road	Temp.	15	25	A, D, F	1, 2
TAR-6A	CH10.2	1,204	0.6	Existing	Unimproved two-track/field road	Temp.	15	25	D, F	1, 2
TAR-10	CH12.6	1,481	0.9	New	Grass field	Temp.	0	25	C, D, F	1, 2, 3
TAR-11	CH12.8	449	0.3	New	Open land	Temp.	0	25	B, D, F	3
Sub-Total		5,876	3.3							
VELMA LATERAL										
Stephens										
TAR-68A	VE5.4	5,522	3.2	Existing	Gravel oil and gas lease road	Temp.	15	25	D, F	1, 2
Carter										
TAR-68B	VE9.0	3,189	1.8	Existing	Unimproved two-track/oil and gas lease road	Temp.	15	25	D, F	1, 2
TAR-15E	VE9.7	942	0.5	New	Open land	Temp.	0	25	B, D, F	3

APPENDIX E (cont'd)

Temporary and Permanent Access Roads Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/ Road ID	Milepost	Length (feet)	Acres	New or Existing	Existing Road Type	Perm./ Temp.	Approx. Existing Width (feet)	Construction Width (feet)	Reason for Use [a]	Proposed Improve-ments [b]
Carter/Garvin										
TAR-68C	VE10.7	2,357	1.4	Existing	Gravel oil and gas lease road	Temp.	20	25	D, F	1, 2
Sub-Total		12,010	6.9							
FACILITIES										
BENNINGTON COMPRESSOR STATION										
Bryan										
PAR-68C	198.5	140	0.1	New	Open land	Perm.	0	25	G	1, 4
BENNINGTON METER STATION										
Bryan										
PAR-68B	199.6	12	<0.1	New	Open land	Perm.	0	25	G	1, 4
CALUMET COMPRESSOR STATION										
Canadian										
PAR-14	17.5	21	<0.1	New	Open land	Perm.	0	20	G	1, 4
PAR-15	17.5	12	<0.1	New	Open land	Perm.	0	20	G	1, 4
CANA METER STATION										
Canadian										
PAR-2A	TP0.0	558	0.3	Existing	Existing gas facility road	Perm.	15	20	G	1, 4
CANADIAN VALLEY METER STATION										
Canadian										
PAR-2	10.7	68	<0.1	New	Open land	Perm.	0	20	G	1, 4
CHISHOLM METER STATION										
Kingfisher										
PAR-1	CH0.0	70	<0.1	New	Open land	Perm.	0	20	G	1, 4
GRADY METER STATION										
Garvin										
PAR-47	79.1	4,307	2.5	Existing	Gravel oil and gas lease road	Perm.	15	25	E, F, G, H	1
		894	0.5	New	Open land	Perm.	0	25	E, F, G, H	1
IRON HORSE METER STATION										
Grady										
PAR-22A	47.5	360	0.2	New	Agriculture	Perm.	0	20	E, F, G, H	1, 4
NGPL-801 METER STATION										
Carter										
PAR-68A	119.2	8	<0.1	New	Open land	Perm.	0	25	G	1, 4

APPENDIX E (cont'd)

Temporary and Permanent Access Roads Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/ Road ID	Milepost	Length (feet)	Acres	New or Existing	Existing Road Type	Perm./ Temp.	Approx. Existing Width (feet)	Construction Width (feet)	Reason for Use [a]	Proposed Improve-ments [b]
NGPL Meter Station										
Bryan										
PAR-68E	198.5	140	0.1	New	Open land	Perm.	0	25	G	1, 4
OKARCHE AND MARKWEST METER STATION										
Kingfisher										
PAR-1.1	0.0	15	<0.1	New	Agriculture	Perm.	0	25	G	4
SHOLEM BOOSTER STATION										
Stephens										
PAR-68D	VE7.3	16	<0.1	New	Open land	Perm.	0	25	G	1, 4
TATUMS COMPRESSOR STATION										
Garvin										
PAR-68	99.5	780	0.5	Existing	Unimproved two-track/field road	Perm.	15	25	G	1, 4
VELMA METER STATION										
Stephens										
PAR-69	VE0.1	730	0.3	Existing	Gravel oil and gas lease road	Perm.	15	15	G	1, 4
PAR-69A	VE0.1	99	<0.1	Existing	Gravel oil and gas lease road	Perm.	15	15	G	1, 4
MLV-1100-4										
Grady										
PAR-44A	74.1	201	0.1	Existing	Gravel oil and gas lease road	Perm.	15	20	E, F, G	1
		238	0.1	New	Open land, Forest		0	20	G	1, 4
MLV-1010-2										
Kingfisher										
PAR-6A	CH9.4	152	0.1	New	Agriculture	Perm.	0	20	E, F, G	4
MLV-1100-2										
Grady										
PAR-17A	36.4	251	0.1	New	Agriculture	Perm.	0	20	E, F, G	4
MLV-1100-3										
Grady										
PAR-26A	55.6	117	0.1	New	Open land	Perm.	0	20	E, F, G	4
MLV-1200-3										
Carter										
PAR-90A	136.5	152	0.1	New	Open land	Perm.	0	20	E, F, G	4

APPENDIX E (cont'd)

Temporary and Permanent Access Roads Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/ Road ID	Milepost	Length (feet)	Acres	New or Existing	Existing Road Type	Perm./ Temp.	Approx. Existing Width (feet)	Construction Width (feet)	Reason for Use [a]	Proposed Improve-ments [b]
MLV-1200-4										
Johnston										
PAR-96A	156.3	1,734	0.8	Existing	Unimproved two-track/field road	Perm.	15	20	E, F, G	1, 4
MLV-1200-5										
Bryan										
PAR-100A	175.1	125	0.1	New	Open land	Perm.	0	20	E, F, G	4
MLV-1200-6										
Bryan										
PAR-101A	193.5	169	0.1	New	Open land	Perm.	0	20	E, F, G	4
MLV-1100-5										
Stephens										
PAR-55A	86.7	288	0.4	Existing	Private gravel road	Perm.	25	25	E, F, G	1
Sub-Total		11,657	6.5							
YUKON CONTRACTOR YARD										
Canadian										
TAR-13A	about 15 miles east of MP17	1,512	1.1	Existing	Agriculture	Temp.	40	30	E, F	1, 4
TOTAL		191,493	111.4							

[a] Reason for Use:
- A To access pipeline right of way where stream crossings have not been established.
- B To access pipeline right of way where access to the pipeline at road crossings is not possible.
- C To access pipeline right of way where access to the pipeline at railroad crossings is not possible.
- D Temporary access by heavy equipment and stringing trucks until access along the pipeline right of way is established.
- E Access by heavy equipment for duration of the project.
- F Inspector and trade light weight vehicle access (e.g., cars, pickups, welding rigs, HDD mud trucks).
- G Permanent access (AR-1.1 to Okarche and Mark West Meter Station; PAR-14 and -15 to Calumet Compressor Station; PAR-44 to permanent ROW; AR-47 to Grady Meter Station; PAR-68, 68A, 68C, 68D to Tatums Compressor Stations).
- H Intermediate access to long right-of-way sections.

[b] Proposed Improvements:
- 1 Dress existing road surfaces with gravel if required.
- 2 Install construction mats if required.
- 3 Grade and gravel new temporary roads and/or use construction mats. Restore after construction.
- 4 Grade and gravel new permanent roads, install culverts where required.

APPENDIX F

HORIZONTAL DIRECTIONAL DRILL PROCEDURES AND MUD MONITORING PLAN

Midship Pipeline Company, LLC
Midship Project

Resource Report 2 – Water Resources Appendix 2D -

Horizontal Directional Drill Procedures and Mud Monitoring Plan Docket No. CP17-458-000

April 2018

TABLE OF CONTENTS

1.0 PROJECT INTRODUCTION

Midship Pipeline Company, LLC ("Company") is filing an Application with the Federal Energy Regulatory Commission ("FERC") for a Certificate of Public Convenience and Necessity authorizing it to construct, own and operate the proposed Midship Project ("Project"). As described in more detail in Resource Report 1, the Project includes 199.7 miles of Mainline, along with Chisholm (20.5 miles) and Velma (13.8 miles) laterals, compressor stations, meter stations, and other appurtenant facilities. For environmental and other reasons, the Company has proposed 13 HDDs on the Mainline and Velma Lateral, as follows:

- North Canadian River (Milepost [MP] 7.7)
- Interstate 40 (I-40) (MP 15.7)
- Canadian River (MP 28.4)
- Oklahoma Kansas Texas Railroad (OKT RR) (MP 36.9)
- Washita River #1 (MP 65.0)
- Wildhorse Creek (MP 100.5)
- Henry House Creek (MP 120.2)
- Washita River #2 (MP 135.9)
- Rock Creek (MP 151.7)
- Pennington Creek (MP 154.1)
- Blue River (MP 174.0)
- Wildhorse Creek Tributary/Wetland (MP VE9.5)
- State Highway 76 (Hwy 76) (MP VE11.5)

The purpose of this Plan is to outline general HDD implementation procedures and monitoring and control methods in the event of an unanticipated release of drilling mud during construction. This Plan will also establish the minimum requirements that a Contractor must meet for the Project. The HDD Contractor(s) awarded the Project will be required to prepare a written plan addressing how they will meet and comply with the minimum requirements of this Plan. The Company and its authorized representatives will review the Contractor's plan to ensure that it meets these requirements. Site specific HDD Crossing Plans proposed for the Project are included in Appendix 1C of Resource Report 1.

The term 'Contractor' will be used interchangeably herein to refer to either the Prime Pipeline Construction Contractor or their HDD Subcontractor. The Prime Contractor will ultimately be responsible for their HDD Subcontractor.

2.0 DESCRIPTION OF HDD METHODS

HDD is a trenchless construction method, which is accomplished in three phases using a specialized horizontal drilling rig with ancillary tools and equipment. HDD is a pipeline construction method that avoids or minimizes impact to the ground surface by drilling a hole and pulling the pipeline through it rather than digging a trench. HDD requires the drilling of a small diameter hole, or pilot hole, along a pre-determined design path that originates and terminates on the surface. The pilot hole is then enlarged sufficiently to accommodate the pipeline to be installed. The pipeline may or may not be installed concurrently with the hole enlargement, depending upon the final diameter of the enlarged hole and the soil conditions encountered.

The Contractor will provide the necessary labor, tools, materials and equipment to successfully complete the installation of directionally drilled piping as specified for this Project, within the guidelines set forth herein, and to the alignment, grades and specifications shown on the design drawings.

The Contractor will be responsible for the final constructed product, and for furnishing the qualified labor and supervision, and the equipment and supplies necessary for this method of construction.

HDD techniques are used to create or direct a borehole along a pre-determined path to a specified target location. This involves the use of mechanical and hydraulic deviation equipment to change the boring course and uses instrumentation to monitor the location and orientation of the boring head assembly along the pre-determined course.

Equipment, provided by the Contractor, will include drill bits, mechanical cutters, and/or mud motors along with several small diameter fluid jets to assist in fracturing the rock and soil formations, cooling the drill bits, and displacing the cuttings back to the surface as drill advances towards the target.

Steering will be accomplished by the installation of an offset section of drill stem or "bent sub" that causes the cutterhead to turn eccentrically about its centerline when it is rotating. When steering adjustments are required, the cutterhead-offset section is rotated toward the desired direction of travel and the drill stem is advanced forward without rotation.

3.0 PROTECTION OF UNDERGROUND FACILITIES

The Contractor will undertake the following steps prior to commencing drilling operations:

- Contractor will contact the appropriate federal, state, county and local agencies as directed by permits at least five (5) working days prior to commencing each HDD drilling operation.
- Contractor will contact the local "One-Call" center (or 811) a minimum of two (2) working days before commencing each HDD drilling operation to have all utilities in the area located and marked.
- When requested by the Company, Project Inspectors, or owner of a foreign utility, the Contractor will expose the foreign utility if the HDD will cross within 10 feet of the foreign utility. The foreign utility must be exposed or affirmatively located in situations where the HDD is running parallel and within 10 feet of a foreign utility.

4.0 INSTRUMENTATION

The Contractor will at all times provide and maintain instrumentation which will accurately locate the pilot hole alignment and depth, measure the drill string axial and torsional loads. The Contractor will also monitor mud volumes to determine if mud loss is occurring.

The Contractor will supply in their plan for review and approval the instruments and methods that will be used to provide this information.

The Company, its representative, and the Permitting Agency's representatives will have access to these instruments and their readings at all times. A log of all recorded readings will be maintained, and will become a part of the As-Built record information supplied to the client within 30 days of Project completion.

5.0 PRE-CONSTRUCTION

The Company and its representatives will utilize a qualified and experienced Geotechnical Contractor to complete a series of soil borings including rock cores for each HDD location to define as reasonably as possible the geological substrata of the area to be crossed in order to complete the design of the crossing.

The Geotechnical Contractor will be expected to utilize the information obtained from the soil borings and the United State Army Corps of Engineers ("USACE") publication "Guidelines Installation of Utilities Beneath Corps of Engineers Levees Using Horizontal Directional Drilling" for establishing downhole allowable mud drilling pressures for all HDD's (Formation Pressure Limiting Factor).

The purpose of this publication is to establish drilling mud pressure limits based on soil types and depths under USACE-regulated flood control levees to reduce the chance of inadvertent mud returns to the surface in close proximity to the levees. While this Project will not be crossing any flood control levees, it can serve the same purpose for all HDD's to lessen the likelihood of inadvertent mud returns at the surface for any HDD.

The Company or its assigned engineering representative will use any available Geotechnical Reports and their HDD experience to design each HDD to include the following:

- Name of the feature being crossed
- Type of sampling equipment used for investigation
- Plan and profile alignment sheets showing the location, and subsurface conditions of the proposed HDD crossing
- General classification of soils along path of the proposed HDD using American Association of State Highway and Transportation Officials ("AASHTO") classification descriptions
- Soil densities as determined by blow counts or laboratory analysis
- Tables providing Formation Limiting Pressures for drilling mud for each soil boring
- Elevation(s) of the HDD centerline
- Location of underground utilities and structures (if found during design survey or otherwise provided to designer) which will include the following, if known:
    - Name of utility owner
    - Depth of cover
    - Size or diameter

    - Proximity to HDD
    - Other information provided
- Various general construction related notes
    - For example, the Contractor will confer with utility owners after the "One Call" contacts have been made to verify the information or changes related to known or any unknown utilities. The Contractor will work with the Company or its' engineering representative to alter HDD design if necessary to avoid foreign utilities if changes are required.
    - For example, the Contractor will pothole or excavate, under the direction of the foreign utility owners, any utility that is close enough in location and/or depth that may be impacted by the drilling operations.

6.0 JOB CONDITIONS

If necessary, the Contractor will prepare temporary all weather vehicle access to the HDD Entry and Exit sites. They will also provide a level, hard standing work area for equipment ingress and egress and for the drilling operation area. The work area prepared may generally include the following items based on location.

6.1 ENTRY (RIG SIDE)

- A rectangular area will be prepared approximately 200 feet long by approximately 150 feet wide. Actual size will be based on each location.
- Access will be by approved access roads and/or along the pipeline working right-of-way.
- The ground conditions around the HDD work area may utilize wooden construction or similar mats if necessary.
- A small drill pit will be excavated around the drill hole to temporarily contain the drilling mud and cutting returns until it is pumped to the mud cleaning equipment (see additional equipment below).

6.2 DEAD MAN

The Dead Man (an anchor for the drill rig) comes with the rig. It is usually about 1 foot deep x 22 feet long x 5 feet wide and is the primary anchorage device for the operation. The excavation for the Dead Man must be accurate and the top of the Dead Man must be flush with the ground. If additional anchorage is needed, the mud tanks can be connected to the rear of the rig or anchor piles will be driven to provide adequate stability. The anchorage must be rigid and must not pivot.

6.3 EXIT (PIPE SIDE)

The exit side setup will be similar in size and setup as the entry side except that this side will normally not have a drilling rig.

This is the side where the pipeline will be welded up into long sections to be pulled in after the hole has been drilled and reamed to proper size. Equipment may include the following: welding equipment, pipe side booms, cranes, pipe rollers and supports, and other pipe handling equipment.

6.4 ADDITIONAL EQUIPMENT

Additional equipment supplied by the Contractor that may be used at either side of the drill include:

- Excavators
- 6-inch vacuum assist pumps
- Vacuum truck fitted with booster pumps
- Dewatering pumps
- Mud cleaning system
- Rollers to support pull string
- Pipe cradles
- Drill string trailers
- Other trucks and support equipment

7.0 SAFETY REQUIREMENTS

The Contractor will perform the work in a manner to maximize safety and reduce exposure to personnel and the general public from equipment and potentially hazardous conditions, in accordance with applicable safety standards. The Contractor will provide the Company a written safety plan, and will conduct daily tailgate safety meetings with all personnel on the site.

Perform the directional drilling construction operations in a manner that will minimize the movement of the ground; prevent subsidence of the surface, structures and utilities above; or in the vicinity of the directional drilling operations, and to protect the integrity of the carrier pipe as it is installed.

8.0 PROJECT PERSONNEL

The Contractor will maintain qualified and experienced HDD personnel to observe conditions that might threaten the stability of the HDD path or cause inadvertent mud returns or mud loss. Project personnel generally will include, but may not be limited to, the following:

- Construction Foreman
- Drilling Engineer
- Tracking Engineer
- Mud Engineer
- Rig Operator
- Equipment Operator
- Inspectors
- Laborers

9.0 HOURS OF OPERATION

Generally, HDD operating hours are expected to be during daylight hours, working 10 to 12 hours per day on a 6-day work schedule. When the pipe string is being pulled in, operating hours are normally continuous around the clock until the pipe is completely pulled in.

Where continuous hours of operations are required, the Company will work with homeowners in the vicinity of the drilling operations who may be disturbed by the work to come up with a workable situation to alleviate the landowner's concerns.

10.0 EXECUTION OF THE HDD

10.1 HDD GUIDANCE

Traditionally a Magnetic Guidance System ("MGS") will be setup and operated by drilling personnel experienced with the system. The system uses parallel wires and other electronic transmission and receiving equipment that can accurately detect the depth and location of the drilling head as it progresses along the proposed drill path. As the drilling progresses, the Contractor can adjust the direction of the drill path based on the information received from the MGS. The direction is adjusted by orienting the bent sub in the direction that the adjustment is needed. Directional readings are made and corrected with each addition of a new length of drill pipe, which is generally about 30 feet long; however, directional reading may be made more often.

The layout of the Tru-Tracker wires, or control wires, requires a "line of sight" during the initial survey and layout of the drill. The distance between the Tru-Tracker wires (which are laid on the surface) should be approximately the same distance in width as the depth of the drill at any particular point. For example, if the depth of the HDD is 60 feet deep, the wires should be spaced about 60 feet apart. Tru-Tracker wires should be equidistant from the drilling centerline when viewed along the alignment (plan view). The Tru-Tracker wires do not have to be continuous (i.e., when a river has to be crossed).

The drilling accuracy is directly related to the layout of the Tru-Tracker wires, and experience of the Contractor to read the location of the drill. Depending on the HDD location and depth, the Contractor may need to use other tracking methods such as gyroscopic equipment. As part of the plan, the Contractor will identify the method of tracking they expect to use for approval.

10.2 DIRECTIONAL DRILLING OPERATION

A complete Directional Drilling Rig may consist of the following major components provided by the Contractor:

- Rigs with sufficient capacity for HDD installations will be used. Pull force capacities often range up to 1,000,000 pounds of capacity with over 80,000 ft.-lbs. of torque, as required
- Rig power unit

- Generator
- Water pumps
- Mud tanks, mixing, cleaning and circulation equipment (type and size to be verified by the Contractor)
- Mud pumps
- Drill pipe and racks
- Control cabin
- Tru-Tracker guidance system components (or other approved tracking equipment)
- MGS probe and interface
- Computer, printer, and software
- DC power source current control box and tracking wire
- Miscellaneous tools
- Various sizes of fly cutters, drill bits, mud motors, and barrel reamers
- Dry bentonite bags for preparing drilling mud
- Communication equipment

The drill unit is placed at the entry hole, and aligned with the direction of the drill path. The drill unit is then elevated at the rear so that the entry angle conforms to the proposed drill profile. The rig is then anchored in position and the pilot hole operation begins.

10.2.1 Pilot Hole

The pilot hole operation is executed by using the selected cutting tool, the bent sub steering tool, and the pressurized injection of the bentonite slurry. The drilling is carried out continuously in intervals of 30 feet, equivalent to one length of drill pipe. The alignment and depth is checked and corrected, and then a new length of drill pipe is added, drilled forward and alignment checked until the end of the drill is reached.

Magnetic Guidance System

A MGS probe and interface will be used to provide a continuous and accurate determination of the location of the drill head during the pilot operation. The MGS will be capable of tracking at all depths up to approximately one hundred feet in any soil condition, including hard rock. The MGS will enable the Driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction).

The MGS are generally accurate to +/- 2 percent of the vertical depth of the borehole at each position that readings are taken at depths up to one hundred feet. Ferrous materials will not influence or affect the MGS readings or accuracy.

The actual tracking method used will be identified by the Contractor. The equipment selected will be able to provide the same tracking information for depths involved.

10.2.2 Reaming

Once the drill bits exit at the prescribed location, the downhole assembly (drill bit, steering tool, etc.) is detached and a series of reamers are installed and pullback along the pilot hole until the hole size is larger enough to pull the pipe in. Typically for a 36-inch-diameter pipeline, there will be a 24-inch diameter for the first reaming pass, followed by a 36-inch and 48-inch diameter second and third reaming pass. The Contractor will then run a 36-inch barrel through the hole to ensure a clean bore hole.

During the reaming process, bentonite slurry is pumped under high pressure through the drill string to the reamer.

Reaming operations will be conducted at the discretion of the Contractor to ensure that the hole is sufficient to accommodate the pull section.

Reaming operation diameters are typically limited to 1.5 times the service pipe diameter; however, to avoid damage to the line pipe during installation due to design factors (i.e., soil conditions, project length and/or alignment, soil strata, etc.) the Contractor reserves the right to exceed the 1.5 factor.

When the reaming operation of the hole is completed, a “swab” or “barrel reamer” is pulled through the hole. Drilling mud is pumped through the drill string to the reamer as it is pulled along the drill path. This ensures the hole is prepared for the carrier pipe pullback.

Once the Drill Superintendent is satisfied that the hole is clear of obstructions, and conditioned, and is ready for the pullback operation to begin, the pulling head which has been attached to the pipe to be pulled in, is then connected to the drill string by a swivel, and the pulling operations is started. The swivel prevents the carrier pipe from rotating in the hole during the pullback.

10.3 TESTING, INSPECTION, STRESS LOADS, BUOYANCY, AND POST PULLBACK

10.3.1 Testing and Inspection

Prior to pulling the pipe in, the pipeline will be welded into long pipe strings. All welds will be visually inspected and non-destructively tested. The weld joints will then be coated with a corrosion protective coating and an additional abrasive resistant coating to protect the coating from abrasions as the pipe is pulled in. Prior to pullback, the pipe strings will be hydrostatically tested to a pressure of 95 to 100 percent of the pipe’s specific minimum yield strength (“SMYS”) for a period of not less than 4 hours. The entire length of the pipeline coating will also be inspected to locate any defects in the coating. Repairs will be made, as necessary.

10.3.2 Buoyancy

To reduce friction at the crown of the drilled hole due to the pipe rubbing along the top of the drill hole and the positive buoyancy of the carrier pipe in the bentonite slurry, the Contractor may use a PVC or HDPE pipe inserted in the carrier pipe to inject water into the pipe to counteract the positive buoyancy of the pipe.

The inserted pipe allows the equalization of air pressure on either side of the injected water column in the carrier pipe.

10.3.3 Pulling Loads

The design of the HDD will ensure that the maximum allowable axial tensile load imposed on the pull section will be less than or equal to 90 percent of the pipe specified minimum yield strength. The Contractor will be required to ensure that this tensile load limit is not exceeded.

10.3.4 Torsional Stress

A swivel will be used to connect the pull section to the reaming assembly to minimize or eliminate torsional stress imposed on the carrier pipe section.

10.3.5 Pull Section Support

The pull section will be supported on pipe rollers that are spaced appropriately to adequately support the pipe during the pullback so that it moves freely and the pipe is not damaged, kinked, or wrinkled.

10.3.6 Post Pullback

After the pipeline is installed, the pipeline will be hydrostatically tested for a period of no less than 8 hours at a pressure not less than what is required by the Class location where the pipeline is installed and not more than 100 percent of the pipe's SMYS. The Company may require the test pressure to be greater then what is required by code. Note that the post pullback pressure test may be delayed to instead be included as part of the hydrotest when the testing for that pipeline segment occurs.

10.4 DRILLING FLUIDS

10.4.1 Composition

Drilling fluids will be a non-toxic mixture of bentonite, polymers, and any other additives to help with the drilling procedures. The viscosity may be varied to best fit the soil conditions encountered as recommended by the Contractor.

The Contractor will maintain mud pressures and flow rates during drilling operation to prevent fracturing the sub grade material around and/or above the bore.

The Contractor will maintain their drilling operations to ensure their activities are conducted in a manner to provide a stable borehole and prevent the discharge of drilling fluids to waterbodies or to the land surface due to exceeding anticipated mud pressure limits specified by the Geotechnical Report.

The Contractor will monitor mud volumes used to detect if mud loss is occurring. The Contractor will patrol the HDD path and adjacent areas for any inadvertent returns that may occur, and communicate this to the drilling Superintendent.

The “Formation Pressure Limiting Pressures” for each HDD, based on depth and soil composition, will be established with a safety factor of 1.5 of the pressures calculated by the Geotechnical Contractor and provided in the tables generated in the Geotechnical Report.

10.4.2 Water

Unless the Company has obtained permits to allow for the uptake of water from local waterbodies, the Contractor will supply water from a water hydrant or other approved water source. Non-potable water may need to be tested and/or treated prior to use in a hydrostatic test.

10.4.3 Re-Circulation

Recycled drilling fluid systems will incorporate linear motion shakers to adequately remove solids from the drilling fluids, before they are recycled in the drilling process. The Contractor may provide other drilling fluid handling equipment, as it deems necessary to properly manage the drilling fluids and to minimize drilling related wastes.

The Contractor will provide vacuum truck(s) and/or Frac tanks that have sufficient capacity to collect and transfer drilling fluids from the exit pit to the drilling fluid system, located at the drill entry, or to a disposal site.

10.4.4 Disposal

Disposal of excess drilling fluids will be conducted in compliance with all environmental regulations, right-of-way, workspace agreements and permit requirements. Drilling fluid disposal procedures, including identification of disposal sites, will be submitted to the Company for approval prior to commencing work.

Used drilling muds may be managed several ways: (1) it may be recycled for use at subsequent drill sites, (2) it may be beneficially used onsite for soil amendments, in accordance with any applicable state regulations, (3) it may be provided to a third party to be beneficially reused as fill or a soil amendment to agricultural fields, or (4) it may be disposed of at a commercial disposal site authorized for management of such wastes. Consideration has been given to beneficial use of drilling muds, where practical, to minimize the negative impacts associated with disposal of a potentially useful material. An inadvertent release plan for HDD crossings will be provided prior to construction.

11.0 MONITORING FOR AND CONTROLLING INADVERTENT RETURNS

The Contractor will employ best efforts to maintain full annular circulation of drilling fluids in order to reduce the chance of inadvertent return of mud to the surface in locations other than at the entry and exit holes of the HDD.

Control of drilling fluid returns at locations other than the entry and exit points will use the following methods:

- The Contractor will patrol the right-of-way and adjacent areas, observing the drill path of the HDD, especially at the current location of the drill head during the pilot hole and for each reamer pass.
- If inadvertent surface returns of drillings fluids occur, they will be immediately contained with hand placed barriers (i.e., hay bales, sandbags, silt fences, etc.) and collected using pumps, as practical, provided by the Contractor.
- If the amount of surface return is not great enough to allow practical collection, the affected area will be diluted with fresh water and the fluid will be allowed to dry and dissipate naturally.
- If the amount of surface return exceeds that which can be contained with hand placed barriers, small collection sumps (less than 10 cubic yards) may be used.
- If the amount of the surface return exceeds that which can be contained and collected using small sumps, drilling operations will be suspended until surface return volumes can be brought under control.
- Unsuccessful drill holes will be abandoned and sealed. Grout will be pumped into the hole to completely seal and fill it, except for the top 5 feet where compacted soil will be placed in the hole. The area will be graded to its original contour
- Drilling operations may also be suspended if at any time the Environmental Inspector or Regulatory Agency's monitor determines that the inadvertent returns are endangering environmentally sensitive areas until the Contractor can bring the mud release under control.
- The Environmental Inspector will immediately notify Company personnel in the event of any inadvertent return and make any required regulatory notifications.

To measure the downhole mud injection volume flow rate, the Contractor can use an inline flow meter to calculate the flow rate in gallons per minute ("gpm"). Another method is to calculate by pump size, diameter, and stroke, timed in revolutions per minute.

Calculation of mud returns can be done three different ways:

- Measure the volume of the excavated receiving pits or mud tanks.
- Calculate by tanker volume.
- The Contractor can measure the intake volume of the first receiving tank on the cleaning unit.

Comparison of the injection flow rate and return flow rate can be used to determine mud loss to the formations and/or possible inadvertent returns.

To find the percentage of solids in returns, the Contractor can use a mud balance scale to weigh the mud.

12.0 CONTAINMENT, RESPONSE, AND NOTIFICATION PLAN

During the entire construction process, the Contractor will continuously patrol the pipeline route and adjacent areas for inadvertent returns or other problems. The following will apply:

- On-site observation of the crossing area will be conducted during active drilling with mud circulation.
- Construction personnel will be briefed on what to watch for and will be made aware of the importance of timely detection and response to any release of drilling mud.
- Construction personnel will have appropriate, communication equipment (e.g., radio, cell phones) available at all times during installation of the directionally drilled crossing.
- The Drill Superintendent will have the authority to order installation of containment structures, if needed, and to require additional response measures if deemed appropriate.
- The Environmental Inspector and/or Regulatory Agency's monitor will have the authority to suspend drilling operations until Contractor has brought the release under control and/or require the Contractor to take other actions to minimize and cleanup the release.

13.0 RESPONSE TO INADVERTENT RETURNS

In the event an inadvertent drilling mud return is observed during the crossing, the return will be assessed to determine the amount of drilling mud being released and potential for the release to reach waterbodies or wetlands. Generally, releases will be handled as follows depending on location; however, site specific actions may be different if directed by the Environmental Inspector and/or by a Regulatory Agency's monitor.

13.1 UPLAND AREAS

Evaluate the release to determine if containment structures are warranted and can effectively contain the release. Deploy appropriate containment measures to contain and recover drilling mud as feasible.

Remove excess mud at a rate sufficient to prevent an uncontrolled spreading of drilling fluid beyond the containment area. Suspend drilling if the mud release cannot be controlled until appropriate containment is in place.

13.2 WETLAND AREAS

In the event of a mud release in a wetland area, the Contractor will immediately notify the Company's Environmental Inspector who will make notification to appropriate environmental regulatory agencies.

The Contractor will initiate immediate suspension of drilling until appropriate evaluation and containment measures are completed.

13.3 IN-STREAM

In the event of a mud release in a stream, the Contractor will contain the released drilling mud to prevent solids propagation. The Contractor will immediately suspend the drilling operation if the released volume is determined to pose a threat to human health and safety or the environment. The Contractor then will document the release and immediately notify the Company's Environmental Inspector, who will make notification to appropriate environmental regulatory agencies. If drilling has been stopped, it will not resume until the release has been stopped and contained and the Environmental Inspector (EI) agrees that drilling can resume.

Critical habitat for the Arkansas River shiner exists at the Canadian River crossing. In the event of an inadvertent release of drilling mud within the Canadian River or the 300 feet of adjacent riparian habitat, Midship will immediately notify FERC and the USFWS, in addition to implementing the steps outlined above. Midship proposes that for the Canadian River, in the interest of implementation of a rapid response to a drilling mud release, authorization to contain and clean up a drilling mud release within the river or the adjacent riparian area should be at the discretion of the third-party EI in direct verbal consultation with the Director of OEP (or delegate) and the USFWS. The third-party EI, in direct verbal consultation with these agencies, also would authorize re-commencement of drilling operations.

13.4 CONTAINMENT

Containment, response and clean-up equipment will be made available at the HDD crossing location to assure a timely response. Equipment supplied by the Contractor may include:

- Hay bales
- Push brooms
- Silt fence
- Pumps
- Plastic sheeting
- Mud storage tanks
- Shovels
- Vacuum truck
- Squeegees
- Light plant/generator

13.5 CLEAN-UP BY THE CONTRACTOR

Clean-up measures will be developed following mud release on land or in wetland areas. The following measures are to be considered as appropriate:

- Drilling mud will be cleaned up by hand using hand shovels, buckets and soft-bristled brooms as possible without causing extensive ancillary damage to existing vegetation. Fresh water washes are also to be employed if deemed beneficial and feasible.
- Containment structures will be pumped out and the ground surface scraped to bare soil; without causing ancillary damage to existing vegetation.
- Material will be collected in containers or roll off boxes for temporary storage prior to removal from the site.

- Potential for secondary impact from the clean-up process is to be regularly evaluated and clean-up activities terminated if physical damage to the site is deemed to exceed the benefits of removal activities.
- In general, no clean-up measures will be initiated for in-stream releases. If site-specific conditions are such that containment and clean-up may be feasible and beneficial, fresh water washes or other low-impact steps may be employed without undue disturbance to the stream banks and bed.

Final clean-up of the drill site will return the area as close as practical to pre-drill conditions. Additional clean-up requirements may be stipulated by permit or ROW agreement.

14.0 ALTERNATIVE HDD SITE SELECTION

In the event an HDD cannot be completed at the proposed location, an alternate crossing location will be analyzed. The site conditions of the proposed alternate HDD locations will take into account, including geotechnical conditions, topography, condition of riparian area, water quality, potential threatened and endangered species, within and downstream of the bore area. Appropriate approvals from necessary regulatory agencies will be obtained. Any proposed alternate HDD location will be submitted to FERC with the analysis of the proposed site.

15.0 SITE-SPECIFIC DISCUSSION

Site-specific construction diagrams and a typical HDD drawing can be found in Appendix 1C and Appendix 1E of Resource Report 1, respectively. Table 1 describes planned activities deemed necessary between the entry and exit points of the proposed HDDs.

Table 1. Planned Activities between the Entry and Exit Points of the HDDs

HDD No.	MP	Feature	Type of Clearing Proposed[a]	Notes
1	7.7	North Canadian River	Hand-cleared footpath for guide wire on both sides; additional hand clearing of wider path on the entry (south) side to access water source.	Limited number of trees (approximately 50 feet linear) on south (entry) side to be hand cleared to 10-foot width to allow rubber-tired vehicles to carry hoses, pumps, etc.
2	15.7	I-40	Hand-cleared footpath for guide wire on north side.	South side is open.
3	28.4	Canadian River	Hand-cleared footpath for guide wire on both sides.	Not a water source
4	36.9	Railroad	No clearing needed, except possibly for brush immediately adjacent to the railroad.	Both sides are open.
5	65.0	Washita River	Hand-cleared footpath for guide wire on both sides. Minimal hand clearing, if any, in thin tree line on north side.	Appears open to bank on north (entry) side for rubber-tired vehicle access to carry hoses, pumps, etc. to water source.
6	100.5	Wildhorse Creek	Hand-cleared footpath for guide wire on both sides.	Both sides are relatively open; appears open to bank on south (entry) side for rubber-tired vehicle access to carry hoses, pumps, etc. to water source.
7	120.2	Henry House Creek	Minimal hand clearing, if any, on both sides for guide wires.	Both sides are open; appears open to bank on west (entry) side for rubber-tired vehicle access to carry hoses, pumps, etc.

Table 1. Planned Activities between the Entry and Exit Points of the HDDs

HDD No.	MP	Feature	Type of Clearing Proposed[a]	Notes
				to water source.
8	135.9	Washita River	Hand-cleared footpath for guide wire on both sides; additional hand clearing of wider path on the entry (west) side to access water source.	Limited number of trees (approx.. 150 feet linear) on east (entry) side to be hand cleared to 10-foot width to allow rubber-tired vehicles to carry hoses, pumps, etc.
9	151.7	Rock Creek	Hand-cleared footpath for guide wire on both sides; additional hand clearing of wider path on the entry (east) side to access water source.	For access to the water source, Midship will attempt to acquire permission to use the existing co-located ROW.
10	154.1	Pennington Creek	Hand-cleared footpath for guide wire on both sides, if any clearing is needed.	Not a water source.
11	174.0	Blue River	Hand-cleared footpath for guide wire on both sides.	Not a water source.
12	VE9.5	Wildhorse Creek Tributary/Wetland	Hand-cleared footpath for guide wire on both sides.	Not a water source.
13	VE11.5	State Highway 76	Hand-cleared footpath for guide wire on east side.	Not a water source.

[a] Guide wires mentioned in this column are needed to orient and steer the drill head.

15.1 NORTH CANADIAN RIVER (MAINLINE MP 7.7)

At the North Canadian River HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the river (Table 1). In addition to the hand clearing for guide wires, additional hand clearing will be required on the south side (entry side) for use by rubber-tired vehicles in assisting with accessing water for hydrostatic testing and drilling mud water. This additional hand-cleared access also will serve as a contingency for moving rubber-tired containment and cleanup equipment into the area if an inadvertent release of drilling fluids occurs (Section 13.0).

The space between the HDD entry and exit points at the North Canadian River includes areas under active cultivation, pasture, and strips of trees in uplands near the river banks. All of these areas will be allowed to return to their previous conditions after the HDD has been completed. A small area (approximately 1 acre) of false ROW will be required for this HDD on the south side of the river in the agricultural field adjacent to W Okc 150th Street.

15.2 INTERSTATE 40 (I-40) (MAINLINE MP 15.7)

At the I-40 HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on the north side (exit side) of I-40 (Table 1). Guide wires on the south side (entry side) will be placed in an area cleared already for active agriculture. No additional access is planned, but additional hand clearing could be requested in the field for the forested area on the north side if an inadvertent release of drilling fluids occurs (Section 13.0).

All areas impacted by the I-40 HDD will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

15.3 CANADIAN RIVER (MAINLINE MP 28.4)

At the Canadian River HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the river (Table 1). The Canadian River is not a water source for the Project, so no additional access is planned. However, additional hand clearing could be requested in the field if an inadvertent release of drilling fluids occurs and access for rubber-tired containment and clean-up equipment is needed (Section 13.0).

The space between the HDD entry and exit points at the Canadian River includes mostly thinly forested areas in uplands adjacent to the river, but also small areas under active cultivation or developed for pasture (specifically at the entry and exit points). All of these areas will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

15.4 OKLAHOMA KANSAS TEXAS RAILROAD (OKT RR) (MAINLINE MP 36.9)

At the OKT RR HDD, no clearing is anticipated to be needed for the guide wires, except possibly for limited removal of brush immediately adjacent to and on both sides of the railroad (Table 1). Additional hand clearing could be requested in the field if an inadvertent release of drilling fluids occurs, and access for rubber-tired containment and clean-up equipment is needed (Section 13.0).

The space between the HDD entry and exit points at the railroad crossing primarily includes areas under active cultivation and developed for pasture. Narrow strips (<100 feet on each side) of brush and sparsely distributed trees run parallel and adjacent to the rail bed. All of these areas will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

15.5 WASHITA RIVER #1 (MAINLINE MP 65.0)

At the Washita River #1 HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the river, as necessary (Table 1). The area from the entry point to the river (north side) already is relatively open for this purpose and for access for rubber-tired vehicles needed to set pumps and run hoses for hydrostatic testing and drilling mud water. Additional hand clearing could be requested in the field, particularly on the exit side, if an inadvertent release of drilling fluids occurs, and access for rubber-tired containment and clean-up equipment is needed (Section 13.0).

The space between the HDD entry and exit points at the Washita River includes areas under active cultivation, pasture, and forest in uplands along the southern river bank. All of these areas will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

15.6 WILDHORSE CREEK (MAINLINE MP 100.5)

At the Wildhorse Creek HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the creek, if necessary (Table 1). Both sides of this crossing already are relatively open, which will allow ready access for rubber-tired vehicles needed to set pumps and run hoses for hydrostatic testing and drilling mud water, as well as access for rubber-tired containment and cleanup equipment if an inadvertent release of drilling fluids occurs (Section 13.0).

The space between the HDD entry and exit points at Wildhorse Creek includes areas under active cultivation and pasture, with a few trees in uplands along fence lines and in patches along the creek bank. All of these areas will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

15.7 HENRY HOUSE CREEK (MAINLINE MP 120.2)

At the Henry House Creek HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the creek, if necessary (Table 1). Both sides of this crossing already are relatively open, which will allow ready access for rubber-tired vehicles needed to set pumps and run hoses for hydrostatic testing and drilling mud water, as well as access for rubber-tired containment and cleanup equipment if an inadvertent release of drilling mud occurs (Section 13.0).

The space between the HDD entry and exit points at Henry House Creek includes open land, with a few scattered trees in uplands adjacent to the proposed area to be cleared along the west bank of the creek. All of these areas will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

15.8 WASHITA RIVER #2 (MAINLINE MP 135.9)

At the Washita River #2 HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the river, as necessary (Table 1). In addition to the hand clearing for guide wires, additional hand clearing may be required on the east side (entry side) for use by rubber-tired vehicles in assisting with accessing water for hydrostatic testing and drilling mud water. This additional hand-cleared access also will serve as a contingency for moving rubber-tired containment and cleanup equipment into the area if an inadvertent release of drilling fluids occurs (Section 13.0).

The space between the HDD entry and exit points at the Washita River includes cultivated land and pasture, with a strip of trees in uplands on the east bank of the river. These areas on both sides of the river will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

15.9 ROCK CREEK (MAINLINE MP 151.7)

At the Rock Creek HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the creek, as necessary (Table 1). In addition to the hand clearing for guide wires, additional hand clearing may be required on the east side (entry side) for use by rubber-tired vehicles in assisting with accessing water for hydrostatic testing and drilling mud water. This additional hand-cleared access also will serve as a contingency for moving rubber-tired containment and cleanup equipment into the area if an inadvertent release of drilling fluids occurs (Section 13.0). Alternatively, for access to the water source, Midship will attempt to acquire permission to use the existing co-located ROW.

The space between the HDD entry and exit points at Rock Creek is primarily forested land on the east side of the creek and sparsely forested pasture on the west side, all adjacent to an existing ROW. These areas on both sides of the creek will be allowed to return to their previous conditions after the HDD has been completed. False ROW in cleared or sparsely forested uplands will be required on the west (exit) side of this HDD.

15.10 PENNINGTON CREEK (MAINLINE MP 154.1)

At the Pennington Creek HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the creek (Table 1). Pennington Creek is not a water source for the Project, so no additional access is planned. However, additional hand clearing could be requested in the field if an inadvertent release of drilling fluids occurs and access for rubber-tired containment and clean-up equipment is needed (Section 13.0).

The space between the HDD entry and exit points at Pennington Creek includes open land on the west side of the creek, with a few scattered, isolated trees in uplands. False ROW will be required for this HDD on the west (exit) side of the creek. The false ROW will span an intermittent stream near MP 153.6 and require removal of an adjacent small stand of trees. The east side of Pennington Creek is mostly open with scattered, isolated trees nearer the creek that likely can be avoided. A somewhat denser stand of trees in an upland occurs farther to the east where the drill equipment will be staged.

The cleared areas on both sides of the creek will be allowed to return to their previous conditions after the HDD has been completed.

15.11 BLUE RIVER (MAINLINE MP 174.0)

At the Blue River HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the river (Table 1). The Blue River is not a water source for the Project, so no additional access is planned. However, additional hand clearing could be requested in the field if an inadvertent release of drilling fluids occurs and access for rubber-tired containment and clean-up equipment is needed (Section 13.0).

The space between the HDD entry and exit points at the Blue River crossing is primarily upland forested land. False ROW will be needed on the east (exit) side of the crossing in open land, although the cutting of one or two trees might be required at the far eastern end. All of these areas will be allowed to return to their previous conditions after the HDD has been completed.

15.12 WILDHORSE CREEK TRIBUTARY/WETLAND (VELMA LATERAL MP VE9.5)

At the Wildhorse Creek tributary/wetland HDD on the Velma Lateral, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires on both sides of the tributary/wetland (Table 1). The tributary/wetland is not a water source for the Project, so no additional access is planned. However, additional hand clearing could be requested in the field if an inadvertent release of drilling fluids occurs and access for rubber-tired containment and clean-up equipment is needed (Section 13.0).

The space between the HDD entry and exit points at the tributary/wetland crossing is primarily pasture/scrub upland on the east side of the crossing and pasture/scrub on the west side with a narrow (approximately 50 feet) forested strip adjacent to the tributary. These areas on both sides of the creek will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

15.13 STATE HIGHWAY 76 (HWY 76) (VELMA LATERAL MP VE11.5)

At the State Highway 76 HDD, hand clearing will be used between the entry and exit points, where clearing is necessary, to create a narrow path for guide wires (Table 1). All areas impacted by the Hwy 76 HDD will be allowed to return to their previous conditions after the HDD has been completed. No false ROW will be required for this HDD.

APPENDIX G

ROAD AND RAILROAD CROSSINGS ASSOCIATED WITH THE MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT

APPENDIX G

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
MAINLINE				
Canadian				
Dirt road	0.2	Dirt	Lease	Open cut
248th Street NW	0.5	Asphalt	Local/county	Conventional bore
234th Street NW	1.6	Gravel	Local/county	Open cut
220th Street NW	2.8	Gravel	Local/county	Open cut
206th Street NW	3.8	Gravel	Local/county	Open cut
Road	4.3	Gravel	Lease	Open cut
192nd Street NW	4.8	Gravel	Local/county	Open cut
Edmond Road NW	5.9	Asphalt	Local/county	Conventional bore
N Calumet Road	6.0	Asphalt	Local/county	Conventional bore
164th Street NW	6.9	Gravel	Local/county	Open cut
150th Street NW	8.1	Gravel	Local/county	Open cut
Memorial Road	9.2	Gravel	Local/county	Open cut
AT&L Railroad	9.3	Railroad	Federal	Conventional bore
U.S. Highway 270	9.3	Asphalt	Federal	Conventional bore
N Red Rock Road	9.7	Gravel	Local/county	Open cut
122nd Street NW	10.2	Asphalt	Local/county	Conventional bore
Road	10.6	Gravel	Farm road	Open cut
N Red Rock Road	11.2	Gravel	Local/county	Open cut
Darlington Road NW	11.4	Gravel	Local/county	Open cut
Britton Road NW	12.5	Gravel	Local/county	Open cut
U.S. Highway 270	13.7	Asphalt	State / federal	Conventional bore
Jones Road NW	13.9	Gravel	Local/county	Open cut
State Highway 66	15.1	Concrete	Local/county	Conventional bore
I-40/U.S. Highway 270 (WBL)	15.7	Asphalt	Federal	HDD
I-40/U.S. Highway 270 (EBL)	15.7	Asphalt	Federal	HDD
Elm Street W	16.1	Gravel	Local/county	Open cut
27th Street SW (Smith Road W)	17.5	Gravel	Local/county	Open cut
S Courtney Road	19.3	Gravel	Local/county	Open cut
Reuter Road W	20.0	Gravel	Local/county	Open cut
S. Heaston Road	20.7	Asphalt	Local/county	Conventional bore
Reno Road W	21.3	Asphalt	Local/county	Conventional bore
15th Street SW	22.5	Gravel	Local/county	Open cut
S Fort Reno Road	22.7	Gravel	Local/county	Open cut
29th Street SW	23.9	Gravel	Local/county	Open cut
S Brandley Road	24.2	Gravel	Local/county	Open cut
44th Street SW	25.1	Gravel	Local/county	Open cut
S Chiles Road	26.1	Gravel	Local/county	Open cut
59th Street SW	26.3	Gravel	Local/county	Open cut
SW 74th Street	27.3	Gravel	Local/county	Open cut
Grady				
County Road 1140	29.3	Gravel	Local/county	Open cut
County Road 1150	30.5	Gravel	Local/county	Open cut
N 2800 Road	30.6	Gravel	Local/county	Open cut
State Highway 37/152	31.7	Asphalt	State	Conventional bore
Road	32.5	Gravel	Farm road	Open cut

APPENDIX G (cont'd)

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
E 1175 Road (W Gin Road)	33.4	Asphalt	Local/county	Conventional bore
Clayton Road	35.3	Asphalt	Local/county	Conventional bore
U.S. Highway 81	36.4	Asphalt	Federal	Conventional bore
E 1200 Road (Leona Road B Scott Road)	36.5	Gravel	Local/county	Open cut
Road (two-track)	36.8	Gravel	Farm road	Open cut
Oklahoma Kansas & Texas Railroad	36.9	Railroad	Private	HDD
Private Turbine Road	37.3	Gravel	Lease	Open cut
County Road 1210 (Kiowa Road)	37.8	Gravel	Local/county	Open cut
County Road 2840	38.2	Gravel	Local/county	Open cut
E 1220 Road (Harold Road)	38.9	Caliche	Local/county	Open cut
Road	39.1	Dirt	Lease	Open cut
Sooner Road	40.0	Caliche	Local/county	Open cut
County Street 2850	40.7	Gravel	Local/county	Open cut
E 1250 Road (Dutton Road)	42.2	Asphalt	Local/county	Conventional bore
Dirt Road	43.8	Dirt	Local/county	Open cut
County Street 2870	44.0	Caliche	Local/county	Open cut
Road	44.5	Gravel	Farm road	Open cut
Burlington Northern Railroad	45.0	Railroad	State	Conventional bore
State Highway 92	45.0	Asphalt	State	Conventional bore
E 1270 Road	45.4	Asphalt	Local/county	Conventional bore
N 2880 Road	45.9	Asphalt	Local/county	Conventional bore
E 1280 Road	46.5	Asphalt	Local/county	Conventional bore
E 1290 Road	47.6	Dirt	Local/county	Open cut
E 1300 Road	48.7	Asphalt	Local/county	Conventional bore
Road	49.1	Dirt	Farm road	Open cut
I-44 (He Bailey Turnpike)(WBL)	49.1	Concrete	State / federal	Conventional bore
I-44 (He Bailey Turnpike)(EBL)	49.1	Concrete	State / federal	Conventional bore
N 2895 Road	49.2	Asphalt	Local/county	Conventional bore
E 1310 Road (Birchfield Lane)	50.0	Dirt	Local/county	Open cut
E 1330 Road	52.3	Asphalt	Local/county	Conventional bore
E 1340 Road	53.4	Dirt	Local/county	Open cut
Road	53.7	Dirt	Farm road	Open cut
U.S. Highway 62/277 (State Highway 9)	54.6	Asphalt	State / federal	Conventional bore
State Highway 39	55.6	Asphalt	State	Conventional bore
Road	56.8	Gravel	Farm road	Open cut
Hereford Road	57.4	Asphalt	Local/county	Conventional bore
Road	57.8	Dirt	Farm road	Open cut
E 1390 Road (Cardinal Lane)	59.0	Caliche	Local/county	Open cut
Road	59.1	Grass	Farm road	Open cut
Alex Highway (County Street 2940)	59.9	Asphalt	Local/county	Conventional bore
Laflin Creek Road	60.2	Asphalt	Local/county	Conventional bore
E 1410 Road (Hawkins Road)	61.6	Caliche	Local/county	Open cut
Cox Road	62.6	Gravel	Local/county	Open cut
Road	63.3	Grass	Lease	Open cut
Road	63.4	Grass	Lease	Open cut
Road	63.5	Grass	Lease	Open cut
Black Road	63.6	Asphalt	Local/county	Conventional bore

APPENDIX G (cont'd)

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
E 1440 Road (River Road)	64.6	Asphalt	Local/county	Conventional bore
Road	65.9	Dirt	Farm road	Open cut
Old Bradley Highway	66.2	Asphalt	Local/county	Conventional bore
Road	66.6	Gravel	Lease	Open cut
Road	66.7	Gravel	Lease	Open cut
State Highway 19	67.3	Asphalt	State	Conventional bore
Road (Rock)	68.3	Gravel	Lease	Open cut
Road (Rock)	68.5	Gravel	Lease	Open cut
Road	68.9	Dirt	Lease	Open cut
Road	69.1	Gravel	Lease	Open cut
Road	69.5	Dirt	Lease	Open cut
Road (Rock)	69.6	Gravel	Lease	Open cut
Road (Rock)	69.7	Gravel	Lease	Open cut
Road (Rock)	69.7	Gravel	Lease	Open cut
Road (Rock)	69.8	Gravel	Lease	Open cut
Road (Rock)	70.2	Gravel	Lease	Open cut
Road	70.6	Grass	Farm road	Open cut
Road	71.1	Dirt	Farm road	Open cut
Road	71.7	Dirt	Farm road	Open cut
E 1510 Road	72.2	Gravel	Local/county	Open cut
E 1520 Road	73.3	Asphalt	Local/county	Conventional bore
Road	73.4	Dirt	Farm road	Open cut
N 2970 Road	74.0	Caliche	Local/county	Open cut
Road	74.3	Gravel	Farm road	Open cut
Road	75.4	Caliche	Lease	Open cut
Road	76.0	Grass	Farm road	Open cut
Road	76.3	Grass	Farm road	Open cut
Road	76.5	Grass	Farm road	Open cut
Road	76.7	Gravel	Lease	Open cut
Road	76.8	Gravel	Lease	Open cut
E 1550 Road	77.3	Asphalt	Local/county	Conventional bore
Road	77.9	Gravel	Lease	Open cut
Garvin				
Road	79.0	Gravel	Lease	Open cut
Road	80.2	Gravel	Lease	Open cut
N 3000 Road	80.3	Gravel	Local/county	Open cut
Road	80.6	Gravel	Farm road	Open cut
Road	81.1	Gravel	Farm road	Open cut
E 1578 Road	81.1	Gravel	Local/county	Open cut
E 1590 Road	82.4	Asphalt	Local/county	Conventional bore
N 3010 Road	82.9	Gravel	Local/county	Open cut
Road	83.0	Gravel	Farm road	Open cut
Road	83.1	Gravel	Lease	Open cut
Road	83.7	Gravel	Farm road	Open cut
Road	84.5	Gravel	Lease	Open cut
Road	84.8	Grass	Farm road	Open cut

APPENDIX G (cont'd)

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
Stephens				
E 1610 Road (County Line Road)	85.2	Gravel	Local/county	Open cut
Road	85.5	Gravel	Lease	Open cut
State Highway 76	85.7	Asphalt	State	Conventional bore
Road	85.9	Gravel	Lease	Open cut
Road	85.9	Gravel	Lease	Open cut
Road	86.7	Gravel	Lease	Open cut
Goad Road/Ball Park Road	86.7	Gravel	Local/county	Open cut
Road	87.1	Dirt	Farm road	Open cut
Road	88.0	Gravel	Farm road	Open cut
Old Highway 76 (N 3040 Road)	88.5	Gravel	Local/county	Open cut
Road	88.5	Gravel	Farm road	Open cut
Garvin				
State Highway 76/29	90.1	Asphalt	State	Conventional bore
E 1650 Road	90.7	Gravel	Local/county	Open cut
Road	92.6	Grass	Farm road	Open cut
Road	92.6	Grass	Farm road	Open cut
Road	92.9	Grass	Farm road	Open cut
Road	93.0	Grass	Farm road	Open cut
Road	93.1	Grass	Farm road	Open cut
E 1670 Road	93.6	Asphalt	Local/county	Conventional bore
State Highway 76	94.7	Asphalt	State	Conventional bore
Road	95.0	Gravel	Lease	Open cut
Road	95.7	Gravel	Lease	Open cut
Road	95.9	Gravel	Farm road	Open cut
E 1690 Road	96.0	Asphalt	Local/county	Conventional bore
Road	96.2	Grass	Farm road	Open cut
Road	96.4	Grass	Farm road	Open cut
E 1700 Road	97.1	Gravel	Local/county	Open cut
Road	97.2	Grass	Farm road	Open cut
E 1710 Road	98.2	Asphalt	Local/county	Conventional bore
Road	99.5	Gravel	Farm road	Open cut
Road	99.5	Grass	Farm road	Open cut
Road	99.7	Grass	Lease	Open cut
Road	99.8	Grass	Farm road	Open cut
Road	100.0	Grass	Farm road	Open cut
E1730	100.4	Dirt	Local/county	Open cut
Carter				
Road	100.7	Grass	Farm road	Open cut
N 3110 Road (Range Road)	101.4	Gravel	Local/county	Open cut
Westmont Road	101.8	Gravel	Local/county	Open cut
Redwood Road	101.9	Gravel	Lease	Open cut
State Highway 7	102.1	Asphalt	State	Conventional bore
Road	102.3	Gravel	Farm road	Open cut
Road	102.4	Gravel	Farm road	Open cut
E 1750 Road (Quinton Road)	103.0	Asphalt	Local/county	Conventional bore
Road	103.1	Gravel	Lease	Open cut
Road	103.2	Grass	Farm road	Open cut

APPENDIX G (cont'd)

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
N 3120 Road (Quinton Road)	103.3	Asphalt	Local/county	Conventional bore
Road	103.4	Gravel	Lease	Open cut
Road	103.4	Gravel	Lease	Open cut
Road	103.7	Gravel	Lease	Open cut
Road	103.8	Gravel	Lease	Open cut
Cargo Road	104.3	Gravel	Local/county	Open cut
Deacon Road	105.0	Gravel	Local/county	Open cut
Van Kirt Road	105.5	Asphalt	Local/county	Conventional bore
Road	105.7	Asphalt	Farm road	Open cut
Road	106.2	Gravel	Farm road	Open cut
Poolville Road	106.7	Asphalt	Local/county	Conventional bore
Sierra Hill Road	107.6	Gravel	Local/county	Open cut
Road	110.2	Gravel	Farm road	Open cut
Road	110.9	Gravel	Farm road	Open cut
Road	111.9	Gravel	Farm road	Open cut
Road	112.3	Gravel	Lease	Open cut
Road	113.2	Asphalt	Lease	Open cut
Road	113.6	Gravel	Lease	Open cut
Road	113.7	Gravel	Farm road	Open cut
Road	114.4	Gravel	Farm road	Open cut
Woodford Road	117.1	Asphalt	Local/county	Conventional bore
Eagle Heights Road	118.1	Gravel	Local/county	Open cut
State Highway 53	118.5	Gravel	State	Conventional bore
Peach Tree Road	119.2	Asphalt	Local/county	Conventional bore
Road	119.4	Gravel	Farm road	Open cut
Road	119.7	Gravel	Private	Open cut
Deese Road	121.2	Asphalt	Local/county	Conventional bore
Horse Apple Road	122.3	Asphalt	Local/county	Conventional bore
Hereford Road	122.3	Asphalt	Local/county	Conventional bore
Road	124.1	Gravel	Lease	Open cut
Road	124.1	Dirt	Farm road	Open cut
Road	124.2	Dirt	Farm road	Open cut
Road	124.2	Dirt	Farm road	Open cut
I-35/State Highway 53 (SBL)	124.5	Concrete	State	Conventional bore
I-35/State Highway 53 (NBL)	124.5	Concrete	State	Conventional bore
State Highway 53	125.0	Asphalt	State	Conventional bore
Road	125.1	Gravel	Lease	Open cut
Road	125.9	Gravel	Lease	Open cut
U.S. Highway 77 (SBL)	126.0	Asphalt	Federal	Conventional bore
U.S. Highway 77 (NBL)	126.0	Asphalt	Federal	Conventional bore
Private Refinery Road	128.1	Asphalt	Local/county	Conventional bore
Road	128.5	Grass	Farm road	Open cut
Road	128.6	Grass	Farm road	Open cut
Dirt Road	129.4	Grass	TBD	Open cut
Happy Trails Road	130.2	Asphalt	Local/county	Conventional bore
Robin Road	131.3	Asphalt	Local/county	Conventional bore
Burlington Northern Santa Fe Railroad	131.7	Railroad	Private	Conventional bore

APPENDIX G (cont'd)

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
Gene Autry Road	132.0	Asphalt	Local/county	Conventional bore
Road	132.4	Gravel	Lease	Open cut
Aldine Road	133.6	Asphalt	Local/county	Conventional bore
Road	134.8	Caliche	Lease	Open cut
Road	136.0	Gravel	Lease	Open cut
U.S. Highway 177	136.5	Asphalt	Federal	Conventional bore
Road	138.6	Gravel	Lease	Open cut
Johnston				
Road	139.7	Gravel	Farm road	Open cut
Road	139.8	Gravel	Private	Open cut
Daube Ranch Road	140.0	Gravel	Lease	Open cut
Road	140.7	Gravel	Lease	Open cut
Road	140.7	Gravel	Lease	Open cut
Road	141.1	Gravel	Lease	Open cut
Road	142.6	Gravel	Lease	Open cut
Road	142.6	Caliche	Lease	Open cut
Road	142.7	Gravel	Lease	Open cut
Road	143.2	Grass	TBD	Open cut
Norton Road	143.8	Caliche	Lease	Open cut
Road	145.6	Gravel	Lease	Open cut
Road	145.7	Gravel	Lease	Open cut
Road	147.6	Gravel	Farm road	Open cut
Road	148.4	Gravel	Lease	Open cut
Road	149.2	Gravel	TBD	Open cut
St. Louis And San Francisco Railroad	149.5	Railroad	Private	Conventional bore
State Highway 12	149.5	Asphalt	State	Conventional bore
Road	149.9	Gravel	Farm road	Open cut
Pine Creek Road	150.1	Gravel	Farm road	Open cut
S McSwain Lane	151.1	Grass	Farm road	Open cut
Rock Creek Road	151.5	Gravel	Local/county	HDD
Rock Creek Loop	152.0	Gravel	Local/county	HDD
Red Creek Loop	152.1	Gravel	Local/county	HDD
S Bullet Prairie Road	152.6	Gravel	Local/county	Open cut
Rural Golf Course Lane	154.3	Gravel	Local/county	HDD
W Golf Course Road	155.0	Asphalt	Local/county	Conventional bore
U.S. Highway 337/State Highway 99 (N Kemp Avenue)	155.4	Asphalt	Federal	Conventional bore
S Red Oak Road	156.6	Gravel	Local/county	Open cut
Blue River Road	158.9	Asphalt	Local/county	Conventional bore
State Highway 78	159.0	Asphalt	State	Conventional bore
Bois D'Arc Lane	163.4	Asphalt	Local/county	Conventional bore
Bee Emit Road	163.9	Gravel	Local/county	Open cut
Short Lane	164.9	Gravel	Local/county	Open cut
Decker Road	165.1	Gravel	Local/county	Open cut
State Highway 78	166.5	Asphalt	State	Conventional bore
Stallings Road	167.1	Gravel	Local/county	Open cut
Blackburn Road	167.4	Gravel	Local/county	Open cut
Horse Creek Road	169.6	Gravel	Local/county	Open cut

APPENDIX G (cont'd)

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
Bryan				
N 3690 Road	170.9	Gravel	Local/county	Open cut
State Highway 22	171.6	Asphalt	State	Conventional bore
N 3700 Road (Albert Pike Road)	172.0	Gravel	Local/county	Open cut
Ft McCulloch Road	173.1	Gravel	Local/county	Open cut
Road	173.4	Gravel	Farm road	Open cut
State Highway 48	175.1	Asphalt	State	Conventional bore
E 1990 Road (Nails Crossing Road)	175.5	Gravel	Local/county	Open cut
Field Road	175.8	Grass	Local/county	Open cut
E 2000 Road (Miller Road)	178.1	Gravel	Local/county	Open cut
N 3760 Road (Hat Powell Road)	178.5	Gravel	Local/county	Open cut
U.S. Highway 69/75 (SBL)	179.4	Asphalt	Federal	Conventional bore
U.S. Highway 69/75 (NBL)	179.5	Concrete	Federal	Conventional bore
Road	180.3	Grass	Farm road	Open cut
Old Highway 69 (Caddo Highway)	180.7	Asphalt	Federal	Conventional bore
Union Pacific Railroad	180.8	Railroad	Federal	Conventional bore
Caddo Hills Road	181.6	Caliche	Local/county	Open cut
Blue Stem Road	181.9	Gravel	Local/county	Open cut
N 3800 Road (Windswept Trail)	182.7	Gravel	Local/county	Open cut
Road	183.2	Dirt	Farm road	Open cut
Road	183.6	Dirt	Farm road	Open cut
E 2020 Road (Pritchard Road)	184.0	Gravel	Local/county	Open cut
Robinson Road	184.5	Asphalt	Local/county	Conventional bore
Morris Hill Lane	185.1	Gravel	Farm road	Open cut
Double Springs Road	187.7	Dirt	Local/county	Open cut
Driftwood Road	188.0	Dirt	Local/county	Open cut
Diamond Rock Road	188.3	Gravel	Local/county	Open cut
Mesquite Lane	188.9	Gravel	Local/county	Open cut
Terrel Road	189.0	Gravel	Local/county	Open cut
State Highway 22	190.0	Asphalt	State	Conventional bore
Slide Up Road	191.4	Asphalt	Local/county	Conventional bore
Road	192.5	Grass	Farm road	Open cut
Banty Road	193.5	Gravel	Local/county	Open cut
U.S. Highway 70	194.0	Concrete	Federal	Conventional bore
Burlington Northern Railroad	194.0	Railroad	Federal	Conventional bore
Labor Road	194.2	Gravel	Local/county	Open cut
Iron Gate Road	194.9	Gravel	Local/county	Open cut
E2083/Saramac Ln	196.3	Gravel	Local/county	Open cut
N 3920 Road (Sulpher Springs Road)	197.0	Asphalt	Local/county	Conventional bore
Road	197.7	Gravel	Farm road	Open cut
State Highway 70E	198.0	Asphalt	State	Conventional bore
Road	198.4	Dirt	Private	Open cut
E 2090 Road (Pipeline Road)	199.1	Gravel	Local/county	Open cut
N 3940 Road (Blue Bird Trail)	199.6	Gravel	Local/county	Open cut
CHISHOLM LATERAL				
Kingfisher				
E 0860 Road	CH0.1	Gravel	Local/county	Open cut
N 2950 Road	CH0.2	Gravel	Local/county	Open cut

APPENDIX G (cont'd)

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
Dirt Road	CH0.5	Dirt	Lease	Open cut
N 2940 Road	CH1.2	Asphalt	Local/county	Conventional bore
N 2940 Road	CH1.2	Asphalt	Local/county	Conventional bore
Gravel Road	CH1.8	Gravel	Lease	Open cut
N 2930 Road	CH2.2	Gravel	Local/county	Open cut
E 0860 Road	CH2.9	Dirt	Local/county	Open cut
Dirt Road	CH3.0	Dirt	Lease	Open cut
Gravel Road	CH3.1	Gravel	Lease	Open cut
N 2920 Road	CH3.2	Dirt	Local/county	Open cut
Dirt Road	CH3.7	Dirt	Lease	Open cut
Dirt Road	CH3.9	Dirt	Lease	Open cut
Dirt Road	CH5.1	Dirt	Lease	Open cut
N 2900 Road	CH5.2	Gravel	Local/county	Open cut
Gravel Road	CH5.9	Gravel	Lease	Open cut
N 2890 Road (Banner Road)	CH6.3	Gravel	Local/county	Open cut
Dirt Road	CH6.4	Dirt	Lease	Open cut
E 0860 Road	CH7.0	Gravel	Local/county	Open cut
N 2880 Road	CH7.4	Gravel	Local/county	Open cut
Dirt Road	CH7.7	Dirt	Lease	Open cut
N 2870 Road	CH8.4	Gravel	Local/county	Open cut
N 2860 Road	CH9.4	Asphalt	Local/county	Conventional bore
Dirt Road	CH10.2	Dirt	Lease	Open cut
N 2850 Road	CH10.5	Dirt	Local/county	Open cut
N 2845 Road	CH11.0	Caliche	Local/county	Open cut
N 2840 Road	CH11.6	Dirt	Local/county	Open cut
Dirt Road	CH11.6	Dirt	Lease	Open cut
Oklahoma Kansas & Texas Railroad	CH12.7	Railroad	State / federal	Conventional bore
U.S. Highway 81/State Highway 3 (NBL)	CH12.7	Concrete	State / federal	Conventional bore
U.S. Highway 81/State Highway 3 (SBL)	CH12.7	Concrete	State / federal	Conventional bore
N 2820 Road	CH13.6	Gravel	Local/county	Open cut
N 2810 Road	CH14.7	Gravel	Local/county	Open cut
E 0870 Road	CH14.8	Dirt	Local/county	Open cut
N 2800 Road	CH15.7	Gravel	Local/county	Open cut
Farm Road	CH17.6	Dirt	Farm road	Open cut
E 0880 Road	CH17.9	Dirt	Local/county	Open cut
N 2780 Road	CH18.3	Asphalt	Local/county	Conventional bore
N 2770 Road	CH19.3	Gravel	Local/county	Open cut
Farm Road	CH19.4	Dirt	Farm road	Open cut
N 2760 Road	CH20.4	Asphalt	Local/county	Conventional bore
VELMA LATERAL				
Stephens				
Gravel Road To Oil Well	VE0.1	Gravel	Leased	Open cut
Old Highway 7 (Cherokee Road)	VE0.4	Asphalt	Local/county	Conventional bore
Gravel Road to Oil Well	VE0.4	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE0.6	Gravel	Leased	Open cut
N 2990 Road	VE1.5	Asphalt	Local/county	Conventional bore
Seminole Road	VE3.7	Gravel	Local/county	Open cut

APPENDIX G (cont'd)

Road and Railroad Crossings Associated with the Midcontinent Supply Header Interstate Pipeline Project

Facility/County/Roadway or Railroad Name	Milepost	Type	Jurisdiction	Crossing Method
Gravel Road to Oil Well	VE3.8	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE4.0	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE4.1	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE4.3	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE4.3	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE4.3	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE4.5	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE4.6	Gravel	Leased	Open cut
Alma Road	VE4.7	Gravel	Local/county	Open cut
Gravel Road to Oil Well	VE5.0	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE5.1	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE5.4	Gravel	Leased	Open cut
N 3030 Road	VE6.0	Gravel	Local/county	Open cut
Gravel Road to Oil Well	VE6.7	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE6.8	Gravel	Leased	Open cut
Cemetery Road (Bois D'Arc Road)	VE7.0	Asphalt	Local/county	Conventional bore
N 3040 Road	VE7.2	Asphalt	Local/county	Conventional bore
Gravel Road to Oil Well	VE7.4	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE7.8	Gravel	Leased	Open cut
Countyline Road	VE8.4	Gravel	Local/county	Open cut
Gravel Road to Oil Well	VE8.4	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE9.0	Gravel	Leased	Open cut
Carter				
Shamrock Road	VE9.5	Asphalt	Local/county	HDD
Gravel Road to Oil Well	VE10.0	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE10.2	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE10.6	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE10.7	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE11.0	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE11.1	Gravel	Leased	Open cut
Gravel Road to Oil Well	VE11.4	Gravel	Leased	Open cut
State Highway 76	VE11.5	Asphalt	State	HDD
Dirt Road	VE11.7	Gravel	Leased	Open cut
Garvin				
E 1730 Road ((Base Line Road)	VE11.7	Gravel	Local/county	Open cut
N 3090 Road	VE12.7	Gravel	Local/county	Open cut
Gravel Road to Oil Well	VE13.0	Gravel	Leased	Open cut

APPENDIX H

KARST MITIGATION PLAN

Midship Pipeline Company, LLC

Midship Project

Resource Report 6 – Geological Resources

Karst Mitigation Plan (Revised)

Docket No. CP17-458-000

September 2017

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

Company	Midship Pipeline Company, LLC
Contractor	Prime Pipeline and/or Facility Contractor and any Subcontractor
Project	Midship Project
ROW	right-of-way

1.0 INTRODUCTION

Midship Pipeline Company, LLC's ("Company's") proposed Midship Project ("Project") will consist of a new-build pipeline system that will transport gas out of the South Central Oklahoma Oil Province and the Sooner Trend Anadarko Basin Canadian and Kingfisher plays in Oklahoma, to existing natural gas pipelines near Bennington, Oklahoma. Approximately 233.1 miles of pipeline will be constructed, along with three (3) compressor stations, one (1) booster station, and other appurtenant facilities.

This Karst Mitigation Plan outlines the procedures that the Contractor will adhere to if karst terrain is encountered while implementing construction activities along the Project right-of-way ("ROW") and at aboveground facility sites. The Contractor will be required to document the geographic locations of all karst features by milepost and submit a detailed report of the karst features and mitigation measures utilized.

The following definitions apply herein:

- Company – The Company's authorized employees, or authorized representatives including, but not limited to, engineering, environmental representatives, land agents, construction management, and inspection services.
- Contractor – The Prime Pipeline and/or Facility Contractor and any subcontractor. The Prime Contractor is ultimately responsible for the actions of its employed subcontractors.

2.0 OBJECTIVE

This Karst Mitigation Plan is intended to outline procedures that may be implemented to support construction and operation in areas where karst features are encountered during construction. As described in Resource Report 6, Section 6.4.3, avoidance will be the primary measure to mitigate karst features.

3.0 GENERAL REQUIREMENTS

Prior to implementing any karst mitigation measures, the Contractor shall provide the Company with appropriate information documenting the karst feature(s) and the proposed mitigation measures to be conducted. The mitigation measures must be reviewed by an engineer representing the Company. The engineer will analyze the data and will make recommendations and/or forward approval to the Company before mitigation may commence.

Karst mitigation measures shall be performed with a Company Construction Inspector present. Approval does not relieve the Contractor from responsibility or full liability while implementing the mitigation measure.

4.0 KARST MITIGATION MEASURES

Karst features have not been identified along the pipeline routes or at the compressor station sites during field environmental surveys or desktop analyses (literature review of potential karst formations; aerial photography review of potential karst areas). However, if a buried karst feature is encountered during construction, options will be to 1) move the pipeline route or facility site to avoid the feature or 2) depending on the results of geotechnical evaluations (if necessary), develop an engineering design solution that will allow construction to continue at the original location.

During operations, the pipeline is designed to withstand without damage if a sinkhole forms. Intrinsic span capabilities of the pipeline segments are summarized below. Calculations are provided in Attachment A.

- Mainline, 0.875-inch pipe wall thickness = 100 feet
- Mainline, 0.688-inch pipe wall thickness = 96 feet
- Mainline, 0.476-inch pipe wall thickness = 78 feet
- Chisholm, 0.625-inch pipe wall thickness = 75 feet
- Chisholm, 0.397-inch pipe wall thickness = 68 feet
- Velma, 0.321-inch pipe wall thickness = 52 feet
- Velma, 0.250-inch pipe wall thickness = 42 feet

Potential engineered karst mitigation measures are presented below.

4.1 Measures to Avoid and Minimize Impacts to Karst Features and Caves

In all work areas, the protection of known and potential karst features (including sinkholes, caves, sinking or losing streams, swallow holes, and springs) will be in accordance with the Federal Energy Regulatory Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan* and its *Wetland and Waterbody Construction and Mitigation Procedures* (2013). Sediment and erosion control methods in these plans will be deployed in such a way as to prevent runoff from entering karst features.

Buffer zones of 300 feet will be established around surficial expressions of any karst features in all work areas. During all construction earthwork activities, these zones will be clearly marked in the field with signs and safety fencing (or similar barrier depending on the feature).

All excavation activities will be completed to minimize alteration of the existing grade and storm water flow to the karst features.

In linear excavations adjacent to karst features, spoils will be placed on the opposite side of the trench from the karst features. In the event of storm water erosion during construction, the soil will flow either flow into the excavation (upslope spoil pile) or away from the trench (downslope soil pile) and not toward the karst features.

Stormwater control measures will include detention, diversion, or containerization to prevent construction influenced stormwater from flowing to the karst feature drainage points (or throats). Drainage points in karst features will not be used for the disposal of water.

Hydrostatic test water from a new pipe will not be discharged directly into the buffer zone of a karst feature. This water will be discharged downgradient of the karst feature. If site conditions prevent a downgradient discharge, the water will be discharged as far from the karst feature buffer zone as is practicable, and the discharged water will be filtered and subjected to sediment and erosion control. Post-construction monitoring will ensure proper re-vegetation and restoration of these areas.

4.2 Sinkhole Mitigation

The Company will conduct awareness training for karst-like features during Supervisor Staff environmental training, including buffer zone requirements for known karst features. The Chief Inspector, Craft Inspectors, Safety Inspector, Lead Environmental Inspector, and Environmental Inspectors will be aware of the potential for unanticipated karst features, including sinkhole formation, during construction and trained to identify the signs of sinkhole formation.

Signs of sinkhole formation and the presence of sinkholes will be immediately and clearly marked and a karst buffer zone established. Evaluation of the area will be conducted by appropriate engineering and construction staff. Avoidance of the area may be possible by a minor route variation or by prohibiting equipment from using the temporary workspace in the immediate area.

Should unknown sinkholes be encountered during construction, the following mitigation measures may be undertaken:

- Route the pipeline away from sinkholes.
- Use a thicker-walled pipe.
- Remediate the sinkhole.

Several options are considered viable for remediation/mitigation of sinkholes and depressions along the Project pipeline facilities and are described in the following sections.

4.2.1 Inverted Filter Approach for Pipeline Excavation Structural Zones

For this option, the sinkhole would be excavated until the throat of the underlying bedrock is encountered. On occasion, the throat may not be fully identified. Geophysical methods might be used to further assess conditions. Once the throat location is identified, a field decision regarding the more suitable repair method would be developed. This approach is anticipated for those cases in which the pipeline traverses directly across the bottom or near the throat of a sinkhole. Geophysical methods that may be used for karst imaging include:

- Electrical resistivity.
- Seismic refraction and reflection.
- Ground penetrating radar.
- Multichannel analysis of surface waves.
- Electromagnetics.
- Gravity survey.

If the inverted filter approach is selected, a non-woven geotextile fabric and large (typically one- to two-foot diameter size) rock would be placed initially to establish a working base and fill the sinkhole bottom and/or throat. Layers of progressively smaller size rock would then be placed at an appropriate elevation to allow placement of well-compacted structural soil fill. After placement of stone is complete, the stone filter backfill would be wrapped with the geotextile and the excavation capped with well-compacted soil fill to achieve proposed subgrade elevation.

4.2.2 Concrete Plug Approach for Pipeline Excavation Structural Zones

This approach would initially consist of excavating and cleaning out the throat or open void to allow placement of a concrete plug, consisting of flowable fill. Depending on the size and shape of the throat opening, it may be prudent to initially place graded stone within the throat area. The concrete plug would be installed such that it is bonded to adjacent bedrock. The thickness of the concrete plug would be based on field observations, but in general, the thickness should be at a minimum of two (2) times the width of the plug. Large rock fill may be incorporated into the flowable fill to reduce the overall volume of flowable fill material.

After curing, the remaining site area will be filled with well-compacted soil, if required to achieve proposed subgrade elevation. This approach is anticipated for those cases in which the pipeline traverses directly across sinkhole voids/openings in non-closed depression areas that typically do not receive normal storm water flow (e.g., along a hillside) or if an unanticipated opening is identified during pipeline excavation.

4.2.3 Large Rock Placement in Cave or Opening

In cases where the pipeline will traverse a large open void or cave feature, stabilizing and filling the large opening would be implemented to minimize disturbance of the underlying cave feature or large open void. Initially, large rock (several feet in diameter) will be securely placed and wedged into the opening or cave feature. Additional angular rock (up to two feet in size) may be placed prior to placement of a nonwoven filter fabric. The remaining depth may be capped with No. 1 stone, suitable graded rock, and soil backfill to achieve proposed subgrade elevation.

4.2.4 General Site Filling Approach

In some cases, pipeline construction will necessitate the backfilling of certain site features (i.e., closed depressions without visible openings/voids at the ground surface and depressions with karst voids or openings exposed to ground surface) in order to facilitate construction and installation of the pipeline. These closed depressions or karst features typically will be located within the construction right of way of the Project but not within the actual pipeline excavation zone or pipe non-structural zone.

Backfill activity for both situations would consist initially of vegetation removal and placement of a geogrid and non-woven filter fabric across the footprint of the site feature to be backfilled. Large angular rock (up to two feet in diameter) may be placed over the geogrid and geotextile. Placement of a layer of No. 1 size stone over the large angular rock may be utilized (if required) and will be based on field decision at the time of construction.

The goal of this remediation/mitigation approach will be to minimize the overall impact to natural/existing storm water infiltration/recharge rates and flow direction.

4.2.5 Above-Ground Facilities (Compressor, Booster, and Meter Stations)

Measures to assure structural integrity in the facility areas include using support systems similar to other industrial facilities established over karst conditions, such as reinforced grade beams and slabs capable of spanning small drop outs. The heavily reinforced grade beams and slabs can be shimmed/jacked into place after completion of hole in-filling and compaction grouting. Alternatively, facilities can be supported by deep foundations (pits or drilled shafts) that extend into competent rock.

In addition, storm water, which is a common triggering mechanism of sinkhole collapse in areas being developed, will be directed away from buildings and equipment foundations.

4.3 Route Surveillance

As required by 49 Code of Federal Regulations, Part 192.613, the Company will conduct route surveillance during construction and operation of the facilities, and surveillance personnel will be trained to monitor the pipeline ROW for evidence of subsidence, surface cracks, or depressions that could indicate sinkhole formation. Should any of these indicators be identified, the Project geotechnical engineer will be notified and will determine the appropriate method of remediation/mitigation. In extreme instances, the affected pipeline segment will be excavated, repositioned, or replaced to a stress-free state and properly bedded and backfilled to pre-construction contours.

APPENDIX I

BLASTING PLAN

Midship Pipeline Company, LLC

Midship Project

Resource Report 6 – Geological Resources

Blasting Plan

Docket No. CP17-__-000

May 2017

TABLE OF CONTENTS

1.0 I NTRODUCTION

This Blasting Plan outlines the procedures and safety measures that the Contractor will adhere to while implementing blasting activities along the Midship Pipeline Company, LLC (“Company”) Midship Project (“Project”) right-of-way (“ROW”). The Contractor will be required to submit a detailed Blasting Specification Plan to the Company that is consistent with the provisions of this Blasting Plan. The Contractor's plan, when approved by the Company, will be incorporated into the Contractor's scope of work.

The following definitions apply herein:

- Company – The Company’s authorized employees, or authorized representatives including, but not limited to, engineering, environmental representatives, land agents, construction management, and inspection services.
- Contractor – The Prime Pipeline and/or Facility Contractor and any subcontractor, including the blasting contractor employed by the Prime Contractor. The Prime Contractor is ultimately responsible for the actions of their employed subcontractors.

2.0 OBJECTIVE

This Blasting Plan is intended to identify blasting procedures, including safety, use, storage, and transportation of explosives that are consistent with minimum safety requirements as defined by the most current federal, state, local and other codes. This may include but is not limited to:

- 27 CFR Part 181 - Commerce in Explosives
- 49 CFR Part 177 - Carriage by Public Highway
- 29 CFR 1926 Subpart U - Blasting and Use of Explosives (applicable sections)
- 29 CFR Part 1910.109 – Explosives and Blasting Agents (Occupational Safety and Health Administration
- ATF P5400.7 – Federal Explosive Laws and Regulations
- 18th or later version of the International Society of Explosives Engineers (“ISEE”) – Blaster’s Handbook
- State and local regulations, such as the Oklahoma Explosives and Blasting Regulation Act of Title 63 (Attachment 1), and the Oklahoma Underground Facilities Damage Prevention Act (Attachment 2)
- Cheniere Standard ES-PPL-7712-CU-0200 – Blasting for Pipelines and Facilities Specification

Additionally, this plan is intended to address environmental aspects of blasting activities, and identify areas of concern along the proposed pipeline segments and related facilities.

3.0 GENERAL REQUIREMENTS

Blasting operations shall be conducted by or under the direct and constant supervision of personnel legally licensed and certified to perform such activities in the jurisdiction where the blasting occurs. Prior to any blasting activities, the Contractor shall provide the Company with appropriate information documenting the experience, licenses, and permits associated with all blasting personnel.

Blasting-related operations including: obtaining, transporting, storing, handling, loading, detonating, and disposing of blasting material; drilling, and ground-motion monitoring shall comply with all applicable federal, state, and local regulations, permit conditions and the construction contract.

Blasting for grade or trench excavation shall be used where deemed necessary by a construction expert after examination of the site, and in other locations only after other reasonable means of excavation have been used and are unsuccessful in achieving the required results. The Company may specify locations (e.g., foreign line crossings, near structures) where consolidated rock shall be removed by approved mechanical equipment such as rock-trenching machines, rock saws, hydraulic rams, or jack hammers in lieu of blasting.

Before blasting, a site-specific Blasting Specification Plan must be submitted by the Contractor to the Company for approval. The site-specific Blasting Specification Plan must be reviewed by an engineer representing the Company. The engineer will analyze the data to determine the combined stress level of each affected existing pipeline within the potential area of impact and will make recommendations and/or forward approval to the Company before blasting may commence.

Special blasting controls will be required if blasting is needed for waterbody crossings. The type of explosive, size of charges, sequence of firing, etc. will be selected to minimize shock wave stresses on aquatic life adjacent to the blasting area. If dry crossings are needed, matting will be used to control fly rock. In addition, where specified, the Contractor will furnish the necessary labor and equipment to employ air bubble curtains to protect nearby aquatic life from blasting shock waves. Air bubble curtains could be specified for both wet and dry crossings, depending on the aquatic life present. For wet crossings the air bubble curtains would be placed upstream and downstream of the blasting area. For dry crossings, the air bubble curtains would be in the dammed-off areas on either side of the pipe ditch.

Drilling and blasting shall be performed with a Company Construction Inspector present. Approval is required to proceed prior to each blast. Approval does not relieve the Contractor from responsibility or full liability.

4.0 PRE-BLASTING REQUIREMENTS

Prior to the initiation of blasting operations, the Contractor shall comply with the following:

- The Contractor will obtain all required federal, state, and local permits relating to the transportation, storage, handling, loading, and detonation of explosives.

- The Contractor shall place all necessary "one calls" a minimum of 48 hours (2 normal working days *M-F non-holiday*) prior to construction where one-call systems are in place.
- The Contractor shall be responsible for the protection of all existing underground facilities.
- Before performing any work on, or accessing the ROW, the Contractor shall verify with the Company that all property owners have been notified of the impending construction and blasting activities.
- The Contractor shall submit to the Company representative their site-specific Blasting Specification Plan for approval prior to execution of any blasting activity.
- All blasting activities will take place during daylight hours.

5.0 SITE-SPECIFIC BLASTING PLANS

For each area determined to require blasting, a site-specific Blasting Specification Plan will be created. The Contractor's Blasting Specification Plan shall include at a minimum the following information:

- Blaster's name, company, copy of license, and statement of qualifications; seismograph company, names, equipment and sensor location
- Site location (milepost and stationing), applicable alignment sheet numbers, and associated rock type and geological structure (solid, layered, or fractured)
- Copies of all required federal, state, and local permits
- Methods and materials including explosive type, product name and size, weight per unit, and density; stemming material; tamping method; blasting sequence; use of non-electrical initiation systems for all blasting operations; magazine type and locations and security for storage of explosives and detonating caps
- Site dimensions including explosive depth, distribution, and maximum charge and weight per delay; hole depth, diameter, pattern, and number of holes per delay
- Dates and hours of conducting blasting, distance and orientation to nearest aboveground and underground structures; schedule identifying when blasting would occur within each waterbody greater than 10 feet wide, or within any wetlands, or designated sensitive waterways
- Blasting procedures for:
    - Storing, handling, transporting, loading, and firing explosives
    - Prevention of misfires, flying rock, fire prevention, noise, and stray current accidental-detonation
    - Signs, flagmen, and warning signals prior to each blast
    - Those locations where the pipeline route:
        - Parallels or crosses an electrical transmission corridor, cable or pipeline
        - Parallels or crosses a highway or road
        - Is within or adjacent to forested areas
        - Approaches within 150 feet of a water well or spring
        - Approaches within 1,000 feet of any residence, building or occupied structure
    - Local notification
    - Pre-blast inspections

- Inspections after each blast
- Disposal of waste blasting material

6.0 MONITORING

During blasting operations, the Contractor will be required to monitor operations in the following manner:

- The Contractor shall provide seismographic equipment to measure the peak particle velocity ("PPV") of all blasts in the vertical, horizontal, and longitudinal directions. Seismic monitoring can only be discontinued if:
  - The blasting schedule and blasting performance consistently produce PPVs that are lower than the maximum allowable limit when measured at an adjacent pipeline; and
  - A Company representative provides written authorization
- The Contractor shall measure the PPV at any adjacent pipelines, at any water wells, potable springs and at any aboveground structures within 150 feet of the blasting
- The Contractor shall complete a Blasting Log Record immediately after each blast and submit a copy to the Company representative

7.0 LIMITS ON PEAK PARTICLE VELOCITY (PPV)

Any proposed blast shall be monitored to ensure that the PPV shall not exceed the specified maximum velocities. Maximum velocities are: 4 inches per second measured adjacent to an underground pipeline or structures and 1.5 inches per second for any aboveground structures including water wells.

For all aboveground facilities within 150 feet of the blasting, the Contractor shall provide additional seismograph equipment to determine the PPV at the aboveground facility. If the measured PPV at an existing pipeline or other structure exceeds the above limits, the Contractor shall stop blasting activities immediately and notify the Company Representative. The Blasting Plan must be modified to reduce the PPV prior to any further blasting.

The frequency caused by the detonation of explosive charge shall not drop below 25 hertz without the review and approval of the designated Company Representative.

The minimum time delay between the detonations of charges shall be 8 milliseconds.

All blasting activity occurring within 300 feet of high pressure pipelines will require seismological surveillance (peak particle velocity and frequency) for every blast, unless otherwise agreed upon following the review of the blasting plan. Pipelines affected by blasting are to be leak surveyed in the affected area following the completion of the blasting operation. The Company will coordinate with and follow all federal, state, and/or local regulatory agency laws regarding PPV limits.

Limits on PPV for surface structures are based on studies which established the limits at which plaster in homes will crack. The primary purpose of the limit is to prevent damage to homes. The Company may increase the limit for other structures such as steel transmission line towers, as appropriate. The designated Company Blasting Representative may approve higher velocities for given site-specific conditions in advance.

8.0 SAFETY

8.1 PROTECTION OF ABOVEGROUND AND UNDERGROUND STRUCTURES

Where blasting is determined to be required, the Company will identify any municipal water mains proposed for crossing, and will consult the local water authority. Reports of identified crossings will include location by milepost, owner, and status and results of contacts with the water authority.

The Contractor will exercise control to prevent damage to aboveground and underground structures including buildings, pipelines, utilities, springs, and water wells. The Contractor will implement the following procedures:

- If blasting occurs within 150 feet of identified water well or potable springs, water flow performance, and water quality testing will be conducted before blasting. If the water well or spring is damaged, the well or spring will be repaired or otherwise restored or the well owner will be compensated for damages. The Company will provide an alternative potable water supply to the landowner *at the Contractor's expense*, until repairs occur. Locations of known water wells or systems within 150 feet of the construction work area are indicated on the Company's construction alignment sheets.
- If blasting occurs within 150 feet of any aboveground structures, the Contractor and the Company representative will inspect structures before and after blasting. In the unlikely event that damage occurs to the aboveground structure, the owner will be compensated by the Contractor.
- The Contractor shall be responsible for the ultimate resolution of all damage claims resulting from blasting. Such liability is not restricted by the 150-foot inspection requirement cited above.
- Blasting will not be allowed within 15 feet of an existing pipeline, unless specifically authorized by the Company.
- Holes that have contained explosive material shall not be re-drilled. Holes shall not be drilled where danger exists of intersecting another hole containing explosive material.
- Blasting mats or padding shall be used on all shots where necessary to prevent scattering of loose rock outside of the approved construction workspace areas and to prevent damage to nearby structures and overhead utilities.
- Blasting shall not begin until occupants of nearby buildings, residences, places of business, places of public gathering, and farmers/ranchers have been notified by the Contractor sufficiently in advance to protect personnel, property, and livestock. The Contractor shall notify all such parties at least 48 hours (2 normal working days M-F non-holiday) prior to blasting.
    - The Company shall work with ranchers to relocate livestock and other animals to safe areas away from the blast zone to prevent injury to the livestock or to prevent stampeding of the livestock as the result of the blast.

- Blasting in or near environmentally sensitive areas such as streams and wildlife areas may include additional restrictions.
- All blasting shall be subject to the following limitations:
    - Maximum PPV of 4 inches per second for buried pipelines or structures or 1.5 inches per second for any above grade structures including water wells in any of three mutually perpendicular axes, measured at the lesser distance of the nearest facility or the edge of the permanent easement
    - Maximum drill size shall be 2.5 inches unless approved by the Company
    - Maximum quantity of explosive per delay shall be governed by the recorded measurements as influenced by work site conditions
    - Explosive agents and ignition methods shall be approved by the Company. Ammonium Nitrate Fuel Oil and other free flowing explosives and blasting agents are not acceptable and shall not be used
    - Drill holes shall not be left loaded overnight
    - Good stemming material is to be used in all holes
- The drilling pattern shall be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) to use as much as possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications. *The Project specifies that no rock greater than three inches in diameter is to be used in backfill unless approved by the Company*. The Contractor shall submit the proposed drilling pattern to the Company for approval prior to implementation.
- Under pipeline crossings and all other areas where drilling and blasting is required within 15 feet of existing oil and gas facilities (as approved by the Company):
    - Drill holes shall be reduced to a maximum of 2 inches or less in diameter
    - The number of holes shot at one time shall be limited to three unless otherwise approved by the Company
    - Appropriate delay between charges to attain desired fragmentation

8.2 PROTECTION OF PERSONNEL

The Contractor shall include in its procedures all federal, state, county, and local safety requirements for blasting. The Contractor's procedures shall address, as a minimum, the following requirements:

The Contractor shall take sole liability for property damage, injury or fatalities to people and livestock caused by blasting operations.

- Only authorized, qualified, and experienced personnel shall handle explosives.
- No explosive materials shall be located where they may be exposed to flame, excessive heat, sparks, or impact. Smoking, firearms, matches, open flames, and heat and spark-producing devices shall be prohibited in or near explosive magazines or while explosives are being handled, transported, or used.

- A code of blasting signals shall be established, posted in conspicuous places and utilized during blasting operations. Contractor training including those directly involved in the blasting operations and all other persons involved in the project (e.g., the Company and their authorized representatives and other Contractor personnel) shall be conducted on the use and implementation of the code.
- The Contractor shall use every reasonable precaution including, but not limited to, visual and audible warning signals, warning signs, flag person, and barricades to ensure personnel safety.
- Warning signs, with lettering a minimum of four inches in height on a contrasting background, will be erected and maintained at all approaches to the blast area. Contractor personnel may need to be in place at these locations just prior to the blast through the “ALL CLEAR” if there is a high likelihood of people entering the blast area.
- Flaggers will be stationed on all roadways passing within 1,000 feet of the blast area to stop all traffic during blasting operations.
- All personnel not involved in the actual detonation shall stand back at least 1,000 feet and workers involved in the actual detonation shall stand back at least 650 feet from the time the blast signal is given until the "ALL CLEAR" has been sounded.
- No loaded holes shall be left unattended or unprotected at any time including overnight.
- No explosives or blasting agent shall be abandoned.
- In the case of a misfire, the blaster shall provide proper safeguards for personnel until the misfire has been re-blasted or safely removed.
- The exposed areas of the blast will be matted wherever practicable. In cases where such a procedure is not deemed to be feasible, the Contractor will submit an alternative procedure for review by the Company and the site in question must be visited and examined by the designated Company Blasting Representative before any approval is granted.
- The Company may employ two-way radios for communication between vehicles and office facilities. The Contractor shall advise the Company and other pipeline contractors of any need to cease use of such equipment during blasting activities.
- All loading and blasting activity shall cease and personnel in and around the blast area will retreat to a position of safety during the approach and progress of an electrical storm irrespective of the type of explosives or initiation system used. **THIS IS A MAJOR SAFETY PRECAUTION AND WILL ALWAYS BE OBSERVED.** All explosive materials, all electrical initiation systems, and all non-electric initiation systems are susceptible to premature initiation by lightning.
- Previous blast areas must be inspected to verify the absence of misfires. No drilling may commence until such inspection occurs. If a misfire occurs adjacent to a hole to be drilled, the misfire will be cleared by the blaster using whatever techniques are called for by the situation prior to commencement of drilling. If a misfire occurs at some distance from the drilling area, drilling may be stopped while clearing preparations are underway. When the misfire is to be cleared by re-shooting, drilling will be shut down and personnel evacuated to a place of safety prior to detonation.

- All transportation of explosives will be conducted in accordance with applicable federal, state, and local laws and regulations. Vehicles used to transport explosives shall be in proper working condition and equipped with tight wooden or non-sparking metal floor and sides. If explosives are carried in an open-bodied truck, they will be covered with a waterproof and flame-resistant tarpaulin. Wiring will be fully insulated to prevent short-circuiting and at least two fire extinguishers will be carried. The truck will be plainly marked to identify its cargo so that the public may be adequately warned. Metal, flammable, or corrosive substances will not be transported in the same vehicle with explosives. There will be no smoking and unauthorized or unnecessary personnel will not be allowed in the vehicle. Competent, qualified personnel will load and unload explosives into or from the vehicle.
- No sparking metal tools will be used to open kegs or wooden cases of explosives. Metallic slitters will be used to open fiberboard cases, provided the metallic slitter does not come in contact with the metallic fasteners of the case. There will be no smoking, no matches, no open lights, or other fire or flame (including welding) nearby while handling or using explosives. Explosives will not be placed where they are subject to flame, excessive heat, sparks, or impact. Partial cases or packages of explosives will be re-closed after use. No explosives will be carried in the pockets or clothing of personnel. The wires of an electric blasting cap shall not be tampered with in any way. Wires will not be uncoiled. The use of electric blasting caps will not be permitted during dust storms or near any other source of large charges of static electricity. Uncoiling of the wires or use of electric caps will not be permitted near radio-frequency transmitters. The firing circuit will be completely insulated from the ground or other conductors.
- No blast will be fired without a positive signal from the person in charge. This person will have made certain that all surplus explosives are in a safe place; all persons, vehicles, and/or boats are at a safe distance; and adequate warning has been given. Adequate warning of a blast will consist of, but is not limited to, the following:
    - Notification to nearby homeowners and local agencies, if necessary
    - Stop vehicular and/or pedestrian traffic near the blast site
    - Signal given by an air horn, whistle or similar device using standard warning signals
- Only authorized and necessary personnel will be present where explosives are being handled or used.
- Condition of the hole will be checked with a wooden tamping pole prior to loading. Surplus explosives will not be stacked near working areas during loading. Detonating fans will be cut from spool before loading the balance of charge into the hole. No explosives will be forced into a bore hole past an obstruction. Loading will be done by a blaster holding a valid license or by personnel under his direct supervision.
- Should flying rock leave the ROW even after all necessary precautions have been taken, it shall be collected immediately and disposed of at approved disposal sites. This work shall not be left to the cleanup crew.

8.3 PROTECTION OF THREATENED AND ENDANGERED SPECIES

- The Company will consult with state and federal agencies regarding areas proposed for blasting where sensitive habitats or species are known to occur. Areas identified as containing sensitive habitats or species, as directed by the appropriate agencies, will be staked and flagged. A qualified project biologist will survey the proposed blasting zone identified by the Pipeline Contractor immediately in advance of any drilling or blasting. Areas will be checked before and after blasting for the presence of sensitive species, and disturbance to species and habitats will be resolved in accordance with guidance provided by the appropriate agencies.

8.4 LIGHTNING HAZARD

- A risk of accidental detonation caused by lightning strikes exists at any time the workplace is experiencing an electrical storm and there are loaded holes on site. If this hazard is judged to exist by the Company representative, work shall discontinue at all operations and workers will be moved to secure positions away from the loaded holes. Furthermore, workers shall not return to the work site until the storm has passed and the Company representative has indicated it is clear to return.
- The Company's Contractor shall have on site and use approved lightning detectors capable of measuring the degree of electrical activity as a storm approaches, and the distance to the storm front from the instrument on the ROW such as:
  - SD-2508 manufactured by Electronics Division
  - S.D.I. International, Model 350 manufactured by Thomas Instruments Inc.
  - Skyscan Lighting Detector manufactured by Skyscan Technologies
  - Or approved equivalent

9.0 STORAGE REQUIREMENTS

- All explosives, blasting agents, and initiation devices shall be stored in locked magazines that have been located, constructed, approved, and licensed in accordance with local, state, and federal regulations.
- The storage of explosives, blasting agents and initiation devices is not permitted on the ROW and will only be stored at approved staging areas or construction yards.
- Magazines shall be dry, well-ventilated, reasonably cool (painting of the exterior with a reflective color), bullet and fire resistant, and kept clean.
- Initiation devices shall not be stored in the same box, container, or magazine with other explosives. Explosives, blasting agents or initiation devices shall not be stored in wet or damp areas; near oil, gasoline, cleaning solvents; near sources of heat radiators, steam pipes, stoves, etc. No metal or metal tools shall be stored in the magazine. There shall be no smoking, matches, open lights, or other fire or flame inside or within 50 feet of storage magazines or explosive materials. The loading and unloading of explosive materials into or out of the magazine shall be done in a business-like manner with no loitering, horseplay, or prank playing.

- Magazines shall be kept locked at all times unless explosives are being delivered or removed by authorized personnel. Admittance shall be restricted to the magazine keeper, blasting supervisor, or licensed blaster. Magazine construction shall meet the requirements of Bureau of Alcohol, Tobacco and Fire Arms P5400.7 "Explosives Law and Regulations" and be in accordance with local, state, or federal regulations and the ISEE Blaster's Handbook.
- Accurate and current records shall be kept of the explosive material inventory to ensure that oldest stocks are utilized first, satisfy regulatory requirements and for immediate notification of any loss or theft. Magazine records shall reflect the quantity of explosions removed, the amount returned, and the net quantity used at the blasting site. *Copies of these records are to be supplied at the end of the project or anytime requested by the Company throughout the project.*
- When explosive materials are taken from the storage magazine, they shall be kept in the original containers until used. Small quantities of explosive materials may be placed in day boxes, powder chests or detonator boxes. Any explosive material not used at the blast site shall be returned to the storage magazine and replaced in the original container as soon as possible, but in any case before the end of the workday.
- Magazine locations shall be in accordance with local, state, or federal regulations. Where no regulations apply, magazines shall be located in accordance with the latest edition of the 18th Anniversary Edition of the Blaster's Handbook and ATF P5400-7 Explosives Law and Regulations. Magazines shall be marked in minimum three-inch high letters with the words "DANGER – EXPLOSIVES" prominently displayed on all sides and roof.

Attachment 1
Oklahoma Explosives and Blasting Regulation Act of Title 63

Source: http://oklegal.onenet.net/oklegal-cgi/get_statute?98/Title.63/63-122.1.html

63-122.1.

The provisions of this part shall be known and may be cited as the "Oklahoma Explosives and Blasting Regulation Act".

63-122.2.

The provisions of this section specify the jurisdictional areas of state agencies relating to the regulation of blasting and explosives. The jurisdictional areas of responsibility specified in this section shall be in addition to those otherwise provided by law and assigned to the specific state agency as follows:

1. Department of Mines. The Department of Mines shall have the following jurisdictional areas relating to the regulation of blasting and explosives:
   a. the use of explosives and blasting activities for surface and nonsurface mining operations pursuant to Title 45 of the Oklahoma Statutes,
   b. except as otherwise provided by this part, the use of explosives and blasting activities for nonmining activities,
   c. except as otherwise provided by this part, the regulation of the use of explosives or of blasting activity not subject to the specific statutory authority of another state agency;
2. State Fire Marshal. The State Fire Marshal shall have regulatory jurisdictional responsibility relating to explosives as follows:
   a. the regulation of the manufacture, sale, transportation for hire or storage of explosives or blasting agents for resale pursuant to Division 2 of the Oklahoma Explosives and Blasting Regulation Act,
   b. the examination of buildings and premises and reporting and orders authorized pursuant to Section 317 of Title 74 of the Oklahoma Statutes;
3. The Department of Public Safety. The Department of Public Safety shall have the regulatory jurisdictional responsibility relating to the transportation of explosives or blasting agents classified as hazardous materials pursuant to the Oklahoma Motor Carrier Safety and Hazardous Materials Transportation Act; and
4. Department of Environmental Quality. The Department of Environmental Quality shall have jurisdictional responsibility relating to the regulation and disposal of explosives or blasting agents classified as solid or hazardous waste pursuant to the Oklahoma Environmental Quality Code.

63-123.1

A. Pursuant to the Oklahoma Explosives and Blasting Regulation Act, except as otherwise provided by this part, the Department of Mines shall be responsible for the administration, regulation and enforcement of all blasting operations or activities, and the storage and use of all blasting agents and explosives by any person, which is not located within the area of a mining operation or site.

B. Except as otherwise provided by this part, it shall be unlawful for any person to store or use any blasting agents or explosives, or conduct, supervise or control a blasting operation in this state without first complying with the provisions of the Oklahoma Explosives and Blasting Regulation Act and rules promulgated by the Oklahoma Mining Commission.

C. Except as otherwise required by this part, by January 1, 1996:

1. Any person performing blasting activity shall be certified as a blaster by the Department of Mines;

2. All blasting operations shall be conducted under the direction of a certified blaster. Blaster certification may be obtained from the Department upon application and proof of competency as determined by rules of the Department; and

3. Before January 1, 1996, all blasting operations and activities shall be conducted by competent, experienced persons who understand the hazards involved.

D. Any blaster certification issued by the Department shall be carried by the blaster or shall be on file at the blasting area during blasting operations.

E. A blaster and at least one other person shall be present at the firing of a blast.

63-123.2.

A. Except as otherwise provided by this part, it is a violation to manufacture, store, or use explosives or blasting agents without first obtaining a permit from the Department of Mines.

B. Permits issued under this division shall not be transferable, and shall be readily available for inspection by representatives of the Department and law enforcement officials.

C. The Department may place such restrictions and limitations on permits as it deems necessary.

D. The Department may issue one-time or limited-time permits or permits for continuous blasting operations.

E. 1. Permits for continuous blasting operations issued under this division shall be valid for the calendar year after the date of issue unless revoked or suspended. Permits for continuous blasting operations may be renewed on each issuance date and a showing of compliance with the Oklahoma Explosives and Blasting Regulation Act and rules promulgated thereto.

2. Permits for one-time or limited-time permits shall be valid only for the time specified in the permit.

F. Any person holding a permit issued under this division shall keep such records as may be required by the Department. Records shall be maintained for not less than two (2) years following the year in which the record is made. All such records shall be open to inspection by the Department or its representatives during normal business hours.

63-123.2A.

A. No person shall purchase blasting agents or explosives in this state without first obtaining a permit pursuant to the Oklahoma Explosives and Blasting Regulation Act or without first obtaining written notification from the Department of Mines that the person is exempt from this permit requirement.

B. Distributors or sellers of blasting agents or explosives shall require presentation of either the permit or exemption notification required in subsection A of this section before the sale or transfer of blasting agents or explosives.

C. The Oklahoma Mining Commission shall promulgate rules to implement this section.

63-123.3.

The Department shall enforce the provisions of this division and for such purposes shall:

1. Issue permits to applicants found by the Department, after inspection and investigation, to be qualified for such permit under the provisions of this division and the rules promulgated by the Department;
2. Deny, suspend, or revoke permits upon a finding of noncompliance or violation of the provisions of this division or of the applicable rules of the Department;
3. Hold hearings upon the application of any person aggrieved by any order of the Department with respect to the denial, suspension, or revocation of any permit; and
4. Inspect, during normal business hours, any building, structure, or premises subject to the provisions of this division, and, upon the discovery of any violation of this division or the applicable rules, issue such orders as are necessary for the safety of workers and the public, and, in the case of imminent hazard or emergency, apply for an injunction in the appropriate district court.

63-123.4.

A. The Department of Mines shall promulgate the necessary rules to implement the provisions of this Division. Rules promulgated by the Department shall include but not be limited to requirements for blasting plans, use of explosives, public notices, and records.

B. The Department of Mines may establish a schedule of fees to be charged for applications for or issuance of new and renewed certifications and permits required pursuant to this division. The fees shall be subject to the following provisions:

1. The Department shall follow the procedures required by the Administrative Procedures Act for promulgating rules in establishing or amending any such schedule of fees;

2. The Department shall base its schedule of fees upon the reasonable costs of operating the programs specified by this division; and

3. The fees authorized by this section shall not be implemented by emergency rule but shall be adopted by permanent rules, which shall be submitted to the Legislature for review pursuant to Section 308 of Title 75 of the Oklahoma Statutes prior to implementation.

63-123.5.

A. In the enforcement of the Oklahoma Explosives and Blasting Regulation Act pursuant to this division, any person who violates any permit condition or who violates any other provision of the Oklahoma Explosives and Blasting Regulation Act or rules promulgated thereto pursuant to this division may be assessed an administrative penalty by the Department. Such penalty shall not exceed Five Thousand Dollars ($5,000.00) for each violation. Each day of continuing violation may be deemed a separate violation for purposes of penalty assessments. In determining the amount of the penalty, consideration shall be given to the person's history of previous violations regarding explosives and blasting operation; the seriousness of the violation, including any irreparable harm to the environment and any hazard to the health or safety of the public; whether the person was negligent; and the demonstrated good faith of the person charged in attempting to achieve rapid compliance after notification of the violation.

B. An administrative penalty shall be assessed by the Department only after the person charged with a violation described under subsection A of this section has been given an opportunity for a hearing pursuant to Article II of the Administrative Procedures Act. Where such a hearing has been held, the Department shall make findings of fact, and shall issue a written decision as to the occurrence of the violation and the amount of the penalty which is warranted, incorporating, when appropriate, an order therein requiring that the penalty be paid. When appropriate, the Department shall consolidate such hearings with other proceedings under the Oklahoma Explosives and Blasting Regulation Act. Any hearing under this section shall be of record. Where the person charged with such a violation fails to avail himself of the opportunity for a hearing, an administrative penalty shall be assessed by the Department after determining that a violation did occur, and the amount of the penalty which is warranted, and issuing an order requiring that the penalty be paid.

C. Upon the issuance of a notice or order charging that a violation of the Oklahoma Explosives and Blasting Regulation Act has occurred, the Department shall inform the operator within thirty (30) days of the proposed amount of said penalty. The person charged with the penalty shall then have thirty (30) days to pay the proposed penalty in full or, if the person wishes to contest either the amount of the penalty or the fact of the violation, forward the proposed amount to the Department for placement in an escrow account. If through administrative or judicial review of the proposed penalty, it is determined that no violation occurred, or that the amount of the penalty should be reduced, the Department shall within thirty (30) days remit the appropriate amount to the person.

D. Administrative penalties owed under the Oklahoma Explosives and Blasting Regulation Act may be recovered in a civil action brought by the Attorney General or any district attorney in the district in which the violation occurred at the request of the Department in the appropriate district court. Such action, also, may be brought by the Department.

E. Any person who willfully and knowingly violates a condition of a permit issued pursuant to this division or fails or refuses to comply with any order issued under this division, or any order incorporated in a final decision issued by the Department under this division, shall, upon conviction, be punished by a fine of not more than Ten Thousand Dollars ($10,000.00) or by imprisonment for not more than one (1) year, or both.

F. Whenever a corporate permittee violates a condition of a permit issued pursuant to this division or fails or refuses to comply with any order issued under this division, or any order incorporated in a final decision issued by the Executive Director of the Department of Mines under this division, any director, officer or agent of such corporation who willfully and knowingly authorized, ordered or carried out such violation, failure or refusal shall be subject to the same administrative penalties, fines and imprisonment that may be imposed upon a person under subsections A and E of this section.

G. Whoever knowingly makes any false statement, representation or certification, or knowingly fails to make any statement, representation or certification in any application, record, report, plan or other document filed or required to be maintained pursuant to this division or any order of decision issued by the Department under this division, shall, upon conviction, be punished by a fine of not more than Ten Thousand Dollars ($10,000.00) or by imprisonment for not more than one (1) year, or both.

H. Any person who fails to correct a violation for which a citation has been issued within the period permitted for its correction shall be assessed an administrative penalty of not less than Seven Hundred Fifty Dollars ($750.00) for each day during which such failure or violation continues.

The period permitted for corrections of violations shall not end until:

1. The entry of a final order by the Department after an expedited hearing which ordered the suspension of the abatement requirements of the citation because it was determined that the person will suffer irreparable loss or damage from the application of the abatement requirements; or

2. The entry of an order by a court in any review proceedings initiated by the person in which the court orders the suspension of the abatement requirements.

I. Any person who shall, except as permitted by law, willfully resist, prevent, impede or interfere with the Department or any of the agents or employees thereof in the performance of duties pursuant to this division shall, upon conviction, be punished by a fine of not more than Five Thousand Dollars ($5,000.00), or by imprisonment for not more than one (1) year, or both.

63-123.6.

The provisions of this part shall be in addition to any other state or federal laws or municipal ordinances regulating explosives, blasting agents or similar devices. Each person shall comply with all applicable state and federal laws and regulations and municipal ordinances for the storage, manufacture, transportation and the use of explosives or blasting agents.

63-123.7.

Any fees, administrative penalties or any other monies obtained by the Department of Mines pursuant to the Oklahoma Explosives and Blasting Regulation Act shall be deposited in the Department of Mines Revolving Fund and shall be expended by the Department of Mines for implementation and enforcement of this part or as otherwise deemed necessary by the Department for complying with its responsibilities and duties according to law.

63-123.8.

A. 1. The provisions of this part shall not apply to:

- a. persons engaged in shooting wells or seismographic operations for the purpose of oil or gas production,
- b. mining operations regulated by Title 45 of the Oklahoma Statutes, and
- c. persons using explosives or blasting agents for noncommercial use on their own land, owned in fee or by contract, for the removal of trees, rocks and dams or for other normal agricultural purposes.

2. Any person exempted from the provisions of the Oklahoma Explosives and Blasting Regulation Act pursuant to this subsection shall be liable for all damages caused by the use of explosives, or blasting agents and blasting operations, which damages shall be recoverable in any court of competent jurisdiction.

B. In addition, the provisions of this part shall not apply to:

1. Any municipalities or counties in this state using any blasting agents, explosives or conducting, supervising or controlling a blasting operation in this state. Any such municipality or county shall comply with rules promulgated by the Oklahoma Mining Commission;

2. The Department of Transportation in the conducting, supervision or controlling of any blasting operation in this state,

provided the Department shall comply with rules promulgated by the Oklahoma Mining Commission;

3. Duly qualified bomb technicians of municipal, county, state, and federal law enforcement agencies for the transportation, storage or disposal of any explosive chemical, compound or device, when such technician is performing responsibilities for the preservation of public peace, safety, or criminal investigation.

Attachment 2
Oklahoma Underground Facilities Damage Prevention Act

§63-142.1. Short title.

This act shall be known and may be cited as the "Oklahoma Underground Facilities Damage Prevention Act".

Laws 1981, c. 94, § 1, eff. Jan. 1, 1982.

§63-142.2. Definitions.

As used in the Oklahoma Underground Facilities Damage Prevention Act:

1) "Certified project" means a project where the public agency responsible for the public project, as part of its procedure, certifies that the project right-of-way is free and clear of underground facilities or wherein the public agency responsible for such project, as part of its procedure, notifies all persons determined by the public agency to have underground facilities located within the construction right-of-way and certifies that all known underground facilities are duly located or noted on the engineering drawings for the project;
2) "Damage" means any impact upon or removal of support from an underground facility as a result of explosion, excavation or demolition which according to the operating practices of the operator of the underground facilities would necessitate the repair thereof;
3) "Demolish" means to wreck, raze, render, move or remove a structure by means of any equipment or explosive;
4) "Demolition" means the act or operation of demolishing a structure;
5) "Excavate" means to dig, compress or remove earth, rock or other materials in or on the ground by use of mechanized equipment or blasting, including, but not necessarily limited to, augering, boring, backfilling, drilling, grading, pile driving, plowing in, pulling in, trenching, tunneling and plowing; provided, however, that neither:
    a) the moving of earth by tools manipulated only by human or animal power, nor
    b) any form of cultivation for agricultural purposes, nor any augering, dozing by noncommercial dozer operators or digging for postholes, farm ponds, land clearing or other normal agricultural purposes, nor
    c) routine maintenance, nor
    d) work by a public agency or its contractors on a preengineered project, nor
    e) work on a certified project, nor
    f) work on a permitted project, nor
    g) the opening of a grave in a cemetery, nor
    h) a solid waste disposal site which is a preengineered project, nor
    i) any individual excavating on his own property and who is not in the excavating business for hire, shall be deemed excavation
6) "Excavation" means the act or operation of excavating;
7) "Excavator" means a person or public agency that intends to excavate or demolish within the State of Oklahoma;
8) "Notification center" means the statewide center currently known as the Oklahoma One-Call System, Inc., which has as one of its purposes to receive notification of

planned excavation and demolition in a specified area from excavators, and to disseminate such notification of planned excavation or demolition to operators who are members and participants;

9) "Operator" shall mean and include any person or public agency owning or operating underground facilities;

10) "Permitted project" means a project where a permit for the work to be performed must be issued by a state or federal agency and, as a prerequisite to receiving such permit, the applicant must locate all underground facilities in the area of the work and in the vicinity of any blasting and notify each owner of such underground facilities;

11) "Person" includes any individual, partnership, corporation, association, cooperative, trust or other entity, including a person engaged as a contractor by a public agency, but not including a public agency;

12) "Preengineered project" means a public project wherein the public agency responsible for such project, as part of its engineering and contract procedures, holds a meeting prior to the commencement of any construction work on such project in which all persons, determined by the public agency to have underground facilities located within the construction area of the project, are invited to attend and given an opportunity to verify or inform the public agency of the location of their underground facilities, if any, within the construction area and where the location of all known underground facilities are duly located or noted on the engineering drawing and specifications for the project;

13) "Public agency" means the state or any board, commission or agency of the state, and any city, town, county, subdivision thereof or other governmental entity;

14) "Routine maintenance" means the grading of roads and barrow or drainage ditches, the removal and replacement of pavement, including excavation relating thereto and the installation and maintenance of drainage and bridge facilities, signs, guardrails, and electrical and communications facilities in or on the public rights-of-way by a public agency; and

15) "Underground facility" means any underground line, cable, facility, system and appurtenances thereto, for producing, storing, conveying, transmitting or distributing communication (including voice, video, or data information), electricity, power, light, heat, refined petroleum products, water (including storm water), steam, sewage and other commodities. Underground facilities shall also mean oil and natural gas pipelines that are subject to the Hazardous Liquid Transportation System Safety Act and natural gas pipelines subject to the jurisdiction of the Oklahoma Corporation Commission Pipeline Safety Department, and any oil and gas pipeline located in a public right-of-way.

Added by Laws 1981, c. 94, § 2, eff. Jan. 1, 1982. Amended by Laws 1995, c. 344, § 27, eff. Nov. 1, 1995; Laws 2002, c. 412, § 1, eff. July 1, 2002; Laws 2003, c. 362, § 1, eff. Nov. 1, 2003; Laws 2004, c. 427, § 1, emerg. eff. June 4, 2004.

§63-142.3. Filing of notice - Participation by municipality in statewide one-call notification center.

All operators of underground facilities shall participate in the statewide one-call notification center and shall have on file with the notification center a notice that such operator has underground facilities, the county or counties where such facilities are located, and the address and telephone number of the person or persons from whom information about such underground facilities may be obtained. A municipality shall participate in the statewide one-call notification center as provided for in this section.

25, § 1, emerg. eff. March 30, 1992; Laws 2003, c. 362, § 2, eff. Nov. 1, 2003, Amended by Laws 2016, HB 1951, c. 151, § 1, eff. November 1, 2016

§63-142.4. Filing fees.

A. As provided for in this section, the notification center shall charge and collect fees from operators filing notices pursuant to Section 142.3 of this title, except for rural water districts which have less than one thousand one hundred meters and municipalities which have a population of less than three thousand (3,000).
B. Upon the initial filing of a notice or statement and annually thereafter, a fee shall be collected in a manner as provided for in Section 142.10 of this title. The fee shall be due and payable on January 1 of each year. Failure to pay such fee on or before February 1 of such year shall result in the filing being void and the notification center shall remove such operator from the list of operators having underground facilities in the county. Such operator may thereafter file again pursuant to this act, but only upon payment to the notification center of the above-specified initial filing fee and an additional late filing fee of Fifty Dollars ($50.00).
C. The notification center shall maintain a current list of all operators on file pursuant to this act and shall make copies of such list available upon payment of the appropriate fees.

Added by Laws 1981, c. 94, § 4, eff. Jan. 1, 1982. Amended by Laws 2003, c. 362, § 3, eff. Nov. 1, 2003..

§63-142.5. Certain excavations, demolitions and explosions prohibited near certain facilities.

No excavator shall demolish a structure, discharge an explosive or commence to excavate in a highway, street, alley or other public ground or way, a private easement, or on or near the location of the facilities of an operator without first complying with the requirements of the Underground Facilities Damage Prevention Act and the Oklahoma Explosives and Blasting Regulation Act.

Added by Laws 1981, c. 94, § 5, eff. Jan. 1, 1982. Amended by Laws 1995, c. 344, § 28, eff. Nov. 1, 1995.

§63-142.6. Notice of proposed demolition, explosion or excavation - Marking or providing location of facilities - Emergencies.

A. Before an excavator shall demolish a structure, discharge any explosive or commence to excavate in a highway, street, alley or other public ground or way, on or near the location of an operator's underground facilities, or a private easement, such excavator shall first notify all operators in the geographic area defined by the notification center who have on file with the notification center a notice pursuant to Section 142.3 of this title to determine whether any operators have underground facilities in or near the proposed area of excavation or demolition. When an excavator has knowledge that an operator does not have underground facilities within the area of the proposed excavation, the excavator need not notify the operator of the proposed excavation. However, an excavator shall be responsible for damage to the underground facilities of an operator if the notification center was not notified. Notice shall be given no more than ten (10) days nor less than forty-eight (48) hours, excluding Saturdays, Sundays and legal holidays, prior to the commencement of the excavation or demolition.

B. Each operator served with notice in accordance with subsection A above either directly or by notice to the notification center shall, within forty-eight (48) hours after receipt of verification from the notification center that the notice has been accepted and acknowledged, excluding Saturdays, Sundays and legal holidays, unless otherwise agreed to between the excavator and operator, locate and mark or otherwise provide the approximate location of the underground facilities of the operator in a manner as to enable the excavator to employ hand-dug test holes to determine the precise location of the underground facilities in advance of excavation. For the purpose of this act, the approximate location of the underground facilities shall be defined as a strip of land two (2) feet on either side of such underground facilities. Whenever an operator is served with notice of an excavation or demolition and determines that the operator does not have underground facilities located within the proposed area of excavation or demolition, the operator shall communicate this information to the excavator originating the notice prior to the commencement of such excavation or demolition.

C. The only exception to subsection A of this section shall be when an emergency exists that endangers life, health or property. Under these conditions, excavation operations may begin immediately, providing reasonable precautions are taken to protect underground facilities. All operators of underground facilities within the area of the emergency must be notified promptly when an emergency requires excavation prior to the location of the underground facilities being marked

D. Every notice given by an excavator to an operator pursuant to this section or to the notification center pursuant to Section 142.3 of this title shall contain at least the following information:

   1. The name of the individual serving such notice;
   2. The location of the proposed area of excavation or demolition;

3. The name, address and telephone number of the excavator or excavator's company;
4. The excavator's field telephone number, if one is available;
5. The type and the extent of the proposed work;
6. Whether or not the discharging of explosives is anticipated; and
7. The date and time when work is to begin.

E. In marking the approximate location of underground facilities, an operator shall follow the standard color coding described herein:

Operator and Type of Product	Specific Group Identifying Color
Electric Power Distribution and Transmission	Safety Red
Municipal Electric Systems	Safety Red
Gas Distribution and Transmission	High Visibility Safety Yellow
Oil Distribution and Transmission	High Visibility Safety Yellow
Dangerous Materials, Product Lines, Steam Lines	High Visibility Safety Yellow
Telephone and Telegraph Systems	Safety Alert Orange
Police and Fire Communications	Safety Alert Orange
Cable Television	Safety Alert Orange
Water Systems	Safety Precaution Blue
Slurry Systems	Safety Precaution Blue
Sewer Systems	Safety Green

Added by Laws 1981, c. 94, § 6, eff. Jan. 1, 1982. Amended by Laws 2003, c. 362, § 4, eff. Nov. 1, 2003, Amended by Laws 2016, HB 1951, c. 151, § 2, eff. November 1, 2016

§63-142.7. Use of powered or mechanized equipment - Exemptions.

A. Except as provided in subsection B of this section, powered or mechanized equipment shall not be used directly over marked routes of underground facilities until the precise location of the underground facilities has been determined by the excavator, and then only after the facilities have been exposed and properly protected to avoid damage to them. If the precise location of the underground facilities cannot be determined by the excavator, the operator thereof shall be notified by the excavator so that the operator can determine the precise location of the underground facilities prior to continuing excavation or demolition.

B. The only exception to the prohibition of the use of powered or mechanized equipment directly over marked routes of underground facilities shall be for the removal of pavement or masonry, and then only to the depth of such pavement or masonry.

Laws 1981, c. 94, § 7, eff. Jan. 1, 1982.

§63-142.8. Additional notice required.

In addition to the notice required by Section 142.6 of this title, whenever the demolition of a structure is proposed, operators in the geographic area defined by the notification center who have a notice on file with the notification center pursuant to Section 142.3 of this title shall be given at least seven (7) business days' notice of the proposed demolition before the demolition work begins. Such notice shall be initiated by the notification center after the excavator has met local code requirements for a demolition permit. When an operator is served with notice and determines that underground facilities are within the proposed area of demolition and such facilities require additional protection, service removal or termination, the operator shall communicate this information to the excavator and by mutual agreement the operator and excavator shall determine a date to begin the demolition which shall not exceed sixty (60) business days from the original demolition notice. If a public agency determines that the structure endangers the public health or safety, then the public agency may, in the manner provided by law, order the immediate demolition of the structure.

Added by Laws 1981, c. 94, § 8, eff. Jan. 1, 1982. Amended by Laws 2003, c. 362, § 5, eff. Nov. 1, 2003; Laws 2004, c. 427, § 2, emerg. eff. June 4, 2004.

§63-142.9. Damage to underground facilities.

A. When any damage occurs to an underground facility or its protective covering, the operator thereof shall be notified immediately by the excavator who caused the damage.
B. Upon receiving notice of such damage, the operator shall promptly dispatch personnel to the location to effect temporary or permanent repairs.
C. Should damage occur that endangers life, health or property, the excavator responsible for the work shall keep all sources of ignition away from the damaged area and shall take immediate action to protect the public and property and to minimize the hazard until arrival of the operator's personnel or until the appropriate police or fire officials shall have arrived and taken charge of the damaged area.
D. An excavator shall delay any backfilling in the immediate area of the damaged underground facilities until the damage has been repaired, unless the operator authorizes otherwise. The repair of such damage must be performed by the operator or by qualified personnel authorized by the operator.

Laws 1981, c. 94, § 9, eff. Jan. 1, 1982.

§63-142.9a. Damage to underground facilities – Liability - Injunction.

A. Any excavator, except for a public agency who fails to comply with the Oklahoma Underground Facilities Damage Prevention Act and who damages an underground facility owned or operated by a nonprofit rural water corporation organized pursuant to Section 863 of Title 18 of the Oklahoma Statutes or a rural water district organized pursuant to the Rural Water, Sewer, Gas, and Solid Waste

Management Districts Act, shall be liable for the underground damage to and responsible for the repair of such facilities. Any new underground facilities installed on and after September 1, 1992, shall contain materials capable of being detected so that the facilities can be accurately located.

B. Any excavator who damages or cuts an underground facility, as a result of negligently failing to comply with the provisions of the Oklahoma Underground Facilities Damage Prevention Act or as a result of failing to take measures for the protection of an underground facility shall be liable to the operator of the underground facility for the repair of the damaged underground facility.

C. Except for public agencies, any excavator who by willful act or by reckless disregard of the rights of others, repeatedly violates the provisions of the Oklahoma Underground Facilities Damage Prevention Act and repeatedly damages underground facilities, thereby threatening the public health, safety, and welfare, may be enjoined by a court of competent jurisdiction from further excavation.

Added by Laws 1992, c. 369, § 1, eff. Sept. 1, 1992. Amended by Laws 2002, c. 412, § 2, eff. July 1, 2002; Laws 2003, c. 362, § 6, eff. Nov. 1, 2003.

§63-142.10. Statewide notification center.

A. This act recognizes the value of and authorizes the establishment of a statewide notification center.

B. Upon establishment, the notification center shall operate twenty-four (24) hours a day, seven (7) days a week. Notification, as required by Section 142.6 of this title, to operators who are members of or participants in the notification center, shall be given by notifying the notification center by telephone or other acceptable means of communication, the content of such notification to conform to Section 142.6 of this title.

C. All operators who have underground facilities within the defined geographical boundary of the notification center shall be afforded the opportunity to become a member of the notification center on the same terms as the original members. Others may participate as nonmembers on terms and conditions as the members deem appropriate.

D. A suitable record shall be maintained by the notification center to document the receipt of the notices from excavators as required by this act.

Added by Laws 1981, c. 94, § 10, eff. Jan. 1, 1982. Amended by Laws 2003, c. 362, § 7, eff. Nov. 1, 2003.

§63-142.11. Exemptions.

Notwithstanding anything which may be contained in this act to the contrary, public agencies and their contractors engaged in work within the public right-of-way which work is a preengineered project, certified project or routine maintenance shall be exempt from the provisions of this act. Provided, a public agency contractor, prior to engaging in routine maintenance, shall take reasonable steps to determine the location of underground facilities in or near the proposed area of work. Reasonable steps may include utilization of the statewide one-call notification center procedures as provided for in Section 142.6 of this title.

Added by Laws 1981, c. 94, § 11, eff. Jan. 1, 1982. Amended by Laws 1986, c. 114, § 1, eff. Nov. 1, 1986; Laws 2003, c. 362, § 8, eff. Nov. 1, 2003.

§63-142.12. Election not to participate in statewide one-call notification center – Designation of person authorized to provide information.

Added by Laws 2003, c. 362, § 9, eff. Nov. 1, 2003. Repealed by Laws 2016, HB 1951, c. 151, § 3, eff. November 1, 2016

§63-142.13. Enforcement authority – Corporation Commission.

The Corporation Commission is hereby designated as the agency to enforce the provisions of the Oklahoma Underground Facilities Damage Prevention Act, Section 142.1 et seq. of Title 63 of the Oklahoma Statutes, over excavation or demolition on or near or directly over the location of, and notice of damage to, oil and natural gas physical facilities which are described by the currently effective definition of "pipeline" in 49 CFR Part 192.3 and "pipeline" and "pipeline system" in 49 CFR Part 195.2. Enforcement authority granted in this section shall be concurrent with and shall not be construed to modify or limit any private right of action, including those available pursuant to Section 142.9a of Title 63 of the Oklahoma Statutes. Terms used in this section shall be as defined in the Oklahoma Underground Facilities Damage Prevention Act.

Added by Laws 2014, c. 243, § 1, emerg. eff. May 9, 2014.

APPENDIX J

WATERBODIES CROSSED BY THE MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT PIPELINE FACILITIES

APPENDIX J

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
MAINLINE							
Tributary to North Canadian River	S-CN-WCR-17/01/18-01	6.7	Ephemeral	4.6	Open cut	A, E, G	Warm water
North Canadian River	S-CN-WCR-16/12/08-01	7.7	Perennial	0.0	HDD	A, C, E, G	Warm water
Tributary to Six Mile Creek	S-CN-WCR-16/12/07-01	9.5	Ephemeral	3.6	Open cut	A, E, G	Warm water
Sixmile Creek	S-CN-WCR-17/01/18-02	12.2	Intermittent	10.1	Open cut	A, E, G	Warm water
Tributary to Sixmile Creek	S-CN-WCR-16/12/07-02	12.9	Intermittent	1.0	Open cut	A, E, G	Warm water
Tributary to Sixmile Creek	S-CN-WCR-16/12/07-03	13.3	Intermittent	2.0	Open cut	A, E, G	Warm water
Tributary to North Canadian River	S-CN-LAG-17/01/18-01	15.4	Intermittent	7.4	Open cut	A, E, G	Warm water
Tributary to North Canadian River	S-CN-LAG-17/01/18-02	15.6	Intermittent	0.0	HDD	A, E, G	Warm water
Tributary to North Canadian River	S-CN-WCR-16/12/07-04	16.0	Ephemeral	5.6	Open cut	A, E, G	Warm water
Tributary to North Canadian River	S-CN-WCR-16/12/08-99	16.9	Ephemeral	2.4	Open cut	A, E, G	Warm water
Tributary to North Canadian River	S-CN-RKT-17/04/13-04a	17.4	Intermittent	21.1	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-CN-TAS-17/01/19-02	18.2	Intermittent	6.7	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-CN-AAL-17/01/18-03	19.3	Ephemeral	3.0	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-CN-AAL-17/01/18-01	19.9	Intermittent	5.2	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-CN-TAS-17/01/19-01	21.3	Ephemeral	4.3	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-CN-WCR-16/12/08-02	23.1	Ephemeral	3.7	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-CN-TAS-17/01/18-04	24.6	Intermittent	5.1	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-CN-WCR-16/12/09-01	25.5	Intermittent	15.2	Open cut	A, E, G	Warm water
Canadian River	S-GR-RKT-16/12/09-03	28.4	Perennial	0.0	HDD	A, E, G, H	Warm water
Tributary to Canadian River	S-GR-TAS-17/01/19-02	28.8	Ephemeral	3.0	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-GR-RKT-16/12/10-01	30.0	Ephemeral	3.0	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Canadian River	S-GR-RKT-16/12/10-03	30.8	Perennial	12.1	Dry open cut	A, E, G	Warm water
Tributary to Canadian River	S-GR-RKT-16/12/10-02	31.1	Ephemeral	3.5	Open cut	A, E, G	Warm water
Tributary to Canadian River	S-GR-EHK-17/01/18-02	32.1	Ephemeral	8.8	Open cut	A, E, G	Warm water
Tributary to Buggy Creek	S-GR-WCR-16/12/10-06	34.6	Ephemeral	2.0	Open cut	A, E, G	Warm water
Buggy Creek	S-GR-RFT-16/12/10-01	34.8	Perennial	17.5	Dry open cut	A, E, G, H	Warm water
Tributary to Buggy Creek	S-GR-WCR-16/12/10-05	35.4	Intermittent	3.3	Open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GR-WCR-16/12/09-03b	39.4	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Salt Creek	S-GR-WCR-16/12/09-03	39.4	Ephemeral	4.0	Open cut	A, E, G	Warm water
Salt Creek	S-GR-RKT-17/01/18-08	41.1	Perennial	15.1	Dry open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GR-RFT-16/12/09-01	42.2	Perennial	16.1	Dry open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GR-WCR-16/12/09-05	43.7	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to West Bitter Creek	S-GR-WCR-16/12/10-07	45.7	Ephemeral	6.6	Open cut	A, E, G	Warm water
Tributary to West Bitter Creek	S-GR-RFT-16/12/10-06	46.4	Ephemeral	1.2	Open cut	A, E, G	Warm water
West Bitter Creek	S-GR-WCR-16/12/09-01	48.8	Perennial	10.1	Dry open cut	A, C, E, G	Warm water
Brushy Creek	S-GR-RFT-16/12/12-01	50.4	Perennial	17.0	Dry open cut	A, E, G	Warm water
Tributary to Brushy Creek	S-GR-RKT-17/07/11-10	50.9	Ephemeral	6.2	Open cut	A, E, G	Warm water
Unnamed Pond	S-GR-RFT-16/12/12-02	50.9	Pond	NA	NA	A, E, G	Warm water
Tributary to Brushy Creek	S-GR-RFT-16/12/12-03	51.1	Ephemeral	2.9	Open cut	A, E, G	Warm water
Tributary to East Bitter Creek	S-GR-RKT-17/01/18-11	51.9	Ephemeral	3.8	Open cut	A, E, G	Warm water
East Bitter Creek	S-GR-EHK-17/01/18-09	52.7	Perennial	8.2	Open cut	A, C, E, G	Warm water
Unknown Tributary	S-GR-RKT-17/01/18-15	53.3	Ephemeral	3.0	Open cut	A, E, G	Warm water
Tributary to Spring Creek	S-GR-RKT-16/12/10-09	53.8	Ephemeral	NA	NA	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Spring Creek	S-GR-RKT-16/12/10-10	54.5	Perennial	9.0	Open cut	A, E, G	Warm water
Tributary to West Winter Creek	S-GR-RFT-17/02/08-07	56.8	Perennial	3.8	Open cut	A, E, G	Warm water
Tributary to West Winter Creek	S-GR-RFT-17/02/08-11	57.1	Intermittent	2.0	Open cut	A, E, G	Warm water
Tributary to West Winter Creek	S-GR-RKT-16/12/12-12	57.6	Ephemeral	1.0	Open cut	A, E, G	Warm water
Tributary to West Winter Creek	S-GR-RKT-16/12/12-11	57.6	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to West Winter Creek	S-GR-RKT-16/12/12-09	58.1	Ephemeral	4.5	Open cut	A, E, G	Warm water
Tributary to West Winter Creek	S-GR-RKT-16/12/12-10	58.2	Intermittent	3.4	Open cut	A, E, G	Warm water
Tributary to West Winter Creek	S-GR-RKT-16/12/12-07	58.3	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Winter Creek	S-GR-RKT-16/12/12-04	59.0	Intermittent	3.2	Open cut	A, E, G	Warm water
Winter Creek	S-GR-RKT-16/12/12-02	59.7	Perennial	8.9	Dry open cut	A, C, E, G	Warm water
Tributary to Winter Creek	S-GR-RKT-16/12/12-13	60.8	Intermittent	5.3	Open cut	A, E, G	Warm water
Tributary to Winter Creek	S-GR-RKT-16/12/13-04	61.0	Ephemeral	1.0	Open cut	A, E, G	Warm water
Tributary to Winter Creek	S-GR-RKT-16/12/13-02	61.1	Intermittent	4.0	Open cut	A, E, G	Warm water
Tributary to Winter Creek	S-GR-RKT-16/12/13-01a	61.1	Ephemeral	2.2	Open cut	A, E, G	Warm water
Tributary to Winter Creek	S-GR-RKT-16/12/13-01b	61.1	Ephemeral	2.0	Open cut	A, E, G	Warm water
Unnamed Tributary	S-GR-RKT-16/12/13-14	61.9	Ephemeral	7.0	Open cut	A, E, G	Warm water
Tributary to Laflin Creek	S-GR-TAS-17/01/19-01b	63.4	Ephemeral	4.4	Open cut	A, E, G	Warm water
Tributary to Laflin Creek	S-GR-TAS-17/01/19-01a	63.4	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Washita River	S-GR-RKT-16/12/13-16	63.8	Ephemeral	2.0	Open cut	A, E, G	Warm water
Washita River	S-GR-RKT-16/12/13-19	65.0	Perennial	0.0	HDD	A, C, E, G	Warm water
Roaring Creek	S-GR-EHK-17/01/19-07	66.9	Perennial	21.1	Dry open cut	A, C, E, G	Warm water
Tributary to Slough Creek	S-GR-WCR-16/12/14-02	68.7	Intermittent	5.6	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Slough Creek	S-GR-WCR-16/12/14-01	69.3	Perennial	3.0	Open cut	A, E, G	Warm water
Tributary to Sandy Creek	S-GR-RFT-16/12/13-04	71.0	Ephemeral	2.0	Open cut	A, E, G	Warm water
Sandy Creek	S-GR-EHK-17/01/19-09	71.9	Perennial	9.6	Open cut	A, E, G	Warm water
Tributary to Washita River	S-GR-RKT-17/01/19-16	73.3	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Washita River	S-GR-WCR-16/12/13-03	73.8	Ephemeral	2.4	Open cut	A, E, G	Warm water
Tributary to Washita River	S-GR-AAL-17/01/19-07a	74.0	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Washita River	S-GR-AAL-17/01/19-07b	74.0	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Larimore Creek	S-GR-WCR-16/12/14-03	74.8	Intermittent	10.2	Open cut	A, E, G	Warm water
Tributary to Larimore Creek	S-GR-RFT-16/12/12-09	75.2	Ephemeral	2.1	Open cut	A, E, G	Warm water
Larimore Creek	S-GR-RFT-16/12/12-06	75.4	Perennial	2.0	Open cut	A, E, G	Warm water
Tributary to Larimore Creek	S-GR-RKT-16/12/14-08	76.1	Ephemeral	3.0	Open cut	A, E, G	Warm water
Tributary to Larimore Creek	S-GR-TAS-17/07/11-12	76.4	Ephemeral	6.5	Open cut	A, E, G	Warm water
Tributary to Larimore Creek	S-GR-RKT-16/12/15-01	76.4	Intermittent	1.0	Open cut	A, E, G	Warm water
Tributary to Rounds Creek	S-GR-RKT-16/12/15-02	77.3	Intermittent	2.3	Open cut	A, E, G	Warm water
Tributary to Rounds Creek	S-GR-WCR-16/12/15-02	77.8	Intermittent	4.1	Open cut	A, E, G	Warm water
Tributary to Rounds Creek	S-GA-RKT-16/12/15-03	78.6	Intermittent	2.9	Open cut	A, E, G	Warm water
Tributary to Rounds Creek	S-GA-WCR-16/12/15-01	79.2	Intermittent	2.3	Open cut	A, E, G	Warm water
Rounds Creek	S-GA-RKT-17/01/20-03	79.8	Perennial	10.5	Dry open cut	A, E, G	Warm water
Tributary to Rush Creek	S-GA-RFT-16/12/15-15	81.2	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Rush Creek	S-GA-RFT-16/12/16-07	81.6	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Rush Creek	S-GA-RFT-16/12/16-12	82.1	Ephemeral	1.3	Open cut	A, E, G	Warm water
Rush Creek	S-GA-RFT-16/12/16-10	83.9	Perennial	36.7	Dry open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Rush Creek	S-GA-RFT-16/12/16-26	84.1	Ephemeral	1.0	Open cut	A, E, G	Warm water
Tributary to Rush Creek	S-GA-RFT-16/12/20-01a	84.8	Intermittent	2.0	Open cut	A, E, G	Warm water
Tributary to Rush Creek	S-ST-RKT-17/07/13-02	85.8	Intermittent	43.1	Open cut	A, E, G	Warm water
Tributary to Wildcat Creek	S-ST-LAG-17/01/19-04c	87.0	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Wildcat Creek	S-ST-LAG-17/01/19-04b	87.0	Ephemeral	NA	NA	A, E, G	Warm water
Unnamed Pond	S-ST-LAG-17/01/19-03	87.0	Pond	NA	NA	A, E, G	Warm water
Tributary to Wildcat Creek	S-ST-LAG-17/01/19-04a	87.0	Ephemeral	4.0	Open cut	A, E, G	Warm water
Tributary to Wildcat Creek	S-ST-RFT-16/12/20-17	87.2	Ephemeral	3.4	Open cut	A, E, G	Warm water
Tributary to Wildcat Creek	S-ST-WCR-17/10/26-02	88.7	Intermittent	NA	NA	A, E, G	Warm water
Tributary to Wildcat Creek	S-ST-RFT-16/12/21-06b	88.8	Intermittent	24.5	Open cut	A, E, G	Warm water
Tributary to Wildcat Creek	S-ST-RFT-16/12/21-04	89.2	Ephemeral	1.0	Open cut	A, E, G	Warm water
Tributary to Wildcat Creek	S-ST-RFT-16/12/21-01	89.7	Ephemeral	2.0	Open cut	A, E, G	Warm water
Wildcat Creek	S-GA-RFT-16/12/21-02	89.9	Perennial	20.5	Dry open cut	A, E, G	Warm water
Tributary to Wildcat Creek	S-GA-RFT-16/12/21-08	90.4	Intermittent	2.2	Open cut	A, E, G	Warm water
Tributary to Wildcat Creek	S-GA-RFT-16/12/21-17	90.9	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Wildcat Creek	S-GA-RFT-16/12/21-15	91.2	Ephemeral	4.0	Open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-RFT-16/12/21-12	92.3	Ephemeral	1.6	Open cut	A, E, G	Warm water
Unnamed Pond	S-GA-TAS-17/10/27-02	92.3	Pond	NA [e]	NA [e]	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/05-03	93.1	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/05-06	93.7	Ephemeral	2.8	Open cut	A, E, G	Warm water
Unnamed Pond	S-GA-TAS-17/10/27-01	94.6	Pond	NA	NA	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/05-25	94.9	Ephemeral	3.1	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Salt Creek	S-GA-AJF-17/01/05-23	95.0	Ephemeral	1.2	Open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/05-22	95.2	Ephemeral	5.1	Open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/05-15	95.3	Perennial	6.6	Dry open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/05-13	95.5	Intermittent	4.0	Dry open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/05-98	95.9	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/08-04	96.3	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/08-03	96.3	Ephemeral	4.1	Open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/08-06	96.5	Ephemeral	3.5	Open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/08-07	96.6	Ephemeral	3.1	Open cut	A, E, G	Warm water
Tributary to Salt Creek	S-GA-AJF-17/01/10-01	97.5	Ephemeral	5.0	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-GA-AJF-17/01/10-11	98.6	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-GA-AJF-17/01/10-10	98.6	Ephemeral	2.4	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-GA-AJF-17/01/10-06	99.6	Ephemeral	3.6	Open cut	A, E, G	Warm water
Wildhorse Creek	S-CR-AJF-17/01/10-18	100.5	Perennial	0.0	HDD	A, C, E, G	Warm water
Flat Creek	S-CR-RKT-17/01/11-08	102.7	Perennial	3.0	Open cut	A, E, G	Warm water
Tributary to Flat Creek	S-CR-RKT-17/01/11-06	102.9	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Flat Creek	S-CR-EHK-17/01/11-11	103.6	Ephemeral	2.7	Open cut	A, E, G	Warm water
Tributary to Flat Creek	S-CR-RKT-17/01/11-10	104.1	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-CR-LAG-17/06/29-02	104.9	Ephemeral	3.2	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-CR-EHK-17/01/11-23	105.0	Intermittent	4.0	Open cut	A, E, G	Warm water
Tributary to Bear Creek	S-CR-RKT-17/01/11-21	106.6	Ephemeral	1.1	Open cut	A, E, G	Warm water
Bear Creek	S-CR-RKT-17/01/12-06	106.8	Ephemeral	5.2	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Bear Creek	S-CR-RKT-17/01/12-02	107.6	Ephemeral	2.2	Open cut	A, E, G	Warm water
Tar Branch	S-CR-AJF-17/01/09-02	108.4	Ephemeral	17.0	Open cut	A, E, G	Warm water
Tributary to Tar Branch	S-CR-EHK-17/01/09-09	109.0	Intermittent	10.0	Open cut	A, E, G	Warm water
Tributary to Tar Branch	S-CR-AJF-17/01/09-10	109.2	Ephemeral	3.4	Open cut	A, E, G	Warm water
Tributary to Tar Branch	S-CR-EHK-17/01/09-11	109.3	Ephemeral	3.3	Open cut	A, E, G	Warm water
Tributary to Tar Branch	S-CR-AJF-17/01/09-11	109.6	Ephemeral	2.7	Open cut	A, E, G	Warm water
Tributary to Tar Branch	S-CR-AJF-17/01/09-09	109.9	Ephemeral	3.1	Open cut	A, E, G	Warm water
Tributary to West Spring Creek	S-CR-AJF-17/01/09-07	110.9	Ephemeral	3.9	Open cut	A, E, G	Warm water
Caddo Creek Site 7 Reservoir	S-CR-RKT-17/06/28-02	110.9	Lake	NA [e]	NA [e]	A, E, G	Warm water
West Spring Creek	S-CR-AJF-17/01/09-04	111.4	Ephemeral	6.1	Open cut	A, E, G	Warm water
Tributary to West Spring Creek	S-CR-AJF-17/01/09-05	111.8	Ephemeral	3.6	Open cut	A, E, G	Warm water
Tributary to West Spring Creek	S-CR-RKT-17/01/16-04	112.1	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to West Spring Creek	S-CR-RKT-17/01/16-01	112.8	Intermittent	13.9	Open cut	A, E, G	Warm water
Tributary to West Spring Creek	S-CR-RKT-17/01/16-05	113.0	Ephemeral	3.5	Open cut	A, E, G	Warm water
Tributary to Spring Creek	S-CR-RKT-17/01/16-06	113.1	Ephemeral	2.2	Open cut	A, E, G	Warm water
Tributary to Spring Creek	S-CR-RKT-17/01/16-07	113.3	Ephemeral	1.3	Open cut	A, E, G	Warm water
Tributary to Spring Creek	S-CR-RKT-17/01/16-99	113.4	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Spring Creek	S-CR-RKT-17/01/16-09	113.7	Ephemeral	3.0	Open cut	A, E, G	Warm water
Tributary to Spring Creek	S-CR-RKT-17/01/16-08	113.8	Ephemeral	1.0	Open cut	A, E, G	Warm water
Spring Creek	S-CR-RKT-17/01/16-98	114.2	Perennial	33.5	Dry open cut	A, E, G	Warm water
Tributary to Spring Creek	S-CR-RKT-17/01/16-11	114.2	Ephemeral	8.7	Open cut	A, E, G	Warm water
Tributary to Spring Creek	S-CR-RKT-17/01/16-10	114.6	Ephemeral	3.4	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary Hickory Creek	S-CR-RKT-17/06/29-07	115.1	Intermittent	4.2	Open cut	A, E, G	Warm water
Hickory Creek	S-CR-LAG-17/01/16-04	115.8	Perennial	18.6	Dry open cut	A, C, E, G	Warm water
Tributary to Hickory Creek	S-CR-LAG-17/01/16-05	115.8	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Hickory Creek	S-CR-LAG-17/01/16-03	116.1	Intermittent	10.7	Open cut	A, E, G	Warm water
Tributary to Hickory Creek	S-CR-AAL-17/01/16-02	116.4	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Salt Branch	S-CR-AAL-17/01/16-01b	116.8	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Salt Branch	S-CR-AAL-17/01/16-01a	116.8	Ephemeral	1.5	Open cut	A, E, G	Warm water
Tributary to Salt Branch	S-CR-AJF-17/01/16-01	117.1	Ephemeral	3.4	Open cut	A, E, G	Warm water
Tributary to Salt Branch	S-CR-AJF-17/01/16-02	117.3	Ephemeral	3.3	Open cut	A, E, G	Warm water
Tributary to Salt Branch	S-CR-WCR-17/04/13-02	118.1	Intermittent	6.1	Open cut	A, E, G	Warm water
Tributary to Salt Branch	S-CR-RKT-17/01/12-09	118.2	Ephemeral	1.4	Open cut	A, E, G	Warm water
Tributary to Salt Branch	S-CR-RKT-17/01/12-10	118.8	Ephemeral	1.2	Open cut	A, E, G	Warm water
Tributary to Henry House Creek	S-CR-RKT-17/01/26-04	119.5	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Henry House Creek	S-CR-RKT-17/01/26-05	119.9	Intermittent	5.0	Open cut	A, E, G	Warm water
Henry House Creek	AS-CR-NHD-Line-30	120.2	Intermittent	0.0	HDD	A, E, G	Warm water
Grindstone Creek	S-CR-RKT-17/01/12-13	121.8	Intermittent	12.9	Open cut	A, E, G	Warm water
Tributary to Grindstone Creek	S-CR-RKT-17/01/12-12	122.1	Ephemeral	2.2	Open cut	A, E, G	Warm water
Tributary to Grindstone Creek	S-CR-RKT-17/01/12-17	122.5	Ephemeral	1.0	Open cut	A, E, G	Warm water
Tributary to Philips Creek	S-CR-AJF-17/01/16-06	123.0	Ephemeral	2.4	Open cut	A, E, G	Warm water
Tributary to Philips Creek	S-CR-RKT-17/06/28-09	123.2	Intermittent	15.3	Open cut	A, E, G	Warm water
Tributary to Philips Creek	AS-CR-RKT-17/06/28-08	123.4	Intermittent	NA	NA	A, E, G	Warm water
Tributary to Philips Creek	S-CR-RKT-17/06/28-08	123.4	Intermittent	15.3	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Philips Creek	S-CR-AAL-17/01/24-05	124.3	Perennial	10.4	Dry open cut	A, E, G	Warm water
Tributary to Philips Creek	S-CR-WCR-17/04/13-04	124.4	Ephemeral	1.0	Open cut	A, E, G	Warm water
Tributary to Philips Creek	S-CR-LAG-17/01/05-99	124.6	Intermittent	4.6	Open cut	A, E, G	Warm water
Tributary to Philips Creek	S-CR-WCR-17/04/14-02	124.6	Intermittent	NA	NA	A, E, G	Warm water
Tributary to Philips Creek	S-CR-LAG-17/06/29-01	124.8	Intermittent	5.2	Open cut	A, E, G	Warm water
Tributary to Philips Creek	S-CR-LAG-17/01/05-02	124.8	Ephemeral	2.8	Open cut	A, E, G	Warm water
Tributary to Philips Creek	S-CR-LAG-17/01/05-02b	124.8	Ephemeral	2.3	Open cut	A, E, G	Warm water
Tributary to Caddo Creek	S-CR-LAG-17/01/05-03	125.6	Intermittent	3.0	Open cut	A, E, G	Warm water
Tributary to Buzzard Creek	S-CR-WCR-17/04/14-03	126.2	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Buzzard Creek	S-CR-LAG-17/01/08-03	126.7	Intermittent	16.2	Open cut	A, E, G	Warm water
Buzzard Creek	S-CR-LAG-17/01/08-02	126.7	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Buzzard Creek	S-CR-LAG-17/01/08-04	127.0	Intermittent	2.8	Open cut	A, E, G	Warm water
Tributary to Bullhead Creek	S-CR-LAG-17/01/08-06c	127.8	Intermittent	2.1	Open cut	A, E, G	Warm water
Bullhead Creek	S-CR-LAG-17/01/08-06a	127.8	Intermittent	10.9	Open cut	A, E, G	Warm water
Tributary to Bullhead Creek	S-CR-LAG-17/01/08-06b	127.9	Intermittent	NA	NA	A, E, G	Warm water
Deadman Branch	S-CR-AAL-17/01/09-04a	128.8	Intermittent	34.4	Open cut	A, E, G	Warm water
Deadman Branch	S-CR-AAL-17/01/09-04b	128.8	Intermittent	5.1	Open cut	A, E, G	Warm water
Tributary to Deadman Branch	S-CR-AAL-17/01/09-03a	129.1	Intermittent	12.0	Open cut	A, E, G	Warm water
Tributary to Deadman Branch	S-CR-AAL-17/01/09-03b	129.1	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Deadman Branch	S-CR-AAL-17/01/09-01b	129.3	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Deadman Branch	S-CR-AAL-17/01/09-01a	129.3	Intermittent	3.2	Open cut	A, E, G	Warm water
Tributary to Deadman Branch	S-CR-LAG-17/01/09-01	129.5	Intermittent	3.3	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Deadman Branch	S-CR-LAG-17/01/09-02	129.7	Ephemeral	1.8	Open cut	A, E, G	Warm water
Tributary to Deadman Branch	S-CR-LAG-17/01/09-03	129.8	Intermittent	2.1	Open cut	A, E, G	Warm water
Tributary to Deadman Branch	S-CR-LAG-17/01/09-05	130.0	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Deadman Branch	S-CR-LAG-17/01/09-04	130.0	Intermittent	4.0	Open cut	A, E, G	Warm water
Unnamed Pond	S-CR-LAG-17/01/09-07	130.3	Pond	NA	NA	A, E, G	Warm water
Tributary to Big Branch	S-CR-AAL-17/01/09-05	131.1	Intermittent	5.2	Open cut	A, E, G	Warm water
Tributary to Big Branch	S-CR-LAG-17/01/09-08	131.6	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Big Branch	S-CR-AAL-17/01/09-06	131.6	Intermittent	2.0	Open cut	A, E, G	Warm water
Tributary to Big Branch	S-CR-AAL-17/01/20-01	131.7	Ephemeral	3.1	Open cut	A, E, G	Warm water
Tributary to Big Branch	S-CR-LAG-17/01/20-02	131.9	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Big Branch	S-CR-LAG-17/01/20-01a	131.9	Intermittent	1.0	Open cut	A, E, G	Warm water
Tributary to Big Branch	S-CR-WCR-17/01/09-01a	132.6	Ephemeral	1.0	Open cut	A, E, G	Warm water
Tributary to Big Branch	S-CR-WCR-17/01/10-03	132.8	Ephemeral	2.5	Open cut	A, E, G	Warm water
Tributary to Big Branch	S-CR-WCR-17/01/10-01	133.2	Intermittent	9.4	Open cut	A, E, G	Warm water
Tributary to Big Branch	S-CR-WCR-17/01/10-04	133.6	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Big Branch	S-CR-WCR-17/01/10-06	134.2	Ephemeral	5.3	Open cut	A, E, G	Warm water
Washita River	S-CR-LAG-17/01/10-01	135.9	Perennial	0.0	HDD	A, C, E, G	Warm water
Tributary to Washita River	S-CR-AAL-17/01/10-02	136.4	Intermittent	4.7	Open cut	A, E, G	Warm water
Tributary to Washita River	S-CR-AAL-17/01/10-04	136.8	Perennial	12.8	Dry open cut	A, E, G	Warm water
Tributary to Washita River	S-CR-AAL-17/01/10-06a	137.2	Intermittent	3.5	Open cut	A, E, G	Warm water
Tributary to Washita River	S-CR-AAL-17/01/10-07	137.2	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Washita River	S-CR-AAL-17/01/10-06b	137.2	Intermittent	NA	NA	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Washita River	S-CR-LAG-17/01/10-04	138.3	Ephemeral	1.7	Open cut	A, E, G	Warm water
Tributary to Washita River	S-CR-LAG-17/06/28-01	138.3	Ephemeral	12.9	Open cut	A, E, G	Warm water
Tributary to Oil Creek	S-JO-LAG-17/01/20-04b	139.0	Intermittent	2.2	Open cut	A, E, G	Warm water
Tributary to Oil Creek	S-JO-AAL-17/01/20-08	139.1	Ephemeral	4.0	Open cut	A, E, G	Warm water
Tributary to Oil Creek	S-JO-AAL-17/01/20-09	139.2	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Oil Creek	S-JO-AAL-17/01/20-06	139.4	Ephemeral	4.1	Open cut	A, E, G	Warm water
Tributary to Washita River	S-JO-AAL-17/01/21-01	140.1	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Washita River	S-JO-LAG-17/01/21-01	140.3	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Washita River	S-JO-LAG-17/01/21-02	140.8	Intermittent	1.0	Open cut	A, E, G	Warm water
Tributary to Washita River	S-JO-AAL-17/01/21-02	140.9	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Washita River	S-JO-LAG-17/01/21-03	141.0	Ephemeral	1.2	Open cut	A, E, G	Warm water
Tributary to Oil Creek	S-JO-AAL-17/01/21-03	141.1	Ephemeral	NA	NA	A, E, G	Warm water
Oil Creek	S-JO-RKT-17/01/21-01	141.4	Perennial	27.7	Dry open cut	A, C, E, G	Warm water
Tributary to Oil Creek	S-JO-TAS-17/12/12-02	141.4	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Oil Creek	S-JO-TAS-17/12/12-03	141.5	Ephemeral	5.1	Open cut	A, E, G	Warm water
Tributary to Oil Creek	S-JO-TAS-17/12/12-04	141.5	Intermittent	79.1	Open cut	A, E, G	Warm water
Tributary to Oil Creek	S-JO-TAS-17/12/12-05	141.6	Intermittent	42.0	Open cut	A, E, G	Warm water
Oil Creek	S-JO-RKT-17/01/21-01	141.8	Perennial	40.6	Dry open cut	A, C, E, G	Warm water
Oil Creek	S-JO-RKT-17/01/21-01	141.9	Perennial	57.6	Dry open cut	A, C, E, G	Warm water
Oil Creek	S-JO-RKT-17/01/21-01	142.0	Perennial	45.0	Dry open cut	A, C, E, G	Warm water
Oil Creek	S-JO-RKT-17/01/21-01	142.1	Perennial	27.3	Dry open cut	A, C, E, G	Warm water
Tributary to Oil Creek	S-JO-TAS-17/12/13-02	142.2	Ephemeral	12.2	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Sycamore Creek	S-JO-EHK-17/02/02-03	143.1	Ephemeral	11.4	Open cut	A, E, G	Warm water
Tributary to Oil Creek	S-JO-TAS-17/12/13-04	143.2	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Sycamore Creek	S-JO-RKT-17/02/02-06	143.4	Ephemeral	5.1	Open cut	A, E, G	Warm water
Tributary to Sycamore Creek	S-JO-EHK-17/02/02-04	143.5	Ephemeral	3.4	Open cut	A, E, G	Warm water
Tributary to Sycamore Creek	S-JO-EHK-17/02/02-04	143.5	Ephemeral	3.5	Open cut	A, E, G	Warm water
Tributary to Sycamore Creek	S-JO-EHK-17/02/02-04	143.5	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Courtney Creek	S-JO-TAS-17/10/24-04	144.0	Ephemeral	2.7	Open cut	A, E, G	Warm water
Tributary to Courtney Creek	S-JO-TAS-17/10/24-02	144.0	Ephemeral	1.3	Open cut	A, E, G	Warm water
Courtney Creek	S-JO-RFT-16/12/17-08	144.2	Perennial	10.0	Dry open cut	A, E, G	Warm water
Tributary to Mill Creek	S-JO-EHK-17/02/02-05	145.0	Ephemeral	5.3	Open cut	A, E, G	Warm water
Tributary to Mill Creek	S-JO-TAS-17/10/24-01	145.0	Ephemeral	1.0	Open cut	A, E, G	Warm water
Mill Creek	S-JO-EHK-17/02/02-06	146.0	Perennial	10.0	Dry open cut	A, C, E, G	Warm water
Tributary to Washita River	S-JO-RFT-16/12/17-03	148.2	Ephemeral	5.9	Open cut	A, E, G	Warm water
Tributary to Washita River	S-JO-RFT-17/02/03-05	149.0	Intermittent	5.4	Open cut	A, E, G	Warm water
Tributary to Washita River	S-JO-RFT-17/02/03-04	149.0	Intermittent	9.4	Open cut	A, E, G	Warm water
Unnamed Pond	S-JO-RFT-17/02/03-02	149.3	Pond	148.1	Open cut	A, E, G	Warm water
Sand Creek	S-JO-AAL-17/01/10-08	150.3	Intermittent	11.3	Open cut	A, E, G	Warm water
Tributary to Sand Creek	S-JO-AAL-17/01/10-09	150.3	Intermittent	7.6	Open cut	A, E, G	Warm water
Tributary to Sand Creek	S-JO-LAG-17/01/10-07	150.6	Ephemeral	1.1	Open cut	A, E, G	Warm water
Tributary to Rock Creek	S-JO-LAG-17/01/10-06	151.0	Ephemeral	NA	NA	A, E, G	Warm water
Rock Creek	S-JO-WCR-17/01/10-07a	151.7	Perennial	0.0	HDD	A, E, G	Warm water
Tributary to Rock Creek	S-JO-WCR-17/01/10-07b	151.7	Perennial	NA	HDD [a]	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Rock Creek	S-JO-AAL-17/01/11-01	152.8	Intermittent	3.3	Open cut	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-AJF-17/01/11-04	153.2	Ephemeral	9.3	Open cut	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-AJF-17/01/11-04	153.3	Ephemeral	6.4	Open cut	A, E, G	Warm water
Unnamed Pond	S-JO-AJF-17/01/11-03	153.5	Pond	NA [e]	NA [e]	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-LAG-17/01/11-01	153.6	Intermittent	NA	NA	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-AJF-17/01/11-02	153.6	Intermittent	5.0	Open cut	A, E, G	Warm water
Pennington Creek	S-JO-AJF-17/01/11-01	154.1	Perennial	0.0	HDD	A, C, E, G	Cool Water, HQW
Tributary to Pennington Creek	S-JO-TAS-17/01/11-01	154.6	Intermittent	9.6	Open cut	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-TAS-17/01/11-04	154.6	Perennial	20.7	Open cut	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-TAS-17/01/11-05	154.6	Intermittent	4.5	Open cut	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-TAS-17/01/11-05	154.6	Intermittent	4.1	Dry open cut	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-TAS-17/01/11-02	154.6	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-TAS-17/01/11-03	154.8	Intermittent	10.2	Open cut	A, E, G	Warm water
Tributary to Pennington Creek	S-JO-TAS-17/01/11-10	155.1	Intermittent	9.4	Open cut	A, E, G	Warm water
Tributary to Little Sandy Creek	S-JO-TAS-17/01/11-11	156.0	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Little Sandy Creek	S-JO-AJF-17/01/11-08	156.7	Ephemeral	4.9	Open cut	A, E, G	Warm water
Tributary to Little Sandy Creek	S-JO-AJF-17/01/11-08	156.7	Ephemeral	3.1	Open cut	A, E, G	Warm water
Tributary to Little Sandy Creek	S-JO-AAL-17/01/11-02	156.7	Intermittent	NA	NA	A, E, G	Warm water
Tributary to Little Sandy Creek	S-JO-AJF-17/01/11-08	156.8	Ephemeral	3.0	Open cut	A, E, G	Warm water
Little Sandy Creek	S-JO-AAL-17/01/24-01	156.9	Perennial	12.2	Dry open cut	A, E, G	Warm water
Big Sandy Creek	S-JO-AAL-17/01/24-02	157.7	Perennial	20.5	Dry open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Big Sandy Creek	S-JO-EHK-17/01/13-10a	157.8	Ephemeral	3.8	Open cut	A, E, G	Warm water
Tributary to Big Sandy Creek	S-JO-EHK-17/01/13-10c	157.8	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Big Sandy Creek	S-JO-EHK-17/01/13-10d	157.8	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Big Sandy Creek	S-JO-EHK-17/01/13-10b	157.8	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Big Sandy Creek	S-JO-EHK-17/01/13-07	158.4	Intermittent	35.2	Open cut	A, E, G	Warm water
Tributary to Lake Texoma	S-JO-EHK-17/01/13-12	159.1	Ephemeral	1.0	Open cut	A, E, G	Warm water
Tributary to Lake Texoma	S-JO-WCR-17/01/13-02	159.1	Intermittent	2.2	Open cut	A, E, G	Warm water
Tributary to Lake Texoma	S-JO-RFT-17/02/06-03	159.9	Perennial	5.1	Open cut	A, E, G	Warm water
Tributary to Lake Texoma	S-JO-RFT-17/02/06-10	161.2	Ephemeral	3.1	Open cut	A, E, G	Warm water
Tributary to Lake Texoma	S-JO-AJF-17/01/13-01	161.7	Intermittent	2.1	Open cut	A, E, G	Warm water
Tributary to Butcher Pen Creek	S-JO-LAG-17/01/14-06	162.2	Ephemeral	NA	NA	A, E, G	Warm water
Unnamed Pond	S-JO-LAG-17/01/14-05	162.2	Pond	21.5	Open cut	A, E, G	Warm water
Tributary to Butcher Pen Creek	S-JO-LAG-17/01/14-03	162.9	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Butcher Pen Creek	S-JO-LAG-17/01/14-02a	163.0	Intermittent	2.7	Open cut	A, E, G	Warm water
Butcher Pen Creek	S-JO-LAG-17/01/14-01	163.2	Intermittent	11.8	Open cut	A, E, G	Warm water
Tributary to Butcher Pen Creek	S-JO-EHK-17/01/14-03	163.9	Ephemeral	2.8	Open cut	A, E, G	Warm water
Unnamed Pond	S-JO-EHK-17/01/14-04	164.3	Pond	56.1	Open cut	A, E, G	Warm water
Tributary to Rock Creek	S-JO-RKT-17/06/23-01	165.7	Ephemeral	8.4	Open cut	A, E, G	Warm water
Tributary to Blue River	S-JO-WCR-17/01/16-04	167.2	Intermittent	NA	NA	A, E, G	Warm water
Horse Creek	S-JO-EHK-17/01/14-14	169.5	Intermittent	10.7	Open cut	A, E, G	Warm water
Tributary to Horse Creek	S-JO-AJF-17/01/14-01	169.9	Intermittent	28.2	Open cut	A, E, G	Warm water
Tributary to Horse Creek	S-JO-AJF-17/01/14-02	169.9	Ephemeral	4.5	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Horse Creek	S-BR-AJF-17/01/14-03	170.4	Intermittent	8.9	Open cut	A, E, G	Warm water
Tributary to Horse Creek	S-BR-LAG-17/01/14-09	170.7	Ephemeral	7.1	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-07	171.8	Intermittent	10.1	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-08a	171.9	Intermittent	20.7	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-WCR-17/01/16-02	172.1	Intermittent	29.8	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-06	172.7	Ephemeral	11.8	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-05a	172.9	Ephemeral	4.6	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-04	173.0	Ephemeral	4.0	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-AAL-17/01/14-04	173.2	Intermittent	4.2	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/14-04	173.6	Ephemeral	13.1	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-RKT-17/06/23-02	173.9	Ephemeral	0.0	HDD	A, E, G	Warm water
Tributary to Blue River	S-BR-LAG-17/06/26-01	173.9	Ephemeral	0.0	HDD	A, E, G	Warm water
Blue River	S-BR-AAL-17/01/14-06	174.0	Perennial	0.0	HDD	A, C, E, G, NRI	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-03	174.0	Ephemeral	0.0	HDD	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-02	174.5	Ephemeral	5.6	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-01	174.8	Intermittent	27.5	Open cut	A, E, G	Warm water
Tributary to Blue River	S-BR-TAS-17/01/16-01	174.9	Intermittent	14.7	Open cut	A, E, G	Warm water
Tributary to Simon Creek	S-BR-AAL-17/01/14-02	175.9	Ephemeral	21.5	Open cut	A, E, G	Warm water
Tributary to Simon Creek	S-BR-AAL-17/01/14-02	176.0	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Simon Creek	S-BR-AAL-17/01/14-02	176.0	Ephemeral	2.2	Open cut	A, E, G	Warm water
Tributary to Simon Creek	S-BR-AAL-17/01/14-02	176.0	Ephemeral	9.8	Open cut	A, E, G	Warm water
Tributary to Simon Creek	S-BR-AAL-17/01/14-02	176.2	Ephemeral	2.4	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Simon Creek	AS-BR-NHD-Line-79	176.3	Intermittent	11.2	Open cut	A, E, G	Warm water
Tributary to Johnson Creek	S-BR-AJF-17/06/27-05	177.5	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Johnson Creek	S-BR-TAS-17/01/14-02	177.5	Ephemeral	7.1	Open cut	A, E, G	Warm water
Tributary to Johnson Creek	S-BR-TAS-17/01/13-04	178.0	Ephemeral	4.6	Open cut	A, E, G	Warm water
Johnson Creek	S-BR-TAS-17/01/13-06	178.5	Intermittent	9.0	Open cut	A, E, G	Warm water
Tributary to Johnson Creek	S-BR-TAS-17/01/13-08	178.6	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Thompson Creek	S-BR-TAS-17/01/13-03	179.4	Ephemeral	6.4	Open cut	A, E, G	Warm water
Thompson Creek	S-BR-TAS-17/01/13-05	179.9	Intermittent	4.0	Open cut	A, E, G	Warm water
Harrington Creek	S-BR-TAS-17/01/13-01	180.2	Ephemeral	4.0	Open cut	A, E, G	Warm water
Tributary to Caddo Creek	S-BR-AAL-17/01/26-01	180.9	Intermittent	5.0	Open cut	A, E, G	Warm water
Tributary to Caddo Creek	S-BR-TAS-17/10/25-07	181.1	Ephemeral	102.4	Open cut	A, E, G	Warm water
Tributary to Caddo Creek	S-BR-TAS-17/10/25-06	181.3	Ephemeral	2.0	Open cut	A, E, G	Warm water
Caddo Creek	S-BR-TAS-17/01/13-02	182.0	Intermittent	6.7	Dry open cut	A, E, G	Warm water
Tributary to Caddo Creek	S-BR-TAS-17/01/13-96	182.5	Intermittent	6.0	Open cut	A, E, G	Warm water
Tributary to Caddo Creek	S-BR-TAS-17/01/12-96	183.4	Ephemeral	4.5	Open cut	A, E, G	Warm water
Elm Creek	S-BR-TAS-17/01/11-06	184.1	Intermittent	20.0	Open cut	A, E, G	Warm water
Tributary to Mail Rider Creek	S-BR-TAS-17/01/12-06	186.1	Ephemeral	4.0	Open cut	A, E, G	Warm water
Tributary to Mail Rider Creek	S-BR-TAS-17/01/12-06	186.1	Ephemeral	4.3	Open cut	A, E, G	Warm water
Mail Rider Creek	S-BR-TAS-17/01/12-98	186.1	Perennial	22.8	Dry open cut	A, E, G	Warm water
Tributary to Mail Rider Creek	AS-BR-NHD-Line-152	186.4	Intermittent	6.1	Open cut	A, E, G	Warm water
Tributary to Mail Rider Creek	S-BR-TAS-17/01/12-04	186.7	Ephemeral	NA	NA	A, E, G	Warm water
Rock Branch	S-BR-TAS-17/01/12-10	188.0	Intermittent	4.7	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Unnamed Pond	S-BR-LAG-17/01/12-03	190.2	Pond	9.7	Open cut	A, E, G	Warm water
Tributary to Bokchito Creek	S-BR-AJF-17/01/12-06	190.8	Ephemeral	5.0	Open cut	A, E, G	Warm water
Bokchito Creek	S-BR-AJF-17/01/12-02	191.5	Perennial	27.7	Dry open cut	A, E, G	Warm water
Unnamed Pond	S-BR-AJF-17/01/12-11	191.8	Pond	45.1	Open cut	A, E, G	Warm water
Tributary to Bokchito Creek	S-BR-AJF-17/01/12-03	192.3	Ephemeral	7.3	Open cut	A, E, G	Warm water
Tributary to Bokchito Creek	S-BR-AJF-17/01/12-04	192.4	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Bokchito Creek	S-BR-AJF-17/01/12-05	192.5	Ephemeral	4.0	Open cut	A, E, G	Warm water
Unnamed Pond	S-BR-RKT-17/01/12-01	194.3	Pond	66.1	Open cut	A, E, G	Warm water
Sassafras Creek	AS-BR-NHD-Line-89	194.6	Perennial	22.8	Dry open cut	A, E, G	Warm water
Sulphur Creek	AS-BR-NHD-Line-195	195.7	Perennial	21.0	Dry open cut	A, E, G	Warm water
McGee Creek	S-BR-AJF-17/01/12-01	196.4	Intermittent	16.8	Open cut	A, E, G	Warm water
Tributary to Sulphur Creek	S-BR-WCR-17/01/05-04b	197.5	Intermittent	7.1	Open cut	A, E, G	Warm water
Tributary to Sulphur Creek	S-BR-WCR-17/01/05-04a	197.6	Intermittent	NA	NA	A, E, G	Warm water
Tributary to Sulphur Creek	S-BR-WCR-17/01/05-03	198.6	Ephemeral	8.0	Open cut	A, E, G	Warm water
Tributary to Sulphur Creek	S-BR-WCR-17/01/05-02	199.3	Ephemeral	1.0	Open cut	A, E, G	Warm water
MAINLINE – ACCESS ROADS							
Tributary to Buggy Creek	S-GR-WCR-16/12/10-06	34.6	Ephemeral	NA	Existing access road	A, E, G	Warm water
Unnamed Pond	S-GR-RKT-17/01/23-04	44.2	Pond	NA	Existing access road	A, E, G	Warm water
Slough Creek	S-GR-WCR-16/12/14-01	69.3	Perennial	NA	Existing access road	A, E, G	Warm water
Tributary to Wildhorse Creek	S-GA-RFT-17/02/17-02	100.5	Ephemeral	NA	Existing access road	A, E, G	Warm water
Tributary to Flat Creek	S-CR-LAG-17/01/25-01	102.2	Ephemeral	NA	Existing access road	A, E, G	Warm water
Tributary to Bear Creek	S-CR-LAG-17/01/25-03	106.2	Ephemeral	NA	Existing access road	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to West Spring Creek	S-CR-LAG-17/01/25-04	110.4	Ephemeral	NA	Existing access road	A, E, G	Warm water
Tributary to West Spring Creek	S-CR-LAG-17/01/25-05	110.6	Intermittent	NA	Existing access road	A, E, G	Warm water
Tributary to West Spring Creek	S-CR-LAG-17/01/25-06	110.9	Ephemeral	NA	Existing access road	A, E, G	Warm water
Tributary to Philips Creek	S-CR-LAG-17/01/24-03	124.0	Intermittent	NA	Existing access road	A, E, G	Warm water
Unnamed Pond	S-CR-RFT-17/02/08-02	134.6	Pond	NA	Existing access road	A, E, G	Warm water
Tributary to Washita River	S-CR-AAL-17/01/25-04	136.3	Ephemeral	NA	Existing access road	A, E, G	Warm water
Courtney Creek	S-JO-RFT-16/12/17-08	144.2	Perennial	NA	Existing access road	A, E, G	Warm water
Tributary to Mill Creek	S-JO-EHK-17/02/02-05	145.0	Ephemeral	NA	Existing access road	A, E, G	Warm water
Tributary to Mill Creek	S-JO-TAS-17/10/24-01	145.0	Ephemeral	NA	Existing access road	A, E, G	Warm water
CHISHOLM LATERAL							
Unnamed Pond	S-KI-FJN-17/07/10-03	CH1.0	Pond	NA	NA	A, E, G	Warm water
Tributary to Campbell Creek	S-KI-EHK-17/01/17-05b	CH1.3	Intermittent	2.0	Open cut	A, E, G	Warm water
Tributary to Campbell Creek	S-KI-EHK-17/01/17-05a	CH1.3	Perennial	6.1	Open cut	A, E, G	Warm water
Tributary to Campbell Creek	S-KI-EHK-17/01/17-06	CH3.5	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Campbell Creek	S-KI-EHK-17/01/17-10	CH3.9	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Campbell Creek	S-KI-RKT-17/01/17-23	CH4.2	Ephemeral	2.0	Open cut	A, E, G	Warm water
Campbell Creek	S-KI-RKT-17/01/17-22	CH4.3	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Clear Creek	S-KI-RKT-17/01/17-09	CH5.9	Ephemeral	2.0	Open cut	A, E, G	Warm water
Tributary to Clear Creek	S-KI-EHK-17/01/17-01	CH6.2	Intermittent	17.3	Open cut	A, E, G	Warm water
Tributary to Clear Creek	S-KI-RKT-17/01/17-04	CH6.5	Ephemeral	2.9	Open cut	A, E, G	Warm water
Clear Creek	S-KI-WCR-17/01/17-01	CH7.6	Perennial	16.3	Dry open cut	A, E, G	Warm water
Tributary to Clear Creek	S-KI-WCR-17/01/17-02	CH7.9	Ephemeral	16.3	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Tributary to Clear Creek	S-KI-WCR-17/01/17-03	CH8.1	Perennial	6.0	Open cut	A, E, G	Warm water
Tributary to Clear Creek	S-KI-RKT-17/07/12-11	CH8.5	Intermittent	NA	NA	A, E, G	Warm water
Uncle Johns Creek	S-KI-TAS-17/01/17-01	CH9.5	Perennial	40.0	Dry open cut	A, E, G	Warm water
Tributary to Uncle Johns Creek	S-KI-TAS-17/01/17-02	CH9.8	Ephemeral	2.1	Open cut	A, E, G	Warm water
Tributary to Uncle Johns Creek	S-KI-TAS-17/07/12-02	CH10.2	Ephemeral	5.8	Open cut	A, E, G	Warm water
Tributary to Uncle Johns Creek	S-KI-AJF-17/01/17-02	CH11.9	Perennial	8.8	Open cut	A, E, G	Warm water
Tributary to Uncle Johns Creek	S-KI-LAG-17/01/17-03	CH13.3	Intermittent	1.0	Open cut	A, E, G	Warm water
Tributary to Winter Camp Creek	S-KI-AAL-17/01/17-01	CH14.6	Intermittent	7.6	Open cut	A, E, G	Warm water
Tributary to Winter Camp Creek	S-KI-LAG-17/01/17-04	CH15.2	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Winter Camp Creek	S-KI-AAL-17/01/17-02	CH15.2	Ephemeral	3.3	Open cut	A, E, G	Warm water
Tributary to Winter Camp Creek	S-KI-LAG-17/01/17-05	CH16.4	Perennial	20.0	Dry open cut	A, E, G	Warm water
Tributary to Winter Camp Creek	S-KI-RKT-17/01/17-29	CH18.5	Ephemeral	NA	NA	A, E, G	Warm water
Tributary to Winter Camp Creek	S-KI-RKT-17/01/17-33	CH19.2	Ephemeral	2.0	Open cut	A, E, G	Warm water
ACCESS ROADS – CHISHOLM LATERAL							
Tributary to Winter Camp Creek	S-KI-LAG-17/01/17-05	CH16.4	Perennial	NA	Existing access road	A, E, G	Warm water
Velma Lateral							
Tributary to Wildhorse Creek	S-ST-WCR-17/04/11-01	VE0.2	Intermittent	6.2	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-WCR-17/04/11-01	VE0.2	Intermittent	NA	NA	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-WCR-17/04/11-03	VE0.7	Intermittent	34.5	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-WCR-17/04/11-02	VE1.0	Perennial	7.7	Dry open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-WCR-17/04/11-04	VE1.9	Perennial	11.2	Dry open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-WCR-17/04/11-05	VE2.2	Perennial	26.1	Dry open cut	A, C, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]
Wildhorse Creek	S-ST-RKT-17/04/12-02	VE2.5	Perennial	23.8	Dry open cut	A, E, G	Warm water
Unnamed Pond	S-ST-RKT-17/04/11-31	VE3.3	Pond	24.4	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-RKT-17/04/11-33	VE3.4	Ephemeral	10.0	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-RKT-17/04/11-35	VE3.5	Ephemeral	15.8	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-RKT-17/04/11-35	VE3.5	Ephemeral	15.9	Open cut	A, E, G	Warm water
Tributary to Black Bear Creek	S-ST-RKT-17/04/11-21	VE4.5	Perennial	15.0	Dry open cut	A, E, G	Warm water
Black Bear Creek	S-ST-RKT-17/04/11-14	VE4.8	Perennial	23.0	Dry open cut	A, C, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-RFT-17/04/10-02	VE6.2	Perennial	6.4	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-RFT-17/04/10-05b	VE6.5	Ephemeral	14.3	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-RFT-17/04/10-05a	VE6.5	Intermittent	3.0	Open cut	A, E, G	Warm water
Unnamed Pond	S-ST-RFT-17/04/10-13	VE7.0	Pond	17.0	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-ST-RFT-17/04/10-10	VE7.1	Ephemeral	2.4	Dry open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	AS-ST-NHD-Line-168	VE7.7	Intermittent	8.3	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-CR-RFT-17/04/11-03	VE9.4	Perennial	0.0	HDD	A, E, G	Warm water
Tributary to Wildhorse Creek	S-CR-RFT-17/04/10-23	VE10.7	Perennial	15.0	Dry open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-CR-WCR-17/04/10-05	VE11.0	Ephemeral	1.6	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-CR-WCR-17/04/10-03	VE11.4	Intermittent	0.0	HDD	A, E, G	Warm water
Tributary to Wildhorse Creek	S-CR-TAS-17/10/27-06	VE11.5	Intermittent	0.0	HDD	A, E, G	Warm water
Tributary to Wildhorse Creek	S-GA-WCR-17/04/10-01	VE12.8	Ephemeral	1.4	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-GA-WCR-17/04/10-02a	VE13.3	Intermittent	6.3	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-GA-WCR-17/04/10-02b	VE13.3	Intermittent	6.0	Open cut	A, E, G	Warm water
Tributary to Wildhorse Creek	S-GA-WCR-17/04/10-02c	VE13.3	Ephemeral	8.6	Open cut	A, E, G	Warm water

APPENDIX J (cont'd)

Waterbodies Crossed by the Midcontinent Supply Header Interstate Pipeline Project Pipeline Facilities

Facility/Waterbody Name	Waterbody ID	Begin Milepost	Flow Type	Crossing Width (feet) [a]	Proposed Crossing Method [a]	Water Quality Classification [b, c]	Fishery Type [d]

Sources: Oklahoma Water Resources Board. 2017. Water Quality Standards, About the Program. Available online at https://www.owrb.ok.gov/quality/standards/standards.php. Accessed August 2017.

National Park Service. 2017. Nationwide Rivers Inventory. Oklahoma Segments. Available online at https://www.nps.gov/ncrc/programs/rtca/nri/states/ok.html. Accessed July 2017.

Oklahoma Water Resources Board. 2017. Surface Water Data. Available online at http://www.owrb.ok.gov/maps/PMG/owrbdata_SW.html. Accessed August 2017.

[a] NA Waterbody is within the proposed construction workspace but would not be crossed by the pipeline segments.

[b] Oklahoma Water Resources Board, Water Quality Standards (2017):

- A Primary Body Contact Recreation
- B Secondary Contact Recreation
- C Public and Private Water Supply
- D Fish and Wildlife Propagation
- E Agriculture
- F Navigation
- G Aesthetics
- H Emergency Public and Private Water Supply

[c] NRI Waterbody is included on the Nationwide Rivers Inventory at the proposed crossing location.

[d] Fishery Type as designated by the Oklahoma Water Resources Board, as subcategories under Fish and Wildlife Propagation:

- Habitat Limited Waterbody where water chemistry, and habitat are not adequate to support a Warm Water Aquatic Community.
- Warm Water Waterbody where water quality and habitat are adequate to support intolerant climax fish communities and includes an environment suitable for the full range of warm water benthos.
- Cool Water Waterbody where water quality, water temperature, and habitat are adequate to support cool water climax fish communities and includes an environment suitable for the full range of cool water benthos. Typical species may include smallmouth bass, certain darters, and stoneflies.
- Trout Fishery Waterbody where water quality, water temperature, and habitat are adequate to support a seasonal put and take trout fishery. Typical species may include trout.

Special provisions designated by the OWRB (OWRB, 2017):

- HQW High Quality Waters
- ORW Outstanding Resource Waters
- NLW Nutrient Limited Watersheds
- SR Scenic Rivers
- SWPA Source Water Protection Areas
- SWS Sensitive Water Supplies

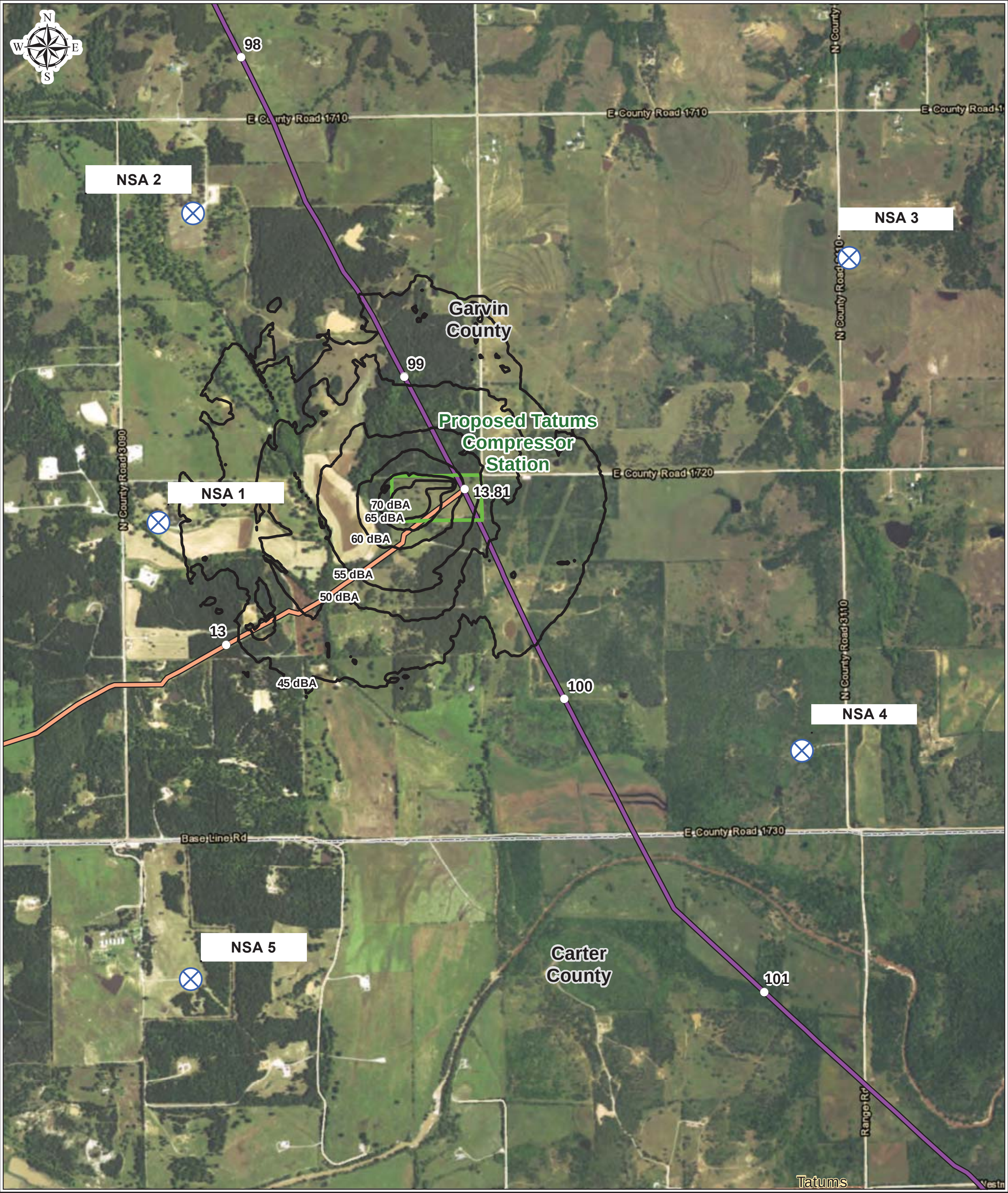
[e] ATWS placed adjacent to, but does not cross, the waterbody.

APPENDIX K

NOISE FIGURES

Figure 4.11.2-1
Midcontinent Supply Header Interstate Pipeline Project

Calumet Compressor Station – Noise Sensitive Areas
Canadian County, Oklahoma



LEGEND

Compressor Station

County

Noise Sensitive Area (NSA) Location

Milepost (1 mi)

Mainline

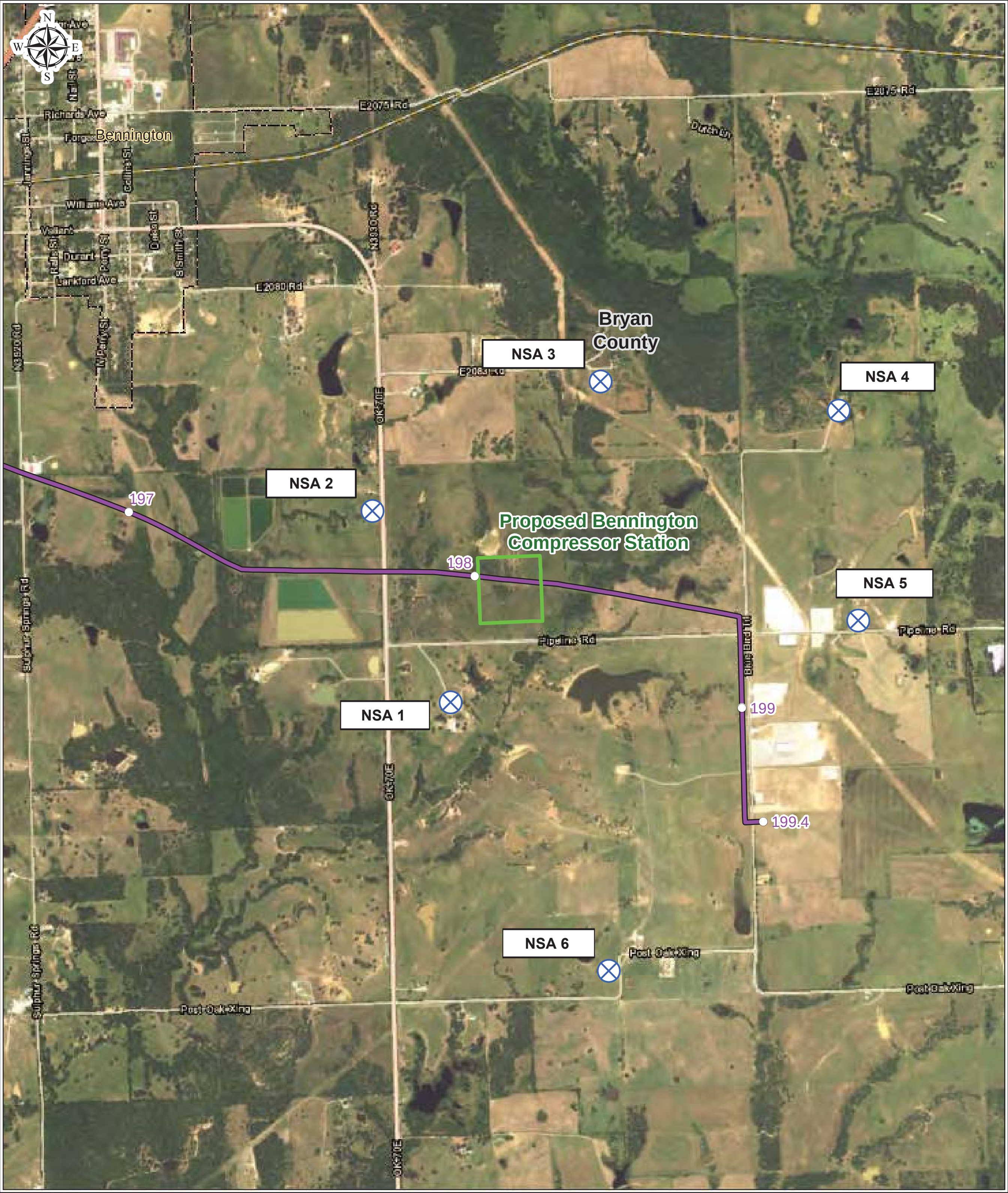
Velma Lateral

DATA SOURCE: USGS, 2014
OPEN-FILE REPORT 2014–1156
BASE MAP SOURCE: Esri, 2016

0 500 1,000 2,000 Feet

Figure 4.11.2-2
Midcontinent Supply Header Interstate Pipeline Project

Tatums Compressor Station – Noise Sensitive Areas
Garvin County, Oklahoma



LEGEND

- Compressor Station
- County
- Noise Sensitive Area (NSA) Location
- Milepost (1 mi)
- Mainline
- Chisholm Lateral
- Velma Lateral
- Municipality

DATA SOURCE: USGS, 2014
OPEN-FILE REPORT 2014–1156
BASE MAP SOURCE: Esri, 2016

0 500 1,000 2,000 Feet

Figure 4.11.2-3
Midcontinent Supply Header Interstate Pipeline Project

Bennington Compressor Station – Noise Sensitive Areas
Bryan County, Oklahoma

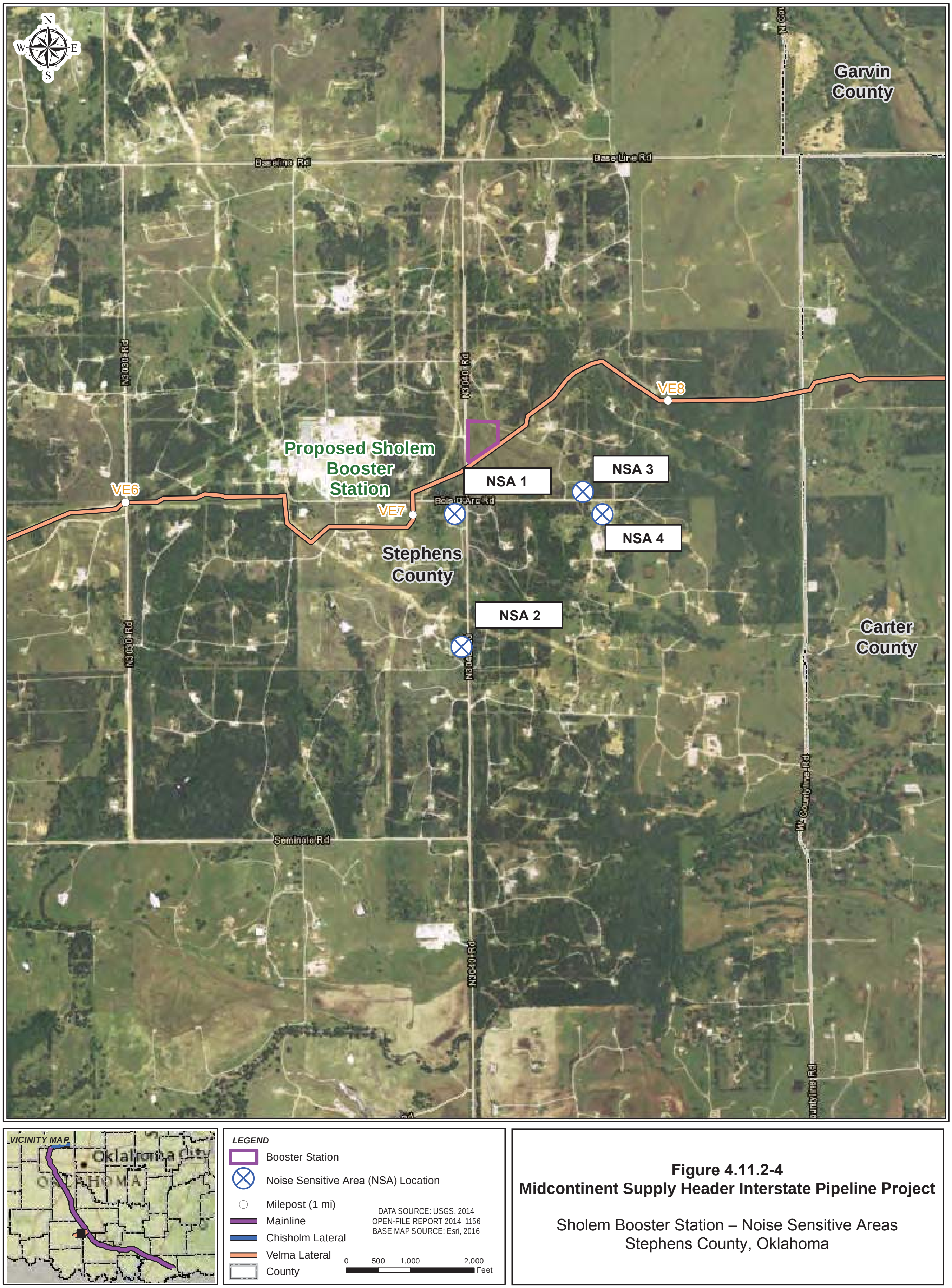


Figure 4.11.2-4
Midcontinent Supply Header Interstate Pipeline Project

Sholem Booster Station – Noise Sensitive Areas
Stephens County, Oklahoma

APPENDIX L

PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE PROJECTS WITH POTENTIAL FOR CUMULATIVE IMPACTS WHEN COMBINED WITH THE MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT

APPENDIX L

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
NON-JURISDICTIONAL PROJECT RELATED ACTIONS						
PRESENT	Okarche/Mark West Meter Station	Kingfisher	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 54 feet of line heading east from the Okarche/Mark West Meter Station.
PRESENT	Chisholm Meter Station	Kingfisher	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 690 feet of line heading south from the Chisholm Meter Station.
PRESENT	Mainline Valve 1010-2	Kingfisher	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 115 feet of line heading west from Mainline Valve 1010-2.
PRESENT	Canadian Valley Meter Station	Canadian	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 54 feet of line heading east from the Canadian Valley Meter Station.
PRESENT	Cana Meter Station	Canadian	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 70 feet of line heading west from the Cana Meter Station.
PRESENT	Calumet Compressor Station	Canadian	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 1,453 feet of line heading west from the Calumet Compressor Station.
PRESENT	Grady Meter Station	Garvin	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 94 feet of line heading north from the Grady Meter Station.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
PRESENT	Mainline Valve 1100-2	Grady	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 149 feet of line heading northeast from Mainline Valve 1100-2.
PRESENT	Iron Horse Meter Station	Grady	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 431 feet of line heading southeast from the Iron Horse Meter Station.
PRESENT	Mainline Valve 1100-3	Grady	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 217 feet of line heading south from Mainline Valve 1100-3.
PRESENT	Mainline Valve 1100-4	Grady	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 446 feet of line heading west from Mainline Valve 1100-4.
PRESENT	Mainline Valve 1100-5	Stephens	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 99 feet of line heading south from Mainline Valve 1100-5.
PRESENT	Velma Meter Station	Stephens	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 571 feet of line heading northeast from the Velma Meter Station.
PRESENT	Sholem Booster Station	Stephens	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 487 feet of line heading south from the Sholem Booster Station.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
PRESENT	Tatums Compressor Station	Garvin	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 1,476 feet of line heading east from the Tatums Compressor Station.
PRESENT	NGPL 801 Meter Station	Carter	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 55 feet of line heading east from the NGPL 801 Meter Station.
PRESENT	Mainline Valve 1200-3	Carter	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 253 feet of line heading west from Mainline Valve 1200-3.
PRESENT	Mainline Valve 1200-4	Johnston	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 948 feet of line heading northeast from Mainline Valve 1200-4.
PRESENT	Mainline Valve 1200-5	Bryan	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 82 feet of line heading east from Mainline Valve 1200-5.
PRESENT	Mainline Valve 1200-6	Bryan	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 160 feet of line heading southeast from Mainline Valve 1200-6.
PRESENT	NGPL Meter Station	Bryan	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 59 feet of line heading south from the NGPL Meter Station.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
PRESENT	Bennington Compressor Station	Bryan	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 59 feet of line heading south from the Bennington Compressor Station.
PRESENT	Bennington Meter Station	Bryan	Would be concurrent with MIDSHIP Project	Non-jurisdictional power line constructed to supply electricity.	Geology, Soils, Groundwater, Surface Water, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction), Noise (construction), Socioeconomics	About 568 feet of line heading north from the Bennington Meter Station.
OIL AND NATURAL GAS PRODUCTION						
PRES./FUT.	Jones Energy Inc., oil and gas production [1]	Canadian, Grady, McClain	Land acquired in 2016; well drilling schedule unknown.	Jones Energy has acquired 18,000 net acres from American Energy Partners. Drilling activity would occur in Canadian, Grady, and McClain Counties.	Geology, Soils, Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction and operation), Noise (construction and operation), Socioeconomics	Located in the general project area; exact well locations unknown.
OIL AND NATURAL GAS TRANSPORT, PROCESSING AND STORAGE						
FUTURE	2018 Line V Replacement Project [b]	Oklahoma, Logan	Proposed – Prior Notice Application Filed April 30, 2018. Construction planned July – November 2018	Replacement of seven non-contiguous segments of 20- and 24-inch pipeline, totaling about 14.4 miles, in Oklahoma and Logan Counties. No aboveground facilities are proposed.	Geology, Soils, Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction and operation), Noise (construction and operation), Socioeconomics	Nearest replacement segment is over 19 miles east of Chisholm Lateral MP CH0.0.
PRESENT	Blue Mountain Delivery Line Project [c]	Grady	Construction – Anticipated completion May 2018	Construction and operation of two segments of natural gas pipelines (4.4 miles of 20-inch-diameter pipeline and 5.2 miles of 12-inch-diameter pipeline) as well as a metering and pigging facility in Grady County, Oklahoma	Geology, Soils, Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction and operation), Noise (construction and operation), Socioeconomics	Intersects the Mainline at milepost (MP) 42.9. Meter facility about 2.0 mile northeast of Mainline MP 42.9.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
PRESENT	Blue Mountain Chisholm Trail Project [d]	Grady, Carter	Construction – Anticipated completion May 2018	Construction and operation of about 4.7 miles of 12-inch-diameter pipeline and a metering facility in Grady County, and installation of a skid-mounted compressor station (totaling about 4,145 horsepower) in Carter County	Geology, Soils, Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction and operation), Noise (construction and operation), Socioeconomics	Metering facility located about 2 miles northeast of Mainline MP 43.0. Compressor station is about 3 miles southwest of Mainline MP 103.0.
PRESENT	Chisholm Trail Cryogenic Gas Plant [c, d]	Grady	Construction – Anticipated completion May 2018	Gas processing facility with a total capacity of 250 million standard cubic feet per day.	Geology, Soils, Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction and operation), Noise (construction and operation), Socioeconomics	About 3.6 miles northeast of Mainline MP 39.0
PRESENT	Cana & STACK Expansion (CaSE) Project [2]	Kingfisher, Canadian, Grady, Garvin, Stephens, Bryan	Construction	The CaSE Project will utilize existing and expansion facilities, as well as capacity on third-party pipelines, to provide 400,000 dekatherms of new takeaway capacity from the Cana, STACK, and SCOOP plays.	Visual Resources, Air (construction and operation), Noise (construction and operation), Socioeconomics	Receipt point at Okarche/Mark West with delivery at Bennington through existing pipeline systems.
PAST	Plains All American Pipeline, LP [e]	Kingfisher, Canadian, Grady, Carter	Construction observed in 2016. Presumed operational.	Active pipeline construction observed by Midship Pipeline in 2016.	Land Use, Air (operation), Socioeconomics	Intersects Chisholm Lateral at MP CH0.2
PAST	Duncan-Longview Project [3, 4]	Kingfisher, Canadian, Grady, Carter	2016 – Currently operational.	Plains All American Pipeline, LP pipeline construction project. The 226-mile-long, 16-inch-diameter pipeline transporting crude oil from Duncan, Oklahoma to a terminal in Longview, Texas.	Land Use, Air (operation), Socioeconomics	Exact project footprint unknown, but does not appear to intersect the MIDSHIP Project.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
PAST	Compressor or Booster Stations [5]	All counties	Prior to 2017 – Currently operational.	Compressor/booster stations associated with area pipelines, operated by a variety of companies. Estimated 5 acres for each site; the following number of stations are located within each county: Kingfisher – 40 Canadian – 22 Grady – 43 Garvin – 23 Stephens – 27 Carter – 24 Johnston – 2 Bryan – 1 Surrounding counties (Atoka, Caddo, Custer, Blaine, McClain) – 110	Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Air (operation), Noise (operation), Socioeconomics	Located within 50 kilometers of the MIDSHIP Project.
PAST	Wynnewood Refinery [5, 6]	Garvin	Currently operational.	Wynnewood Refining Co. LLC's refinery of gasoline, diesel fuel, military get fuel, solvents, asphalt. Unspecified size. Located at 906 S. Powell Avenue, Wynnewood, Oklahoma.	Air (operation)	About 19.2 miles ENE of Mainline MP 100.0.
PAST	Wynnewood Products Terminal [5, 7]	Murray	Prior to 1995 – Currently operational.	Valero Partners Wynnewood LLC products terminal that transports refined products from the Valero Ardmore Refinery in Carter County, Oklahoma.	Air (operation)	About 18.6 miles NE of MP 101.7.
PAST	Valero Ardmore Refinery [4, 5, 8]	Carter	1913 – Currently operational.	The Valero Ardmore Refinery is located on 722 acres and has a total throughput capacity of approximately 90,000 barrels per day. Also has more than 2.4 million barrels of refined product storage.	Air (operation)	About 5.4 miles SW of MP 129.
PAST	Anadarko Plant [5, 9]	Caddo	May 2001 – Currently operational.	WFEC GenCo LLC's 90 megawatt power plant. Unspecified size, located at 701 NE 7th St. Anadarko, Oklahoma.	Air (operation)	About 20.0 miles SW of MP 41.6.
PAST	Atoka Gas Plant [5, 10]	Atoka	About 2007 – Currently operational.	TPL Arkoma Holdings LLC cryogenic processing plant.	Air (operation)	About 19.6 miles NE of MP 174.9.
PAST	Velma Gas Plant [5, 11]	Stephens	1948 – Currently operational.	Atlas Pipeline Midcontinent LLC 100 million cubic feet per day capacity natural gas processing plant.	Air (operation)	About 0.1 mile W of MP VE0.0.
PAST	Maysville Gas Plant [5, 12]	Garvin	1948 – Currently operational.	ONEOK Field Services Company, LLC cryogenic natural gas liquids extraction plant.	Air (operation)	About 12.8 miles NE of MP 80.7.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
PAST	Stephens Gas Plant [5, 13]	Stephens	Prior to 1974 – Currently operational.	ONEOK Field Services Company, LLC cryogenic natural gas processing plant.	Air (operation)	About 0.9 mile NW of MP VE0.0.
PAST	Elmore City Gas Plant [5, 14]	Garvin	Prior to 1974 – Currently operational.	OK Gas Processing, Inc. natural gas/liquids processing plant.	Air (operation)	About 3.2 miles NE of MP 97.2.
PAST	Wasson Station Tank Farm [5, 15]	Carter	1993 – Currently operational.	Nustar Logistics LP - Central West Region petroleum storage facility.	Air (operation)	About 9.7 miles S of MP 116.3
PAST	Binger Plant [5, 16]	Caddo	1976 – Currently operational.	Mustang Gas Products, LLC gas processing plant.	Air (operation)	About 17.4 miles SW of MP 22.7.
PAST	Amber Gas Plant [5, 17]	Grady	Prior to 2014 – Currently operational.	Aka Energy Group cryogenic gas processing plant.	Air (operation)	About 3.3 miles NE of MP 47.8.
PAST	E Durant Dehydration Plant [4]	Bryan	Prior to 2017 – Currently operational.	Finley Resources, Inc. gas processing plant.	Air (operation)	About 9.4 miles S of MP 178.3.
PAST	Cana Gas Plant [5, 18]	Canadian	2011 – Currently operational.	EnLink Midstream Services LLC gas processing plant.	Air (operation)	About 0.5 mile E of MP 15.3.
PAST	Calumet Gas Processing Plant [3]	Canadian	1968 – Currently operational.	Enable Products, LLC gas processing plant.	Air (operation)	About 2.2 miles NW of MP 5.9
PAST	Cox City Processing Plant [5, 19]	Grady	Prior to 1992 – Unknown termination.	Enable Products, LLC gas processing plant.	Air (operation)	About 4.9 miles SW of MP 71.6
PAST	South Canadian Processing Plant [5, 20]	Canadian	2011 – Currently operational.	Enable Products, LLC gas processing plant.	Air (operation) Noise (operation)	About 0.3 mile NW of MP 17.5.
PAST	Tucker Trust Dehydration Plant [5]	Caddo	Prior to 2017 – Unknown termination.	Enable Midstream Partners LP Petroleum processing or storage. Unspecified size. 0.3 miles N of N 2510 & E1110 Road	Air (operation)	About 23.9 miles W of MP 17.8.
PAST	Chitwood Gas Plant [5, 21]	Grady	1948 – Currently operational.	DCP Midstream LP gas processing plant.	Air (operation)	About 5.1 miles W of MP 68.2

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
PAST	Fox Gas Plant [5, 22]	Carter	1940's – Currently operational.	DCP Midstream LP cryogenic gas processing plant.	Air (operation)	About 8.3 miles SW of MP 109.3.
PAST	Kingfisher Natural Gas Processing Plant [5, 23]	Kingfisher	Prior to 1976 – Currently operational.	DCP Midstream LP Gas processing. Unspecified size.	Air (operation)	About 1.2 miles N of MP CH0.0.
PAST	Mustang Gas Plant [5]	Grady	Prior to 2017 – Currently operational.	DCP Midstream LP petroleum processing/storage facility.	Air (operation)	About 10.2 miles NE of MP 38.9.
PAST	Okarche Plant [3, 24]	Kingfisher	Prior to 1981 – Currently operational.	DCP Midstream LP gas processing facility.	Air (operation) Noise (operation)	Less than 0.1 mile NW of MP CH20.1.
PAST	Sholem Gas Plant [5, 25]	Stephens	Prior to 1982 – Unknown termination.	DCP Midstream LP gas processing facility.	Air (operation) Noise (operation)	About 0.2 mile NE of MP VE6.5.
PAST	Healdton Gas Plant [5, 26]	Carter	Prior to 1970 – Currently operational.	Citation Oil and Gas Corporation LLC gas processing facility.	Air (operation)	About 12.5 miles SW of MP 111.5.
PAST	Binger Nitrogen Gas Plant [5]	Caddo	Prior to 2017 – Currently operational.	Binger OPR LLC petroleum processing /storage facility.	Air (operation)	About 16.2 miles W of MP 29.3.
PRESENT	Visio-Cana 5 Tank Battery [f]	Canadian	2017	Cimarex tank battery (temporary crude oil storage, testing, and measuring device). Identified during discussions with landowner while completing a land purchase agreement review.	Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction and operation), Noise (construction), Socioeconomics	Less than 0.1 mile W of MP 9.6.
ELECTRIC GENERATION AND TRANSMISSION PROJECTS						
FUTURE	Plains and Eastern Clean Line [5, 27]	Blaine, Kingfisher, Logan	Currently in planning stages; construction schedule unknown.	Clean Line Energy Partners' 700-mile direct current transmission that will deliver wind energy from the Oklahoma Panhandle region to utilities and customers in the Mid-South and southeastern United States.	Socioeconomics	Parallels the Chisholm Lateral approximately 22 miles N of the lateral.
PRESENT	Stonewall – Wapanucka 138 kV [3, 28]	Johnston, Coal, Pontotoc	2015 – Currently operational.	American Electric Power Company, Inc.'s new 6.4-mile, 138 kilovolt electric transmission line from Stonewall to Wapanucka, Oklahoma.	Socioeconomics	About 14 miles NE of MP 162.5.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]
PAST	Darlington Road – Roman Nose [3, 29]	Blaine, Canadian	June 2017 – Currently operational.	Public Service Company of Oklahoma, an AEP Oklahoma Transmission Company, constructed approximately 13 miles of new 138 kilovolt electric transmission line from a substation near Calumet, OK to a interconnect with an Oklahoma Gas & Electric line near Geary, Oklahoma.	Soils, Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Socioeconomics	Collocated with the mainline from MP 9.9 to 10.4 and then extends eastwards.
PAST	Kingfisher Wind Project [30]	Kingfisher, Canadian	March 2016 – Currently operational.	The Kingfisher Wind Project is an 11,000-acre wind farm comprising 149 turbines in Kingfisher and Canadian Counties. Turbines are clustered in Kingfisher County on the northern side of the Kingfisher/ Canadian County line.	Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Noise (operation), Socioeconomics	The Chisholm Lateral intersects the wind farm; turbines located north and south of the lateral (MP CH0.0 to CH6.2). A second cluster of wind turbines about 3.0 miles south of MPs CH6.2 to CH11.4.
TRANSPORTATION AND COMMERCIAL/RESIDENTIAL DEVELOPMENT PROJECTS						
FUTURE	Kilpatrick Extension [31]	Canadian, Oklahoma	Still in planning stages; construction schedule unknown.	Oklahoma Turnpike Authority's road construction project. The project is an approximately 7-mile extension of the Kilpatrick Turnpike in Oklahoma City that will occur between Interstate-40 and State Highway 152/Airport Road.	Air (operation), Socioeconomics	About 17.9 miles E of MP 27.3.
PRESENT	State Highway 53 Improvement Project [32]	Carter	Utility relocations planned for 2018; construction scheduled to begin in 2020.	Oklahoma Department of Transportation highway improvement project to improve sight distance and the addition of shoulders along approximately 5.6 miles of State Highway 53. The project will permanently impact approximately 27 acres of land.	Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Land Use, Visual Resources, Air (construction and operation), Noise (construction), Socioeconomics	About 0.2 to 0.5 miles N of MP 119.0 to MP 124.5.
PAST	Commercial Metals Company Steel Mill Project [33, 34]	Bryan	2017 – Currently operational.	Commercial Metals Company constructed a new channel around a steel mill in Durant, Oklahoma, which involved placing permanent fill into an unnamed tributary to Kanola Creek.	Groundwater, Surface Water, Wetlands, Vegetation, Wildlife, Socioeconomics	About 8.8 miles SSW of MP 179.0.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]

[a] Mileposts on the Chisholm Lateral are differentiated from the Mainline with a "CH" in front of the milepost number. Mileposts on the Velma Lateral are differentiated from the Mainline with a "VE" in front of the milepost number.

[b] Federal Energy Regulatory Commission Docket No. CP18-384-000.

[c] Federal Energy Regulatory Commission Docket No. CP18-14-000.

[d] Federal Energy Regulatory Commission Docket No. CP18-17-000.

[e] Construction on this project was observed in the field.

[f] Identified during discussions with landowner while completing a land purchase agreement review.

Sources:

[1] Oil and Gas Journal. 2016. Jones Energy completes deal to enter STACK, SCOOP. Available online at http://www.ogj.com/articles/2016/09/jones-energy-completes-deal-to-enter-stack-scoop.html. Accessed June 2017.

[2] Projects. 2017. Enable Gas Transmission Cana & STACK Expansion (CaSE). Available online at http://projects.enablemidstream.com/project/enable-gas-transmission-cana-stack-expansion-case/. Accessed January 2018.

[3] Rextag, A Hart Energy Company. 2017. Global Energy Mapping Data. Available online at https://rextag.com/gis. Accessed June 2017.

[4] Longview News-Journal. 2015. Longview Firm Developing Plan for $100M Pipeline to Shreveport. Available online at https://www.news-journal.com/news/2015/mar/24/longview-firm-developing-plan-for-100m-pipeline-to/. Accessed July 2017.

[5] Oklahoma Department of Environmental Quality. 2017. Open Data Portal. Available online at http://gisdata.deq.opendata.arcgis.com/. Accessed July 2017.

[6] CVR Refining. 2017. Refining Operations. Available online at http://www.cvrrefining.com/RefiningOperations/. Accessed June 2017.

[7] Valero Energy Partners LP. 2017. Operations. Available online at https://www.valeroenergypartners.com/about/operations. Accessed September 2017.

[8] Valero Marketing and Supply Company. 2017. Ardmore Refinery. Available online at https://www.valero.com/en-us/Pages/Ardmore.aspx. Accessed September 2017.

[9] Western Farmers Electric Cooperative. 2014. 2014 Annual Report. Available online at http://www.wfec.com/sites/default/files/2014%20WFEC%20Annual%20Report%20WS.pdf. Accessed June 2017.

[10] Targa Resources. 2016. SouthOK Gathering System. Available online at http://www.targaresources.com/operations/gathering-processing/field-gathering-processing/southok-gas-gathering-processing. Accessed July 2017.

[11] Oklahoma Department of Environmental Quality Air Quality Division. 2011. Draft evaluation of Permit No. 2011-101-TVR. 2011. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/2030.pdf. Accessed July 2017.

[12] Oklahoma Department of Environmental Quality Air Quality Division. 2013. Draft Evaluation of Permit Application No. 2011-227-TVR2, Maysville Gas Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/2657.pdf. Accessed July 2017.

[13] U.S. Environmental Protection Agency. 2015. FRS Facility Detail Report ONEOK Field SVC/Stephens Gas Plant. EPA Registry ID: 110007386989. Available online at https://iaspub.epa.gov/enviro/fii_query_detail.disp_program_facility?p_registry_id=110007386989. Accessed September 2017.

[14] Oklahoma Department of Environmental Quality Air Quality Division. 2009. Draft Evaluation of Permit Application No. 2009-354-TVR2 Elmore City Gas Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/1646.pdf. Accessed July 2017.

[15] Environmental Protection Agency. 2017. FRS Facility Detail Report Nustar Logistics LP – Central West Region Wasson Station Tank Farm. Available online at https://iaspub.epa.gov/enviro/fii_query_detail.disp_program_facility?p_registry_id=110007386765. Accessed July 2017.

[16] Oklahoma Department of Environmental Quality Air Quality Division. 2005. Draft Evaluation of Permit Application No. 2003-175-TVR Binger Gas Plant. Available online at www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/487.doc. Accessed July 2017.

[17] Aka Energy Group, LLC. 2017. Company Profile History. Available online at http://www.akaenergy.com/companyprofile/History.aspx. Accessed July 2017.

APPENDIX L (cont'd)

Past, Present, and Reasonably Foreseeable Future Projects with Potential for Cumulative Impacts when Combined with the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project

Status	Project	County	Construction/ Operation Status	Description	Resources Affected	Location Relative to the MIDSHIP Project [a]

18 Oklahoma Department of Environmental Quality, Air Quality Division. 2010. Draft Evaluation of Permit Application No. 2009-177-C Cana Gas Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/1677.pdf. Accessed July 2017.

19 Oklahoma Department of Environmental Quality, Air Quality Division. 2009. Draft Evaluation of Permit Application No. 2009-198-TV Cox City Processing Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/1518.pdf. Accessed July 2017.

20 NewsOK. 2011. Enogex is Adding Pipeline Assets in Northwest Oklahoma. Available online at http://newsok.com/article/3609071. Accessed July 2017.

21 Oklahoma Department of Environmental Quality, Air Quality Division. 2012. Chitwood Gas Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/2260.pdf. Accessed July 2017.

22 Oklahoma Department of Environmental Quality, Air Quality Division. 2014. Draft Evaluation of Permit Application No. 2013-0130-TVR2 Fox Gas Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/2709.pdf. Accessed July 2017.

23 Oklahoma Department of Environmental Quality, Air Quality Division. 2014. Draft Evaluation of Permit Application No. 2007-240-C (M-4) Kingfisher Natural Gas Processing Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/2705.pdf. Accessed July 2017.

24 Oklahoma Department of Environmental Quality, Air Quality Division. 2014. Draft Evaluation of Permit Application No. 2013-1557-TVR2. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/2695.pdf. Accessed July 2017.

25 Oklahoma Department of Environmental Quality, Air Quality Division. 2013. Draft Evaluation of Permit Application No. 2011-064-TVR2 Sholem Gas Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/2503.pdf. Accessed July 2017.

26 Oklahoma Department of Environmental Quality, Air Quality Division. 2012. Draft Evaluation of Permit Application No. 2012-679-TV Healdton Gas Plant. Available online at http://www.deq.state.ok.us/apps/nondiv/permitspublic/storedpermits/2379.pdf. Accessed July 2017.

27 Clean Line Partners. 2017. Welcome to the Plains & Eastern Clean Line. Available online at http://www.plainsandeasterncleanline.com/site/home. Accessed July 2017.

28 Southwest Power Pool. 2015. Q2 2015 Quarterly Project Tracking Report – Appendix I. Available online at https://www.spp.org/spp-documents-filings/?id=18641. Accessed September 2017.

29 Public Service Company of Oklahoma, an AEP Company. 2018. Darlington Road – Roman Nose. Available online at http://aeptransmission.com/oklahoma/DarlingtonRoad-RomanNose/index.php. Accessed January 2018.

30 OK Energy Today. 2016. Neighbors' Nuisance Suit Dismissed against Kingfisher Wind Farm. Available online at http://okenergytoday.com/2016/10/neighbors-nuisance-suit-dismissed-kingfisher-wind-farm/. Accessed June 2017.

31 Oklahoma Turnpike Authority. 2016. Southwest Kilpatrick Extension. Available online at http://www.drivingforwardok.com/sw-kilpatrick-extension. Accessed June 2017.

32 Oklahoma Department of Transportation. 2015. The Oklahoma Department of Transportation Public Meeting for SH-53 in Carter County, OK. Available online at http://www.okladot.state.ok.us/meetings/a2015/151208/brochure.pdf. Accessed September 2017.

33 U.S. Army Corps of Engineers, Tulsa District, and Oklahoma Department of Environmental Quality. Joint Public Notice No. SWT-2015-293. Available online at http://www.swt.usace.army.mil/Missions/Regulatory/Public-Notices/Article/599826/swt-2015-293/. Accessed September 2017.

34 Commercial Metals Company. North America. Available online at https://www.cmc.com/en/global/locations/north-america. Accessed January 2018.

APPENDIX M

REFERENCES

APPENDIX M
REFERENCES

Allen, Williford and Seale, Inc. 2001. Natural Gas Pipeline Impact Study. Prepared for the Interstate Natural Gas Association of America Foundation, Inc.

Allen, Williford and Seale, Inc. 2014. Pipeline Impact Study: Study of a Williams Natural Gas Pipeline on Residential Real Estate Saddle Ride Subdivision, Dallas Township, Luzerne County, Pennsylvania. Prepared for Williams Pipeline Company. December 2014.

American Hospital Directory. 2016. Hospital Statistics by State. Available online at https://www.ahd.com/state_statistics.html. Accessed December 2016.

American National Standards Institute. 1993. ANSI S12.9-1993/Part 3. Quantities and Procedures for Description and Measurement of Environmental Sound. Part 3: Short-Term Measurements with an Observer Present.

American Oil and Gas Historical Society. 2018. First Oklahoma Oil Well. Available online at https://aoghs.org/petroleum-pioneers/first-oklahoma-oil-well/. Accessed January 2018.

Anderson, R.S. 1982. On the Decreasing Abundance of Nicrophorus americanus Olivier (Coleoptera: Silphidae) in Eastern North America. The Coleopterists Bulletin 36: 362- 365.

Arkansas Geological Survey. 2017. Fossils of Arkansas Fact Sheet. Available online at http://www.geology.ar.gov/geology/fossils.htm. Accessed July 2017.

Ball, M.M, M.E. Henry, and S.E. Frezon. 1988. Petroleum Geology of the Anadarko Basin Region, Province 115, Kansas, Oklahoma, and Texas. U.S. Geological Survey Open-File Report 88-450W. Available online at https://pubs.usgs.gov/of/1988/0450w/report.pdf. Accessed July 2017.

Belden, Mark. 2000. Hydrogeologic Report of the El Reno, Fairview, Isabella and Loyal Minor Groundwater Basins in Central Oklahoma. Available online at http://www.owrb.ok.gov/studies/reports/reports_pdf/tr2000_1%20el%20reno%20fairview%20minor%20basins.pdf. Accessed July 2017.

Bolt, Beranek and Newman, Inc. 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. Prepared for the U.S. Environmental Protection Agency. Washington, DC. December 31, 1971.

Bruckse Bury, M., P. Clark, E. Hamilton, P. Matchen, J. Jacobson, A. Knapp, and M. Archambeault. 2017a. Midship Project: A Phase I Cultural Resources Survey in Bryan, Canadian, Carter, Garvin, Grady, Johnston, Kingfisher, and Stephens Counties, Oklahoma, Volume I. Prepared by TRC Environmental Corporation for Midship Pipeline Company, LLC.

Bruckse Bury, M., P. Clark, E. Hamilton, P. Matchen, J. Jacobson, A. Knapp, and M. Archambeault. 2017b. Midship Project: A Phase I Cultural Resources Survey of Velma Lateral and Other Survey Areas in Bryan, Canadian, Carter, Garvin, Grady, Johnston, Kingfisher, and Stephens Counties, Oklahoma, Volume II. Prepared by TRC Environmental Corporation for Midship Pipeline Company, LLC.

Bruckse Bury, M., P. Clark, E. Hamilton, P. Matchen, J. Jacobson, A. Knapp, and M. Archambeault. 2017c. Midship Project: A Phase I Cultural Resources Survey in Bryan, Canadian, Carter, Garvin, Grady, Johnston, Kingfisher, and Stephens Counties, Oklahoma, Addendum Report to Volumes I and II. Prepared by TRC Environmental Corporation for Midship Pipeline Company, LLC.

Bruckse Bury, M., P. Clark, E. Hamilton, P. Matchen, J. Jacobson, and A. Knapp. 2018. Midship Project: A Phase I Cultural Resources Survey in Bryan, Canadian, Carter, Garvin, Grady, Johnston, Kingfisher, and Stephens Counties, Oklahoma, Addendum Report II to Volumes I and II. Prepared by TRC Environmental Corporation for Midship Pipeline Company, LLC.

Bureau of Labor Statistics. 2007. Census of Fatal Occupational Injuries. Available online at https://www.bls.gov/iif/oshcfoi1.htm. Accessed January 2018.

Bureau of Labor Statistics. 2017. CPI Inflation Calculator. Available online at http://www.bls.gov/data/inflation_calculator.htm. Accessed June 2017.

Canadian Wildlife Service and U.S. Fish and Wildlife Service. 2007. International Recovery Plan for the Whooping Crane (Grus Americana) (3rd rev.). Ottawa: Recovery of Nationally Endangered Wildlife (RENEW) and U.S. Fish and Wildlife Service, Albuquerque, New Mexico. Available online at https://www.fws.gov/uploadedFiles/WHCR%20RP%20Final%207-21-2006.pdf. Accessed August 2017.

Chickasaw Country. 2017. Nature and Outdoors, Blue River. Available online at http://www.chickasawcountry.com/outdoors/blue-river. Accessed August 2017.

Christenson, Scott, N.I. Osborn, C.R. Neel, J.R. Faith, C.D. Blome, J. Puckette, and M.P. Pantea. 2011. Hydrogeology and Simulation of Groundwater Flow in the Arbuckle-Simpson Aquifer, South-Central Oklahoma. U.S. Geological Survey Scientific Investigations Report 2011-5029. Available online at https://pubs.usgs.gov/sir/2011/5029/SIR2011-5029.pdf. Accessed July 2017.

Cornell Lab of Ornithology. 2017. All About Birds. Available online at https://www.allaboutbirds.org/. Accessed August 2017.

Council on Environmental Quality. 1997a. Environmental Justice: Guidance under the National Environmental Policy Act. Available online at http://www.epa.gov/compliance/ej/resources/policy/ej_guidance_nepa_ceq1297.pdf. Accessed August 2014.

Counsel on Environmental Quality. 1997b. Considering Cumulative Effects Under the National Environmental Policy Act. Available online at https://ceq.doe.gov/publications/–cumulative_–effects.html. Accessed July 2017.

Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31. U.S. Department of the Interior, Fish and Wildlife Services Program. Washington, DC.

Diskin, B.A., J.P. Friedman, S.C. Peppas, and S.R. Peppas. 2011. The Effect of Natural Gas Pipelines on Residential Value. Available online at http://www.irwaonline.org/eweb/upload/web_jan_NaturalGas.pdf. Accessed January 2017.

Ellsworth, W.L. 2013. Injection-induced earthquakes. Science, 341:6142, 1225942, doi:10.1126/science.1225942.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual, Technical Report Y-87-1. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Farm Service Agency. 2017a. Conservation Programs. U.S. Department of Agriculture. Available online at https://www.fsa.usda.gov/programs-and-services/conservation-programs/index. Accessed July 2017.

Farm Service Agency. 2017b. Conservation Reserve Program. U.S. Department of Agriculture. Available online at https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservationreserve-program/index. Accessed July 2017.

Farm Service Agency. 2017c. Conservation Reserve Enhancement Program. U.S. Department of Agriculture. Available online at https://www.fsa.usda.gov/programs-and-services/conservation programs/conservation-reserve-enhancement/index. Accessed July 2017.

Federal Aviation Administration, Bureau of Transportation Statistics. 2013. National Transportation Atlas Database. Available online at https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_atlas_database/index.html. Accessed January 2017.

Federal Emergency Management Agency. 2017. National Flood Hazard Layer. Available online at https://fema.maps.arcgis.com/home/item.html?id=cbe088e7c8704464aa0fc34eb99e7f30. Accessed August 2017.

Federal Energy Regulatory Commission. 2011. Environmental Assessment for Sabine Pass Liquefaction, LLC and Sabine Pass LNG, L.P.'s Sabine Pass Liquefaction Project. Docket No. CP11-72-000.

Federal Energy Regulatory Commission. 2012. Environmental Assessment for Millennium Pipeline Co, LLC's Minisink Compressor Project. Docket No. CP11-515-000.

Federal Energy Regulatory Commission. 2014. Final Environmental Impact Statement – Vol 1. FERC EIS 0249F. Constitution Pipeline and Wright Interconnect Projects. Docket Nos. CP13-499-000; CP13-502-000; PF12-9-00.

Federal Register. 1994. Changes in Hydric Soils of the United States. Washington, DC, (current Hydric Soil definition) Vol. 59, No. 133 (July 13).

Fenneman, N.M. 1923. Physiographic Province and Sections in Western Oklahoma and Adjacent Parts of Texas: in Marius R. Campbell, ed., Contributions to the Geography of the United States. U.S. Geological Survey. Available online at https://pubs.usgs.gov/bul/0730d/report.pdf. Accessed July 2017.

Fenneman, N.M., and D.W. Johnson. 1946. Physiographic Divisions of the Conterminous United States. U.S. Geological Survey. Reston, Virgina.

FireDepartment.net. 2016. Oklahoma Fire Departments. Available online at http://www.firedepartment.net/directory/oklahoma. Accessed December 2016.

Fruits, E. (ECONorthwest). 2008. Natural Gas Pipelines and Residential Property Values: Evidence from Clackamas and Washington Counties. Available online at http://www.academia.edu/195355/Natural_Gas_Pipelines_and_Residential_Property_Values_Evidence_from_Clackamas_and_Washington_Counties. Accessed January 2017.

Fuller, R. 2004. Texoma Washita Arm Wildlife Management Area: Outdoor Oklahoma Magazine. Available online at https://www.wildlifedepartment.com/facts_maps/wma/texomawma.pdf. Accessed July 2017.

Gnarus Advisors LLC. 2012. Pipelines and Property Values: An Eclectic Review of the Literature. Co-authored by L. Wilde, C. Loos, and J. Williamson. February 15, 2012. Available online at http://pstrust.org/docs/Gnarus_Pipelines_Property_Values.pdf. Accessed January 2017.

Google Earth. 2016. Search for hotels, RV Parks, and Campgrounds. Accessed December 2016.

Google Earth. 2017. Search for hotels, RV Parks, and Campgrounds. Accessed February 2017.

Hansen, J.L., E.D. Benson, and D.A. Hagen. 2006. Environmental Hazards and Residential Property Values: Evidence from a Major Pipeline Event. November 2006.

Hart, Donald L. and R.E. Davies. 1981. Geohydrology of the Antlers Aquifer. Oklahoma Geological Survey Circular 81. Available online at http://www.ogs.ou.edu/pubsscanned/Circulars/circular81mm.pdf. Accessed July 2017.

Hotels.com. 2016. Hotel Search in Oklahoma Towns. Available online at www.hotels.com. Accessed December 2016.

Hotels.com. 2017. Hotel Search in Oklahoma Towns. Available online at www.hotels.com. Accessed March 2017.

Integra Realty Resources. 2016. Pipeline Impact to Property Value and Property Insurability. Available online at http://www.ingaa.org/File.aspx?id=27480&v=cac46a26. Accessed January 2017.

International Right of Way Online. 2011. The Effects of Natural Gas Pipelines on Residential Value. Available online at http://www.irwaonline.org/eweb/upload/web_jan_NaturalGas.pdf. Accessed July 2017.

Interstate Natural Gas Association of America Foundation. 2016. Pipeline Impact to Property Value and Property Insurability. Prepared by Integra Realty Resources. February 2016. Available online at http://www.ingaa.org/PropertyValues.aspx. Accessed July 2017.

Johnson, K.S. 1988. Geologic Evolution of the Anadarko Basin: *in* Kenneth S. Johnson, ed., Anadarko Basin Symposium. Oklahoma Geological Survey Circular 90. Available online at http://www.ogs.ou.edu/pubsscanned/Circulars/Circular90.pdf. Accessed July 2017.

Johnson, K.S. 2008. Mineral Deposits and Resources of Oklahoma (Exclusive of oil and gas), Educational Publication 9:2008. Oklahoma Geological Survey, University of Oklahoma. Available online at http://www.ogs.ou.edu/pubsscanned/EP9p10_11minoilgas.pdf. Accessed July 2017.

Johnson, R., D. Bernhardt, N. Nelson, and H. Calley. 1973. *Assessment of Potential Radiological Health Effects from Radon in Natural Gas*. Prepared for the U.S. Environmental Protection Agency, Office of Radiation Programs as EPA-520/1-83-004. Washington, DC.

Kansas Geological Survey. 1996. Anadarko Basin—Province Summary. Kansas Geological Survey, Digital Petroleum Atlas. Available online at http://www.kgs.ku.edu/DPA/frontEnd/Anadarko/provSum.html. Accessed July 2017.

Kaufman, K. 1996. Lives of North American Birds. Kaufman Field Guides, Oak Harbor, Ohio. Available online at http://www.audubon.org/bird-guide. Accessed August 2017.

Kochanek, K.D., S.L. Murphy, J.Q. Xu, B. Tejada-Vera. 2017. Deaths: Final Data for 2014. National Vital Statistics Reports; Vol. 65 No. 4. Hyattsville, Maryland: National Center for Health Statistics. Available online at https://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_04.pdf. Accessed June 2017.

Langenbruch, C. and M.D. Zoback. 2016. How Will Induced Seismicity in Oklahoma Respond to Decreased Saltwater Injection Rates? Scientific Advances, 2:11, e1601542, doi:10.1126/sciadv.1601542.

LASR.NET. 2017. LASR.NET, Leisure and Sport. Lake Texoma WMA Hunting. Available online at https://www.lasr.net/travel/lake.php?Lake+Texoma+WMA+Hunting&TravelTo=TX06lk012&VA=Y&Attraction_ID=TX06lk012a006. Accessed July 2017.

Marsh, S. and A. Holland. 2016. Comprehensive Fault Database and Interpretive Fault Map of Oklahoma. Oklahoma Geological Survey Open-File Report OF2-2016. Available online at http://ogs.ou.edu/docs/openfile/OF2-2016.pdf. Accessed July 2017.

Martinez, D., A. Barstow, and K. Stubbs. 2017. Telephone conversation on October 5, 2017, between J. Rieland and T. Lyons (Environmental Resources Management); J. Wacholder (Federal Energy Regulatory Commission); and D. Martinez, A. Barstow, and K. Stubbs (U.S. Fish and Wildlife Service).

Mercy Hospital Healdton. 2016. Mercy Hospital Healdton Quick Facts. Available online at https://www.mercy.net/newsroom-mercy-hospital-healdton-quick-facts. Accessed December 2016.

Mercy Hospital Kingfisher. 2016. Mercy Hospital Kingfisher. Available online at https://www.mercy.net/practice/mercy-hospital-kingfisher. Accessed December 2016.

Mercy Hospital Tishomingo. 2016. Mercy Hospital Tishomingo. Available online at https://www.mercy.net/practice/mercy-hospital-tishomingo. Accessed December 2016

Morton, Robert B. 1992. Simulation of Ground-water Flow in the Antlers Aquifer in Southeastern Oklahoma and Northeastern Texas. Available online at https://pubs.usgs.gov/wri/1988/4208/report.pdf. Accessed July 2017.

National Center for Education Statistics. 2016. Public School Survey. Available online at http://nces.ed.gov/ccd/schoolsearch/. Accessed December 2016

National Historic Route 66 Federation. 2017. The History of Route 66. Available online at http://national66.org/history-of-route-66/. Accessed July 2017.

National Park Service. 2017a. Nationwide Rivers Inventory, Authorizations. Available online at https://www.nps.gov/ncrc/programs/rtca/nri/auth.html. Accessed July 2017.

National Park Service. 2017b. Nationwide Rivers Inventory. Oklahoma Segments. Available online at https://www.nps.gov/ncrc/programs/rtca/nri/states/ok.html. Accessed July 2017.

National Park Service. 2017c. National Center for Recreation &Conservation, Nationwide Rivers Inventory, Oklahoma Segments. U.S. Department of the Interior, National Park Service. Available online at https://www.nps.gov/ncrc/programs/rtca/nri/states/ok.html. Accessed July 2017.

National Weather Service. 2017. Weather Fatalities 2016. Available online at https://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_04.pdf. Accessed June 2017.

Natural Resources Conservation Service. 2017a. Highly Erodible Land Definitions. Available online at https://www.nrcs.usda.gov/wps/portal/nrcs/detail/pr/soils/?cid=nrcs141p2_037282. Accessed June 2017.

Natural Resources Conservation Service. 2017b. Easements. U.S. Department of Agriculture. Available online at http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements. Accessed July 2017.

North American Bird Conservation Initiative. 2017. Bird Conservation Regions Map. Available online at http://nabci-us.org/resources/bird-conservation-regions-map/. Accessed May 2017.

Oklahoma Association of Electric Cooperatives. 2017. Oklahoma Association of Electric Cooperatives, Cooperative Maps. Available online at https://www.oaec.coop/map/. Accessed December 2017.

Oklahoma Conservation Commission. 2017. Oklahoma Conservation Reserve Enhancement Program. Available online at https://www.ok.gov/conservation/Agency_Divisions/Water_Quality_Division/WQ_CREP/. Accessed July 2017.

Oklahoma Corporation Commission. 2017a. Well Browse Database. Available online at https://www.occeweb.com/Orawebapps/OCCORaWebAppsone.html. Accessed September 2017.

Oklahoma Corporation Commission. 2017b. Pipeline Safety. Available online at http://www.occeweb.com/tr/PLSHome.htm. Accessed June 2017.

Oklahoma Department of Agriculture Food and Forestry. 2017. Organic Producers List. Available online at http://www.ag.ok.gov/food/organic.htm. Accessed July 2017.

Oklahoma Department of Environmental Quality. 2015. Integrated Water Quality Assessment - 2014 303(d) List Approved. Available online at http://www.deq.state.ok.us/wqdnew/305b_303d/. Accessed August 2017.

Oklahoma Department of Environmental Quality. 2017a. GIS Data: Land Protection. Available online at http://gisdata.deq.opendata.arcgis.com/datasets?group_ids=27fb0a2c11794bb7b34b6e3119eec02d. Accessed June 2017.

Oklahoma Department of Environmental Quality. 2017b. Data Viewer. Available online at http://gis.deq.ok.gov/maps/. Accessed July 2017.

Oklahoma Department of Environmental Quality. 2017c. Guidance; General Permitting for Oil and Gas Facilities (January 30, 2017). Available online at http://www.occeweb.com/og/DEQ%20Guidance%20for%20OG%20Sources.pdf. Accessed September 2017.

Oklahoma Department of Environmental Quality. 2017d. General Permit OKR10 for Storm Water Discharges from Construction Activities within the State of Oklahoma. Available online at http://www.deq.state.ok.us/WQDnew/stormwater/OKR10Permit_2012_final%20Review_August_Updated.pdf. Accessed September 2017.

Oklahoma Department of Environmental Quality. 2017e. 2011 Oil & Gas Area Emissions. Available online at http://www.deq.state.ok.us/aqdnew/emissions/OilandGasAreaEmissions/index.htm. Accessed October 2017.

Oklahoma Department of Transportation. 2015a. Maps AADT – Annual Average Daily Traffic Current. Available online at http://www.odot.org/maps/aadt/index.htm. Accessed May 2017.

Oklahoma Department of Transportation. 2015b. Oklahoma Long Range Transportation Plan 2015-2040. Available online at http://www.okladot.state.ok.us/p-rdiv/lrp_2015_2040/2040_LRTP_Full_Document.pdf. Accessed January 2017.

Oklahoma Department of Transportation. 2017. Planning & Research Division, Route 66 – Background. Available online at http://www.okladot.state.ok.us/memorial/route66/route66background.htm. Accessed July 2017.

Oklahoma Department of Wildlife Conservation. 2011. Eagles in Oklahoma. Available online at https://www.wildlifedepartment.com/wildlifemgmt/eaglesinok.htm. Accessed August 2017.

Oklahoma Department of Wildlife Conservation. 2013. Public comments of November 20, 2013. ODWC. Oklahoma City, OK.

Oklahoma Department of Wildlife Conservation. 2016a. Species Spotlight. Available online at http://www.wildlifedepartment.com/wildlifemgmt/species.htm. Accessed December 2016.

Oklahoma Department of Wildlife Conservation. 2016b. Arkansas River Shiner. Available online at https://www.wildlifedepartment.com/wildlife/nongamespecies/arkansas-river-shiner. Accessed August 2017.

Oklahoma Department of Wildlife Conservation. 2016c. Arkansas River Shiner (Notropis girardi). Available online at https://www.wildlifedepartment.com/wildlifemgmt/endangered/river_shiner.htm. Accessed August 2017.

Oklahoma Department of Wildlife Conservation. 2017a. What to Hunt. Available online at https://www.wildlifedepartment.com/hunting/what-to-hunt. Accessed August 2017.

Oklahoma Department of Wildlife Conservation. 2017b. Texoma Washita Arm. Available online at https://www.wildlifedepartment.com/wildlife-management-areas/texoma-washita-arm. Accessed August 2017.

Oklahoma Department of Wildlife Conservation. 2017c. Waterfowl. Available online at http://www.wildlifedepartment.com/hunting/species/waterfowl. Accessed August 2017.

Oklahoma Department of Wildlife Conservation. 2017d. Oklahoma's Threatened and Endangered Species. Available online at https://wildlifedepartment.com/wildlifemgmt/endangeredspecies.htm. Accessed August 2017.

Oklahoma Department of Wildlife Conservation. 2017e. Wildlife Management Areas and Other Public Lands. Available online at https://www.wildlifedepartment.com/facts_maps/wmastate.htm. Accessed July 2017.

Oklahoma Department of Wildlife Conservation. 2017f. Protection of the Bald Eagle. Available online at https://www.wildlifedepartment.com/wildlifemgmt/eagleprotection.htm. Accessed November 2017.

Oklahoma Geological Survey. 2008. Geologic Hazards in Oklahoma. Available online at http://www.ogs.ou.edu/pubsscanned/EP9p15hazards.pdf. Accessed July 2017.

Oklahoma Geological Survey. 2015. Statement on Oklahoma Seismicity. Available online at http://ogs.ou.edu/docs/statements/OGS_Statement-Oklahoma-Seismicity-2015-04-21.pdf. Accessed July 2017.

Oklahoma Geological Survey. 2017. OGS Statement on 2017 USGS assessment of continued seismic hazards in Oklahoma. Oklahoma Geological Survey. Available online at http://wichita.ogs.ou.edu/documents/OGS_Statement_USGS_Hazard_Map_2017.pdf. Accessed September 2017.

Oklahoma Historical Society. 2018a. Indian Territories. Available online at http://www.okhistory.org/publications/enc/entry.php?entryname=INDIAN%20TERRITORY. Accessed January 2018.

Oklahoma Historical Society. 2018b. Settlement Patterns. Available online at http://www.okhistory.org/publications/enc/entry.php?entryname=SETTLEMENTPATTERNS. Accessed January 2018.

Oklahoma Natural Heritage Inventory. 2017. Letter correspondence from T. Fagin (Oklahoma Natural Heritage Inventory) to Secretary Bose (Federal Energy Regulatory Commission). OBS Ref. 2017-051-FED-ERC. Dated February 6, 2017.

Oklahoma Office of the Secretary of the Energy and Environment. 2017. Fact Sheet, Earthquakes in Oklahoma. Available online at https://earthquakes.ok.gov/faqs/. Accessed July 2017.

Oklahoma Register. 2017. Title 165: Corporation Commission, Chapter 10: Oil and Gas Conservation. Effective September 11, 2017. Available online at http://www.occeweb.com/og/DEQ%20Guidance%20for%20OG%20Sources.pdf. Accessed September 2017.

Oklahoma Water Resources Board. 1999. Statewide Groundwater Vulnerability Map of Oklahoma. Technical Report 99-1. Available online at https://www.owrb.ok.gov/studies/reports/gwvulnerability/entire-report.pdf. Accessed July 2017.

Oklahoma Water Resources Board. 2008. Water Instream Flow Assessment of Streams Draining the Arbuckle-Simpson Aquifer. Available online at https://www.owrb.ok.gov/util/pdf_util/Arbuckle%20MAY%20Hearing/Ex2_ASHearing_InstreamFlow.pdf. Accessed August 2017.

Oklahoma Water Resources Board. 2009. Geochemistry of the Arbuckle-Simpson Aquifer. Available online at https://www.owrb.ok.gov/util/pdf_util/Arbuckle%20MAY%20Hearing/prehearing_docs/9-GeochemistyArbuckle-Simpson.pdf. Accessed July 2017.

Oklahoma Water Resources Board. 2011. Wellhead Protection Areas: Vector Digital Data. Available online at http://www.owrb.ok.gov. Accessed July 2017.

Oklahoma Water Resources Board. 2016. Oklahoma Water Quality Standards (Title 785, Chapter 45). Available online at http://www.owrb.ok.gov/util/rules/pdf_rul/current/Ch45.pdf. Accessed July 2017.

Oklahoma Water Resources Board. 2017a. Water Quality Standards, About the Program. Available online at https://www.owrb.ok.gov/quality/standards/standards.php. Accessed August 2017.

Oklahoma Water Resources Board. 2017b. Surface Water Data. Available online at http://www.owrb.ok.gov/maps/PMG/owrbdata_SW.html. Accessed August 2017.

Oklahoma Water Resources Board. 2017c. Public Water Supply Approximate System Services Area Shapefiles. Available online at http://www.owrb.ok.gov/maps/PMG/owrbdata_WS.html. Accessed April 2017.

O'Rourke, T. D. and M.C. Palmer. 1994. Feasibility Study of Replacement Procedures and Earthquake Performance Related to Gas Transmission Pipelines. National Center for Earthquake Engineering Ressearch-94-0012.

O'Rourke, T.D. and M.C. Palmer. 1996. Earthquake Performance of Gas Transmission Pipelines. Earthquake Spectra. Vol. 12, No. 3.

Osborn, Noel I. and R.H. Hardy. 1999. Statewide Groundwater Vulnerability Map of Oklahoma. Oklahoma Water Resources Board Technical Report 99-I. Available online at http://www.owrb.ok.gov/studies/reports/gwvulnerability/entire-report.pdf. Accessed July 2017.

OutdoorsOK. 2017. Oklahoma Lakes and Outdoors Information: Blue River, Oklahoma. Available online at http://www.outdoorsok.com/oklahoma/blue/. Accessed August 2017.

Oxford, N. 2016. Oklahoma Puts Limits on Oil and Gas Wells to Fight Quakes. The New York Times (3/08/2016). Available online at https://www.nytimes.com/2016/03/08/us/oklahoma-earthquakes-oil-gas-wells.html. Accessed September 2017.

PGP Valuation Inc. 2008. Updated Market Analysis – The Impact of Natural Gas Pipelines on Property Values. Available online at http://pstrust.org/docs/Pipeline_Impact_on_Property_Values.pdf. Accessed January 2017.

Platt, J.R. 2013. Piping Plovers in Migration: Foraging for their Lives. Available online at https://blogs.scientificamerican.com/extinction-countdown/piping-plovers-in-migration-foraging-for-their-lives/. Accessed August 2017.

PoliceOne. 2016. Police Department Directory. Available online at http://www.policeone.com/law-enforcement-directory/. Accessed December 2016.

Polivika, K.M. and W.J. Matthews. 1997. Habitat Requirements of the Arkansas River Shiner, Notropis girardi. In: U.S. Fish and Wildlife Service. 2011. Arkansas River Shiner Fact Sheet. Final Report, Federal Aid Project No. E-33. Oklahoma Department of Wildlife Conservation. Oklahoma City, Oklahoma.

RBN Energy, LLC. 2017. Will Natural Gas Production in the SCOOP/STACK be OK? Available online at https://rbnenergy.com/sites/default/files/static_pages/rbn_scoop_stack_preview_201702271.pdf. Accessed September 2017.

Rextag, a Hart Energy Company. 2017. Global Energy GIS Database: United States Oil and Gas Wells GIS Data (Update 1021, Fall 2015). Accessed July 2017.

RV Parks Review. 2016. Campground Search by State. Available online at http://www.rvparkreviews.com/. Accessed December 2016.

RV Parks Review. 2017. Campground Search by State. Available online at http://www.rvparkreviews.com/. Accessed January and March 2017.

Skinner, M. 2016. New Year, New Plays, New Plans. Oil and Gas Conservation Division, Oklahoma Corporation Commission (December 20, 2016). Available online at https://earthquakes.ok.gov/wp-content/uploads/2016/12/12-20-16-OCC-News-Release.pdf. Accessed September 2017.

Skinner, M. 2017. Looking Ahead: New Earthquake Directive Takes Aim at Future Disposal Rates. Oil and Gas Conservation Division, Oklahoma Corporation Commission (February 24, 2017). Available online at http://www.occeweb.com/News/2017/02-24-7%20FUTURE%20DISPOSAL.pdf. Accessed September 2017.

Soil Survey Staff. 2017a. Web Soil Survey. Natural Resources Conservation Service, U.S. Department of Agriculture. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed June 2017.

Soil Survey Staff. 2017b. Official Soil Series Descriptions. Natural Resources Conservation Service, U.S. Department of Agriculture. Available online at https://soilseries.sc.egov.usda.gov/. Accessed June 2017.

Southern Area Coordination Center. 2017. Interagency Coordination Centers. Available online at https://gacc.nifc.gov/sacc/state_dispatch.php. Accessed January 2017.

Stubbs, K. and D. Martinez. 2017. Email communication on November 13, 2017, between J. Rieland (Environmental Resources Management), K. Stubbs (U.S. Fish and Wildlife Service), and D. Martinez (U.S. Fish and Wildlife Service).

Terracon. 2017. Geotechnical Engineering Report: Calumet Compressor Station, Sholem Booster Station, and Bennington Compressor Station. Cheniere Doc. No. MSPLML-E-QU-RPT-00005.

Tewksbury, J.J., D.J. Levey, N.M. Haddad, S. Sargent, J.L. Orrock, A. Weldon, B.J. Danielson, J. Brinkerhoff, E.I. Damschen, and P. Townsend. 2002. Corridors Affect Plants, Animals, and Their Interactions in Fragmented Landscapes. Proceedings of the National Academy of Sciences, USA 99: 12923–12926. Available online at http://www.pnas.org/content/99/20/12923.abstract. Accessed August 2017.

Texas Parks and Wildlife Department. 2017. Interior Least Tern (Sterna antillarum athalassos). Available online at https://tpwd.texas.gov/huntwild/wild/species/leasttern/. Accessed August 2017.

The Nature Conservancy. 2017. How We Work In Oklahoma. Available online at https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/oklahoma/howwework/index.htm. Accessed July 2017.

TheUS50.com. 2018. General Oklahoma State History. Available online at http://www.theus50.com/oklahoma/history.php. Accessed January 2018.

TRC. 2016. Personal communication between N. Hudson, TRC, and N.H. Sunseson, PhD, Oklahoma Geological Survey. RE: Fossils in Oklahoma, December 13.

TRIP. 2015. Rural Connections: Challenges and Opportunities in America's Heartland. Available online at http://www.tripnet.org/docs/Rural_Roads_TRIP_Report_May_2015.pdf. Accessed January 2017.

U.S. Army Corps of Engineers. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0). Eds. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-10-20. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

U.S. Bureau of Labor Statistics. 2015. Table 1. Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2015. Available online at https://www.bls.gov/news.release/osh.t01.htm. Accessed September 2017.

U.S. Census Bureau. 2000. Decennial Census 2000, Population, Housing Units, Area, and Density: 2000 – County – County Subdivision and Place (GCT-PH1). Available online at https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t. Accessed December 2016.

U.S. Census Bureau. 2009. Statistical Abstract of the United States: 2010. Available online at https://www.census.gov/library/publications/2009/compendia/statab/129ed.html. Accessed January 2018.

U.S. Census Bureau. 2010. Decennial Census 2010, Table GCT-PH1: Population, Housing Units, Area, and Density: 2010 – County – County Subdivision and Place Available online at https://factfinder. census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed June 2017.

U.S. Census Bureau. 2015a. 2011–2015 American Community Survey 5-Year Estimates: Total Population (Table B01003). Available online at https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed December 2016.

U.S. Census Bureau. 2015b. 2011–2015 American Community Survey 5-Year Estimates: Per Capita Income in the Past 12 Months (Table B19301). Available online at https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed December 2016.

U.S. Census Bureau. 2015c. 2011–2015 American Community Survey 5-Year Estimates: Selected Economic Characteristics (Table DP03). Available online at https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed December 2016.

U.S. Census Bureau. 2015d. 2011–2015 American Community Survey 5-Year Estimates: Industry by Occupation for the Civilian Employed Population 16 Years and Over (Table S2405). Available online at https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed December 2016.

U.S. Census Bureau. 2015e. 2011-2015 American Community Survey 5-Year Estimates: Selected Housing Characteristics (Table DP04). Available online at https://factfinder. census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed December 2016.

U.S. Census Bureau. 2015f. 2011–2015 American Community Survey 5-Year Estimates: Vacancy Status (Table B25004). Available online at https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed December 2016.

U.S. Census Bureau. 2015g. 2011–2015 American Community Survey 5-Year Estimates: Race (Table B02001). Available online at https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed December 2016.

U.S. Census Bureau. 2016. America's Families and Living Arrangements: 2016. Available online at https://www.census.gov/data/tables/2016/demo/families/cps-2016.html. Accessed August 2017.

U.S. Census Bureau. 2017. Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2016. U.S. Census Bureau, Population Division. Release Date: March 2017. Available online at https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml. Accessed August 2017.

U.S. Department of Agriculture. 2017. Introduced, Invasive, and Noxious Plants. Available online at https://plants.usda.gov/java/noxiousDriver. Accessed July 2017.

U.S. Department of Transportation, Federal Highway Administration. 2006. Federal Highway Administration Highway Construction Noise Handbook. Available online at http://www.fhwa.dot.gov/environment/noise/handbook/09.htm. Accessed July 2017.

U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. 2017a. Pipeline Incident 20 Year Trends. Available online at http://www.phmsa.dot.gov/pipeline/library/data-stats/pipelineincidenttrends. Accessed January 2018.

U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. 2017b. Significant Incident Consequences Summary Statistics. Available online at https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages&NQUser=PDM_WEB_USER&NQPassword=Public_Web_User1&PortalPath=%2Fshared%2FPDM%20Public%20Website%2F_portal%2FSC%20Incident%20Trend&Page=Significant%20Incidents%20Consequences. Accessed July 2017.

U.S. Energy Information Administration. 2017. Frequently Asked Questions. Available online at https://www.eia.gov/tools/faqs/faq.php?id=73&t=11. Accessed October 2017.

U.S. Environmental Protection Agency. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. The U.S. Environmental Protection Agency, Office of Noise Abatement and Control. March 1974.

U.S. Environmental Protection Agency. 1989. Arbuckle-Simpson Aquifer of South Central Oklahoma Sole Source Aquifer; Final Determination ACTION: Notice. Available online at https://www.owrb.ok.gov/util/pdf_util/Arbuckle%20MAY%20Hearing/prehearing_docs/1-ArbuckleSSADesignation.pdf. Accessed July 2017.

U.S. Environmental Protection Agency. 1994. Technical Document, Acid Mine Drainage, EPA 530-R-94-036, December. Available online at https://www.epa.gov/sites/production/files/2015-09/documents/amd.pdf. Accessed July 2017.

U.S. Environmental Protection Agency. 2000. Abandoned Mine Site Characterization and Cleanup Handbook, EPA910-B-00.001, August. Available online at http://sites.umuc.edu/library/libhow/apa_examples.cfm?noprint=true#intext. Accessed July 2017.

U.S. Environmental Protection Agency. 2011. Learn About Environmental Justice. Available online at https://www.epa.gov/environmentaljustice/learn-about-environmental-justice. Accessed August 2017.

U.S. Environmental Protection Agency. 2013. Level III Ecoregions of the Continental United States: Corvallis, Oregon. Available online at https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states. Accessed August 2017.

U.S. Environmental Protection Agency. 2016. A Citizen's Guide to Radon. Available online at https://www.epa.gov/radon/citizens-guide-radon-guide-protecting-yourself-and-your-family-radon. Accessed April 2018.

U.S. Environmental Protection Agency. 2017a. Cleanups in My Community. Available online at https://www.epa.gov/cleanups/cleanups-my-community. Accessed June 2017.

U.S. Environmental Protection Agency. 2017b. EnviroFacts. Available online at https://www3.epa.gov/enviro/. Accessed June 2017.

U.S. Environmental Protection Agency. 2017c. Sole Source Aquifers. Interactive Map. Available online at https://www.epa.gov/dwssa. Accessed July 2017.

U.S. Environmental Protection Agency. 2017d. Water Quality Assessment and TMDL Tracking (ATTAINS) Tool. Available online at https://www.epa.gov/tmdl/impaired-waters-and-tmdls-resources-tools-and-databases. Accessed June 2017.

U.S. Environmental Protection Agency. 2017e. Environmental Justice Showcase Communities by Region. Available online at https://www.epa.gov/environmentaljustice/environmental-justiceshowcase-communities-region. Accessed January 2017.

U.S. Environmental Protection Agency. 2017f. Greenhouse Gas Emissions: Understanding Global Warming Potentials. Available online at https://www.epa.gov/ghgemissions/understanding-global-warming-potentials. Accessed July 2017.

U.S. Environmental Protection Agency. 2017g. Monitor Values for Criteria Pollutants. Air Data. Available online at https://www.epa.gov/air-data. Accessed February 2017.

U.S. Environmental Protection Agency. 2017h. National Ambient Air Quality Standards Table. Available online at https://www.epa.gov/criteria-air-pollutants/naaqs-table#3. Accessed January 2017.

U.S. Fire Administration. 2016. National Fire Department Census. Available online at https://apps.usfa.fema.gov/census/search. Accessed December 2016.

U.S. Fish and Wildlife Service. 1991. American Burying Beetle (Nicophorus americanus) Recovery Plan. U.S. Fish and Wildlife Service, Region 5. Concord, New Hampshire. Available online at https://ecos.fws.gov/docs/recovery_plan/910927.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2005. News Release – Critical Habitat Designated for Arkansas River Shiner. Public Affairs Office, Albuequerque, New Mexico. October 13, 2005. Available online at https://www.fws.gov/mountain-prairie/pressrel/05-76.htm. Accessed August 2017.

U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. May 2007. Available online at https://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. Available online at http://www.fws.gov/migratorybirds/. Accessed August 2017.

U.S. Fish and Wildlife Service. 2011a. Whooping Crane Fact Sheet. August 2011. Available online at https://www.fws.gov/southwest/es/Oklahoma/Documents/TE_Species/Species%20Profiles/Whooping%20Crane.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2011b. Arkansas River Shiner Fact Sheet. August 2011. Available online at https://www.fws.gov/southwest/es/oklahoma/Documents/TE_Species/Species%20Profiles/AR%20River%20Shiner.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2011c. Eagle Guidelines: Bald Eagle Management Guidelines and Conservation Measures. Available online at https://www.fws.gov/northeast/ecologicalservices/pdf/NortheastRegionBaldEagle.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2013a. Salt Plains National Wildlife Refuge - Wildlife and Habitat. Available online at https://www.fws.gov/refuge/Salt_Plains/wildlife_and_habitat/index.html. Accessed November 2017.

U.S. Fish and Wildlife Service. 2013b. Whooping Crane (Grus Americana). Available online at https://www.fws.gov/southdakotafieldoffice/CRANE.HTM. Accessed November 2017.

U.S. Fish and Wildlife Service. 2014a. Rufa Red Knot Background Information and Threats Assessment. Supplement to Endangered and Threatened Wildlife and Plants; Final Threatened Status for the Rufa Red Knot (Calidris canutus rufa). U.S. Fish and Wildlife Service, Northeast Region, New Jersey Field Office. Pleasantville, New Jersey. Available online at https://www.fws.gov/northeast/redknot/pdf/20141125_REKN_FL_supplemental_doc_FINAL.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2014b. American Burying Beetle Fact Sheet. April 2014. Available online at https://www.fws.gov/southwest/es/oklahoma/documents/te_species/species%20profiles/american%20burying%20beetle%20fact%20sheet%202014.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2014c. Oklahoma Ecological Services Field Office Migratory Bird and Eagle Impact Avoidance Measures for Actions Associated with Oil and Gas Projects. Available online at https://www.fws.gov/southwest/es/Oklahoma/Documents/TE_Species/Oklahoma%20Guidance%20for%20BGEPA%20and%20MBTA.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2016a. Three Decades of Conservation Efforts Lead to Recovery, Proposed Delisting of Texas, Oklahoma Songbird. Available online at https://www.fws.gov/news/ShowNews.cfm?ref=three-decades-of-conservation-efforts-lead-to-recovery-proposed--&_ID=35911. Accessed August 2017.

U.S. Fish and Wildlife Service. 2016b. Least Tern (Interior Population) Sterna antillarum Fact Sheet. Available online at https://www.fws.gov/midwest/endangered/birds/leasttern/IntLeastTernFactSheet.html. Accessed August 2017.

U.S. Fish and Wildlife Service. 2016c. American Burying Beetle: Additional Information. Available online at https://www.fws.gov/southwest/es/Oklahoma/ABB_Add_Info.htm. Accessed August 2017.

U.S. Fish and Wildlife Service. 2016d. American Burying Beetle Impact Assessment for Project Reviews. U.S. Fish and Wildlife Service Southwest Region, Oklahoma Ecological Services Field Office. March 2016. Available online at https://www.fws.gov/southwest/es/Oklahoma/documents/abb/surveying%20final/abb%20impact%20assessment%20for%20project%20reviews_30march2016_final.pdf. Accessed August 2017.

U.S. Fish and Wildlife Service. 2016e. IPaC Trust Resources Report. Midship (10-20-2016 CL). Generated October 20, 2016.

U.S. Fish and Wildlife Service. 2016f. Official Species List. Provided by the Oklahoma Ecological Services Field Office on December 14, 2016. Consultation code 02EKOK00-2017-SLI-0585.

U.S. Fish and Wildlife Service. 2017a. Tishomingo National Wildlife Refuge Oklahoma. Available online at https://www.fws.gov/refuge/Tishomingo/. Accessed July 2017.

U.S. Fish and Wildlife Service. 2017b. Summary of telephone conversation between A. Cornell (TRC) and D. Martinez (U.S. Fish and Wildlife Service) dated February 1, 2017.

U.S. Fish and Wildlife Service. 2017c. Letter correspondence from the U.S. Fish and Wildlife Service providing the list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project. Consultation Code: 02EKOK00-2017-SLI-1014. February 27, 2017.

U.S. Fish and Wildlife Service. 2017d. Letter correspondence from the U.S. Fish and Wildlife Service providing the list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project. Consultation Code: 02EKOK00-2017-SLI-1015. February 27, 2017.

U.S. Fish and Wildlife Service. 2017e. Information for Planning and Consultation. Available online at https://ecos.fws.gov/ipac/. Accessed August 2017.

U.S. Fish and Wildlife Service. 2017f. Black-capped Vireo (Vireo atricapilla). Available online at https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B07T . Accessed August 2017.

U.S. Fish and Wildlife Service. 2017g. All about Piping Plovers. Available online at https://www.fws.gov/plover/facts.html. Accessed August 2017.

U.S. Fish and Wildlife Service. 2017h. Email correspondence between D. Martinez (Fish and Wildlife Biologist, U.S. Fish and Wildlife Service) and A. Cornell (TRC) dated February 9, 2017.

U.S. Fish and Wildlife Service. 2017i. Piping Plover Critical Habitat Questions and Answers. Available online at https://www.fws.gov/plover/q&a.html. Accessed August 2017.

U.S. Fish and Wildlife Service. 2017j. Species Profile for American Burying Beetle (Nicrophorus americanus). Available online at https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=I028. Accessed August 2017.

U.S. Fish and Wildlife Service. 2017k. Official Species List. Provided by the Oklahoma Ecological Services Field Office on January 3, 2017. Consultation code 02EKOK00-2017-SLI-0680.

U.S. Fish and Wildlife Service. 2017l. National Wildlife Refuge System. About: Mission. Available online at https://www.fws.gov/refuges/about/mission.html. Accessed July 2017.

U.S. Fish and Wildlife Service. 2017m. Fish and Aquatic Conservation. The National Fish Hatchery System. Available online at https://www.fws.gov/Fisheries/nfhs/index.html. Accessed July 2017.

U.S. Fish and Wildlife Service. 2018. Telephone conversation and follow-up correspondence dated May 17 to 23, between A. Barstow (Fish and Wildlife Biologist, Oklahoma Ecological Services Field Office); E. Baum and J. Wachholder (Federal Energy Regulatory Commission); and M. Buckless and T. Lyons (Environmental Resources Management, Inc.).

U.S. Geological Survey. 1995. U.S. Geological Survey – The Geology of Radon. Available online at http://certmapper.cr.usgs.gov/data/PubArchives/radon/georadon/2.html. Accessed April 2018.

U.S. Geological Survey, National Geospatial Technical Operations Center. 2016. Geospatial data for police, fire and medical facilities. Available online at https://ngtoc.usgs.gov. Accessed December 2016.

U.S. Geological Survey. 1996. Groundwater Atlas of the United States. Available online at https://pubs.usgs.gov/ha/ha730/. Accessed July 2017.

U.S. Geological Survey. 2005. Preliminary integrated geologic map databases for the United States. Open-File Report 2005-1351, United States Geological Survey. Available online at https://pubs.usgs.gov/of/2005/1351/. Accessed July 2017.

U.S. Geological Survey. 2006. Quaternary fault and fold database for the United States, United States Geological Survey. Available online at https://earthquake.usgs.gov/hazards/qfaults/. Accessed July 2017.

U.S. Geological Survey. 2014. United States National Seismic Hazard Maps: United States Geological Survey. Available online at https://earthquake.usgs.gov/hazards/hazmaps/. Accessed July 2017.

U.S. Geological Survey. 2016. Seismic Hazard Map, 1% Probability of Exceedance in One Year, 2016. Available online at https://earthquake.usgs.gov/hazards/induced/data.php. Accessed July 2017.

U.S. Geological Survey. 2017a. Mineral Resources Data System. Available online at https://mrdata.usgs.gov/mrds/. Accessed July 2017.

U.S. Geological Survey. 2017b. Induced Earthquakes. Available online at https://earthquake.usgs.gov/research/induced/overview.php. Accessed July 2017.

U.S. Geological Survey. 2017c. Seismic Hazard Map, 1% Probability of Exceedance in One Year, 2017. Available online at https://www.sciencebase.gov/catalog/item/58ab074ee4b0ce4410e6cba2. Accessed July 2017.

U.S. Geological Survey. 2017d. Landslide Overview Map of the Conterminous United States, USGS Landslides Hazard Program. Available online at https://landslides.usgs.gov/hazards/nationalmap/. Accessed July 2017.

U.S. Geological Survey. 2017e. The Public Land Survey System. Available online at https://nationalmap.gov/small_scale/a_plss.html. Accessed September 2017.

U.S. Global Change Research Program. 2014. Climate Change Impacts in the United States. Available online at http://www.globalchange.gov/browse/reports/climate-change-impacts-united-states-third-national-climate-assessment-0. Accessed June 2017.

U.S. Global Change Research Program. 2017. Detection and Attribution of Climate Change. *Climate Science Special Report: Fourth National Climate Assessment, Volume I, Chapter 3*. Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.). U.S. Global Change Research Program, Washington, DC, USA. pp. 114-132, doi: 10.7930/J01834ND.

University of Oklahoma. 2016. Center for Spatial Analysis Data Warehouse. Available online at http://geo.ou.edu/DataFrame.htm. Accessed in December 2016.

USACops. 2016. Police Departments, Sheriffs' Offices, and Other Law Enforcement Agencies. Available online at http://www.usacops.com/. Accessed December 2016.

Walsh, F.R. and M.D. Zoback. 2015. Oklahoma's Recent Earthquakes and Saltwater Disposal. Scientific Advance, 1-9, doi:10.1126/sciadv.1500195.

Walsh, F.R. and M.D. Zoback. 2016. Probabilistic assessment of potential fault slip related to injection-induced earthquakes: Application to north central Oklahoma, USA. Geological Society of America. Available online at https://scits.stanford.edu/sites/default/files/walsh_zoback__in_press_g38275_v1.pdf. Accessed September 2017.

Weingarten, M., S. Ge, J.W. Godt, B.A. Bekins, and J.L. Rubinstein. 2015. High-rate Injection is Associated with the Increase in U.S. Mid-continent Seismicity. Science, 348:6241, 1336-1340. doi:10.1126/science.aab1345.

Wilde, G.R., T.H. Bonner, and R. Patino. 2000. Habitat Use and Ecology of the Arkansas River Shiner and Speckled Chub in the Canadian River, New Mexico and Texas. Unpublished Report for the U.S. Fish and Wildlife Service. In: U.S. Fish and Wildlife Service. 2011. Arkansas River Shiner Fact Sheet. Texas Tech University. Lubbock, Texas.

Wilkins, Kent. 1998. Hydrologic Report of the Woodbine, Marietta, and Texoma Minor Bedrock Groundwater Basins, and the Haworth Terrace and Little River Alluvial and Terrace Minor Groundwater Basins. Available online at https://www.owrb.ok.gov/studies/reports/reports_pdf/tr99_2_WoodbineMinorGW.pdf. Accessed July 2017.

Willemssens, K.A. 2015. Soil Preferences of Nicrophorus Beetles and the Effects of Compaction on Burying Behavior. Master's Thesis. University of Nebraska, Lincoln, Nebraska. Available online at http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1113&context=natresdiss. Accessed August 2017.

Yeck, W.L., G.P. Hayes, D.E. McNamara, J.L. Rubinstein, W.D. Barnhardt, P.S. Earle, and H.M. Benz. 2017. Oklahoma Experiences Largest Earthquake during Ongoing Regional Wastewater Injection Hazard Mitigation Efforts. Geophysical Research Letters, 44, doi:10.1002/2016GL071685.

APPENDIX N

LIST OF PREPARERS

APPENDIX N
LIST OF PREPARERS

Federal Energy Regulatory Commission (FERC or Commission)

Baum, Elaine – Environmental Project Manager, Proposed Action, Land Use, Cumulative Effects
M.P.A., 2006, Florida State University
B.S., Environmental Policy and Planning, 2004, Virginia Tech

Cotton, Douglas – Environmental Deputy Project Manager, Alternatives, Socioeconomics
M.S., Urban and Regional Planning, 1980, University of Wisconsin, Madison
B.A., Geography, 1977, University of Massachusetts, Amherst

Armbruster, Ellen – Cultural Resources
M.A., Anthropology, 1986, University of Pennsylvania
B.A., Anthropology, 1979, Bryn Mawr College

Barakat, Kandilarya – Air Quality, Noise, Reliability and Safety
M.E., Environmental Engineering/Project Management, 2006, University of Maryland, College Park
B.S. Chemical Engineering, 2003, University of Maryland, College Park

McDaniel, Nina – Air Quality, Noise, Reliability and Safety
M.S., Engineering Management, 2012, University of New Orleans
B.S., Civil Engineering, 2010, University of New Orleans

Rana, Anthony – Geology, Groundwater, Soils
M.S., International Development, 2012, Tulane University
Graduate Studies, Hydrogeology and Geochemistry, 1985 to 1988, Oklahoma State University
B.S., Geology, 1984, New Jersey City University

Suter, Maggie – Air Quality, Noise, Reliability and Safety
B.S., Environmental Systems Engineering, 2004, Penn State

Wachholder, Joanne – Surface Water and Wetlands, Wildlife and Vegetation, and Special Status Species
M.S., Crop and Soil Sciences – Environmental Toxicology, 1997, Michigan State University
B.S., Environmental Biology, 1994, University of Wisconsin at Stevens Point

FERC Third-Party Contractor – Environmental Resources Management, Inc.

Lyons, Tina – Project Manager, Proposed Action, Land Use, Conclusions and Recommendations
B.S., Genetics and Cell Biology, 1999, University of Minnesota
B.S., Ecology, Evolution, and Behavior, 1996, University of Minnesota

Buckless, Michael – Deputy Project Manager, Geology, Soils
B.S., Environmental Science and Management, 2013, University of Rhode Island

Lee, Jennifer – Principal
B.S., Environmental Studies and Geography, 1995, St. Thomas University

Bakken, Justin – Geographic Information Systems
M.A., Geographic Information Science, 2011, University of Minnesota
B.A., Biology, 2002, Grinnell College

Born, Nate – Air Quality, Noise
B.S., Civil Engineering, 2014, Louisiana State University
B.S., Computer Science, 2010, University of Minnesota

Colwell, Lauren – Geology, Groundwater
M.S., Geology/Environmental and Natural Resources, 2013, University of Wyoming
B.A., Geology and Archaeology, 2009, Carleton College

Enright, Troy – Air Quality, Noise
B.S., Environmental Science, 2003, University of Minnesota

Huff, Jenifer – Socioeconomics
B.S., Pennsylvania State University, 1979, Urban and Regional Planning

Ingham, Alissa – Land Use
B.S., Environmental Management and Protection, 2012, California Polytechnic State University, San Luis Obispo

Ingham, Reina – Cumulative Effects
B.S., Environmental Management and Protection, 2013, California Polytechnic State University, San Luis Obispo

Jensen, Bart –Alternatives
B.S., Natural Resources and Environmental Studies, 1992, University of Minnesota

Nickel, Dave – Reliability and Safety
B.L.A., Environmental Studies, 2002, University of Minnesota at Duluth

Rieland, Janelle – Special Status Species
B.S., Fisheries and Wildlife, 2002, University of Minnesota

Sullivan, Andrew – Surface Water, Wetlands, Wildlife, Vegetation
B.S., Biology and Zoology, 2008, University of Wisconsin, Madison

Sussman, Ben – Socioeconomics
MCRP, 2002, Georgia Tech
B.S., Science, Technology, and Society, 1998, Stanford University

Thyse, DeAnn
M.A., Anthropology, 2008, University of Minnesota
B.A., Anthropology, 1993, University of Wisconsin, Madison

Environmental Resources Management, Inc. is a third-party contractor assisting the Commission staff in reviewing the environmental aspects of the project application and preparing the environmental documents required by the National Environmental Policy Act. Third-party contractors are selected by Commission staff and funded by project applicants. Per the procedures in Title 40 Code of Federal Regulations Part 1506.5(c), third-party contractors execute a disclosure statement specifying that they have no financial or other conflicting interest in the outcome of the project. Third-party contractors are required to self-report any changes in financial situation and to refresh their disclosure statements annually. The Commission staff solely directs the scope, content, quality, and schedule of the contractor's work. The Commission staff independently evaluates the results of the third-party contractor's work and the Commission, through its staff, bears ultimate responsibility for full compliance with the requirements of the National Environmental Policy Act.

APPENDIX O

RESPONSES TO COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

Midship Pipeline Company, LLC
Midcontinent Supply Header Interstate Pipeline Project

Responses to Comments on the Draft Environmental Impact Statement

INDEX

COMMENT SESSIONS (CS)

CS1 – Durant, Oklahoma Comment Session, March 12, 2018

1

FEDERAL ENERGY REGULATORY
COMMISSION
MIDCONTINENT SUPPLY HEADER
INTERSTATE PIPELINE PROJECT
CP17-458-000
COMMENT SESSIONS
Monday, March 12, 2018
4:00 p.m.
Donald W. Reynolds Community Center
1515 West Main St.
Durant, OK 74701

CS1 – Durant, Oklahoma Comment Session, March 12, 2018 (cont'd)

2

P R O C E E D I N G S

(4:00 p.m.)

MR. BOYER: Alright, the one comment I have is.

COURT REPORTER: Introduce yourself.

MR. BOYER: I'm sorry, my name is Ron Boyer and I'm the County Commissioner for District 1 here in Bryan County.

CS1-1 Alright and one comment I had early on in discussions with the oil companies and even at the state level was in regards to flood plan compliance.

And I was given the -- I thought that basically they were going to handle that at a state level since their WRB is over that but I've never heard the final outcome whether it is yes/no. If not then the county has to be dialed in somehow so that we can take care of it also.

And I'd like to have that comment under or have that somehow that close so we know which way we're going to go because it's a whole other can of worms to get this thing qualified. I've got a meeting with OWRB it seems like every week lately on the flood control around here.

And what else did I mention out there --

MR. BUCKLESS: Yeah, you mentioned the roads?

CS1-2 MR. BOYER: Yeah, yeah, the roads are another issue. The county road system is primarily geared toward lightweight vehicles when they start bringing in their heavy equipment and supplies.

CS1-1 Midship Pipeline Company, LLC (Midship Pipeline) has indicated that it would apply to the Oklahoma Water Resources Board – Planning and Management Division for a Floodplain Development Permit for the Midcontinent Supply Header Interstate Pipeline Project (MIDSHIP Project) in the third quarter of 2018. It has also stated that it would apply to the various county/local floodplain management departments for local floodplain permits, as required, in the third quarter of 2018.

CS1-2 As described in section 4.9.5 of the final environmental impact statement (EIS), Midship Pipeline and its contractors would comply with load limits and other specifications for use of paved and unpaved public roads, including adhering to any applicable permit conditions. In the event that construction traffic causes damage to the roads, Midship Pipeline would make repairs in accordance with the requirements set forth by the landowner or appropriate jurisdictional agency.

CS1 – Durant, Oklahoma Comment Session, March 12, 2018 (cont'd)

3

CS1-2 (cont'd) They tend to, if you will, destroy a lot of the -- or severely damage the roads themselves so I'd like to have a way that we can put on record what roads they're using, what route they're using so that we can monitor it. And at that point ask for compensation or have them repair them or whoever so that they don't stay in disarray.

And I guess the other one I may have mentioned is along the same lines as when the routes are being discussed with the state which is usually the one that sets them up is that the county or the local government -- whichever county you guys are going through is included in that discussion so that we have the rural weight limits managed at that point also.

I believe that's all I have at that time. I'll

CS1-3 look through the rest of your stuff and just see. I just want to mention being it's in an existing right-of-way or close to it --

MR. BUCKLESS: Um-hmm.

MR. BOYER: I don't have much of a fear of it really going off-track from there. It's mainly the preparation to and from it that's probably going to cost us the heartburn.

MR. BUCKLESS: Understood, alright excellent, thank you.

MR. BOYER: Thank you.

CS1-3 Comment noted.

CS1 – Durant, Oklahoma Comment Session, March 12, 2018 (cont'd)

4

CS1-4

MR. MCINTYRE: Yes sir, I'm Travis McIntyre. I'm the Chief of the Bennington Rural Fire Department. As far as Midship goes they've been very helpful on the public safety side with the fire departments trying to get us the grant money we need for the training -- the special training we're going to need for all the trenching and the -- all the pipeline safety that we're going to have to do because our guys need to be ready when that call comes in.

So as far as getting us ready for any safety event they've been very helpful and doing that. They've been open -- or more open than some of the previous pipelines that's been -- that's came through the area.

As far as the STEM they've been talking about helping us with the STEM education and stuff and I think for our local kids it's going to benefit from that. We look forward to seeing what they've got doing and hopefully we can take this relationship with Midship and take it to the next level, open and honest that's what we want. So, as long as they keep it open and honest we'll be alright.

Because that's pretty much what I said out there -- actually I thought I was talking to you out there so. That's it.

(Whereupon the meeting was adjourned at 7:00 p.m.)

CS1-4 Comments noted.

**CS1 – Durant, Oklahoma Comment Session,
March 12, 2018 (cont'd)**

5

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

Name of Proceeding: Midcontinent Supply Header Interstate Pipeline Project

Docket No: CP17-458-000

Place: Durant, OK

Date: Monday, March 12, 2018

were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Gaynell Catherine

Official Reporter

CS2 – Ardmore, Oklahoma Comment Session, March 13, 2018

1

FEDERAL ENERGY REGULATORY
COMMISSION
MIDCONTINENT SUPPLY HEADER
INTERSTATE PIPELINE PROJECT
CP17-458-000
COMMENT SESSIONS
Tuesday, March 13, 2018
4:00 p.m.
Ardmore Convention Center
2401 North Rockford Road
Ardmore, OK 73401

CS2 – Ardmore, Oklahoma Comment Session, March 13, 2018 (cont'd)

2

(Whereupon, at 7:00 p.m., the meeting adjourned as no one from the public attended.)

CS2 – Ardmore, Oklahoma Comment Session, March 13, 2018 (cont’d)

3

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

Name of Proceeding: Midcontinent Supply Header Interstate Pipeline Project

Docket No: CP17-458-000

Place: Ardmore, OK

Date: Tuesday, March 13, 2018

were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Gaynell Catherine

Official Reporter

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018

1

FEDERAL ENERGY REGULATORY
COMMISSION
MIDCONTINENT SUPPLY HEADER
INTERSTATE PIPELINE PROJECT
CP17-458-000
COMMENT SESSIONS
Wednesday, March 14, 2018
4:00 p.m.

ELMORE CITY COMMUNITY CENTER
104 S. MAIN STREET
ELMORE CITY, OK 73433

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018 (cont'd)

2

PROCEEDINGS

(4:00 p.m.)

CS3-1

MR. LEWIS: My name is Paul Lewis, First National Bank and Trust, Chickasha, Oklahoma. And I'm here to talk about the Midstream Pipeline that will be coming through our community of Chickasha or just outside our community and Grady County.

We are in great anticipation of the pipeline coming through. It's been very good so far even though the work has not started we've had people securing land rights and I think that's gone very smoothly -- everyone is very cooperative.

Norman Herrara who's been my contact with Midship has been most helpful in our community in conducting public meetings. He's been to several of our Chamber of Commerce meetings to explain to the leadership in the community what's happening.

He's also met with some people in the farming community, he's met with our Economic Development Council as well as our City Council and recently spoke at my leadership Chickasha class -- about 25 people and leaders in the community.

To give us an overview of what happens in the pipeline -- some of the great things that we see coming out of it is first of all the jobs it creates and already in

CS3-1 Comments noted.

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018 (cont'd)

CS3-1 (cont'd)

anticipation of the pipeline coming through our RV parks are full, our hotels are full, our restaurants are booming with business, retail is good.

So when the work finally starts here we know that it's going to be even better. But in the long-run it creates jobs, it's enhances our ad valorem taxes, our tax base all together, it's -- it's very much a positive for our community. And you know once their gone I think we wish it could go on for years and years and years but once they're gone I think our community will be a better place because they were here.

I can't say enough about the good support that we've had from Mr. Herrara in working with our -- well for instance even before they came to town -- I say they, Midship Pipeline -- they did a little research to see what the needs were in our community.

They talked to our local fire departments asked what their needs where, the equipment that they needed and presented a check to them for about $200,000.00 which was greatly appreciated and still talked about in the first responder community.

So just we've been very pleased and again look forward to as the pipeline starts and to its completion. I'm sure there'll be glitches along the way but they seem very adept at handling that. That's about all I've got to

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018 (cont'd)

4

CS3-1 (cont'd) say.

(Whereupon the meeting adjourned at 7:00 p.m.)

CS3 – Elmore City, Oklahoma Comment Session, March 14, 2018 (cont'd)

5

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

Name of Proceeding: MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT

Docket No: CP17-458-00

Place: ELMORE CITY, OK

Date: Wednesday, March 14, 2018

were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Gaynell Catherine

Official Reporter

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018

1

FEDERAL ENERGY REGULATORY
COMMISSION
MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT
CP17-458-000
COMMENT SESSIONS
Thursday, March 15, 2018
4:00 p.m.

REDLANDS COMMUNITY COLLEGE
1300 S. COUNTRY CLUB ROAD
EL RENO, OKLAHOMA 73036

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)

2

P R O C E E D I N G S

(4:00 p.m.)

MR. SHAW: Well my name is Jacob Shaw. I'm here as a concerned citizen. I have been following the Midship

CS4-1 Pipeline process from the beginning and I immediately had great concerns in regards to seismicity and what efforts were being taken to prevent damage to the pipeline in the event of an earthquake and what was the likelihood of an earthquake occurring across along the pipeline route.

And those addressed those concerns were taken into account during the initial approval process. After receiving the Environmental Impact Study I still have very grave concerns. The the pipeline route is from beginning all the way through the state of Oklahoma, it's going through an area with increased earthquake activity.

And considering that's the Kingfisher Gas Belt where the gas is actually being extracted is at high risk for radon exposure radon being pulled through the natural gas pipeline. There doesn't seem to be any acknowledgement within the report that radon exposure is a potential threat.

And I think the combination of those could put us in a situation after the pipeline is up and running where there is some sort of natural disaster or accident or it could even be natural erosion that could put the entire

CS4-1 As described in section 4.1.4.1 of the EIS, seismic events are not anticipated to affect a modern arc-welded pipeline. Section 4.11.1.4 of the EIS has been revised to include a description of the potential risks associated with exposure to radon gas.

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)

3

CS4-1 (cont'd)

metro area at risk for radon exposure.

And this is something that we have seen so many disasters in the state of Oklahoma when the oil companies are essentially put in charge of a whether it's the approval the approval process to the cleanup they seem to be front and center and you can look at Ponca City, Oklahoma, you can look at Picher, Oklahoma.

Picher is a perfect example of what happens when mistakes are not corrected and they're sent back to the taxpayer. And I'm afraid that we're going to be in a position where we won't know that there's a problem until the cancer rates start to explode.

And historically not just with oil and natural gas but when a population is exposed to cancer-causing materials and this has happened all over the country again and again and again where the families end up in a 15-20 year legal battle just to prove that this was the cause.

And I think we have a chance here to address this beforehand and I was hoping to see within the impact study at least some acknowledgement. I do show there is a seismicity report but nothing concerting right now on exposure.

CS4-2

Also the steps that they've taken to mitigate the impact has been their response within the report is to lower the injection the injection rates of the wastewater

CS4-2 As described in section 4.1.4.1 of the EIS, the Oklahoma Corporation Commission, and not Midship Pipeline, has committed to reducing the wastewater disposal volume to 40 percent of the 2014 injection levels in the Area of Interest that overlaps the MIDSHIP Project and this is outside of the jurisdiction of the Federal Energy Regulatory Commission (FERC or Commission).

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)

4

CS4-2 (cont'd)

disposal wells within the state by 40% and their claim is by taking these measures you know, the earthquake probability is lowered making the pipeline safe.

My counter to that is that wastewater injection rates are something that can always be changed depending on who is in charge of OGS, who is in control of the Governor's Office so many layers within the state that if there was an issue if I'm looking historically they're going to point fingers at each other and it's going to be the people of the state that ultimately have to pay for it possibly with their lives.

CS4-3

And if this area was exposed to radon in mass levels and this is it's a genuine concern even though it is a hard thing to believe that it's possible that we're having to ask these questions in this day and age but again if you look at what happened in Picher an evacuation of Picher, Oklahoma, as difficult as it was is nothing compared to on a population-wise to El Reno even El Reno or Yukon, Mustang, Bethany, Oklahoma City.

And because of we all know the Oklahoma wind doesn't stop for anybody and all of these people I mean within a hundred mile radius at at least would be affected if there was an incident along this portion of the pipeline.

Once you get out of the metro there is another

CS4-3 See the response to comment CS4-1.

As described in section 4.12.1 of the EIS, the U.S. Department of Transportation would require Midship Pipeline to establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. In accordance with Title 49 of the Code of Federal Regulations Part 192.615, key elements of Midship Pipeline's emergency procedures would include but are not limited to the following:

- receiving, identifying, and classifying emergency events such as gas leakage, other releases, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- making personnel, equipment, tools, and materials available at the scene of an emergency;
- protecting people first and then property from actual or potential hazards; and
- implementing emergency shutdown of the system and the safe restoration of service.

**CS4 – El Reno, Oklahoma Comment Session,
March 15, 2018 (cont'd)**

5

CS4-3 (cont'd)

set of problems. In the report it was addressed that there is a copy of this report that's been sent to every tribe that's along the pipeline route. So we go from putting the people in the metro at risk to people in rural areas and tribal communities.

That if we look at what happened in Pawnee with the devastation there especially when you have so many people that are in poverty they have to depend on assistance. I mean that we know that that's going to happen if there is a disaster in one of these rural areas that not only will the people themselves not be able to handle it financially, but the city government that they're in the county itself, the counties along the pipeline route we all know the financial issues that the state is in right now and that's another big element, and I think one that we should all take into consideration is the potential economic impact.

Now obviously lives are more important but if we're looking at it from a position of if there is an ecological disaster, who is going to pay for it? And that was my question from the beginning of this was it was very simple who if there is an issue, if there is a leak, if there is a burst, if there you know, corrosion leads to radon exposure who is going to take responsibility?

Will it be Cheniere Energy? Will it be their

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)

6

CS4-3 (cont'd)

division Midship Pipeline? Will it be the CEO, will it be the spokesman will it be the Regulatory Commission? Who in the event of an issue arising is going to take responsibility?

I have yet to see that yet and based on historical precedent it doesn't lead me that doesn't lead me to believe that anyone is going to take responsibility. With the entities in the state that control our legislature financially it's I know it's probable even with the issues that I presented that this is going to pass and with other pipeline fights we've had here and across the country we know that that's the probability.

But I just want to have this on record today that through the approval process from the initial statement to the Environmental Impact Study I do not believe that the earthquake concerns or the radon concerns have been addressed in any satisfactory manner.

(Whereupon the meeting was adjourned at 7:00 p.m.)

CS4 – El Reno, Oklahoma Comment Session, March 15, 2018 (cont'd)

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceeding before the FEDERAL ENERGY REGULATORY COMMISSION in the Matter of:

Name of Proceeding: MIDCONTINENT SUPPLY HEADER INTERSTATE PIPELINE PROJECT

Docket No: CP17-458-000

Place: EL RENO, OKLAHOMA

Date: Thursday, March 15, 2018

were held as herein appears, and that this is the original transcript thereof for the file of the Federal Energy Regulatory Commission, and is a full correct transcription of the proceedings.

Gaynell Catherine

Official Reporter

FEDERAL AGENCIES (FA)

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance

United States Department of the Interior
OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1001 Indian School Road NW, Suite 348
Albuquerque, New Mexico 87104

ER 18/0074
File 9043.1

March 21, 2018

VIA ELECTRONIC MAIL ONLY

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Subject: COMMENTS – Notice of Availability of Draft Environmental Impact Statement (DEIS) for the Proposed Midcontinent Supply Header Interstate Pipeline Project, FERC No. CP17-458-000, Kingfisher County, Oklahoma

Dear Ms. Bose:

The U. S. Department of the Interior has reviewed the Notice of Availability of Draft Environmental Impact Statement (DEIS) for the Proposed Midcontinent Supply Header Interstate Pipeline Project, FERC No. CP17-458-000, Kingfisher County, Oklahoma. The U. S. Geological Survey offers the following comments which are hereby filed for FERC's use in developing the final document. These comments are intended to inform FERC of potential disturbance of USGS streamgages as well as concerns for groundwater quality and public water supply.

FA1-1 **COMMENT: Groundwater Well Monitoring Plan – pre- and post-construction sampling parameters**

No comprehensive water-quality sampling plan or monitoring plan were provided within the DEIS. Statements about performing pre- and post-construction monitoring for private wells and springs are included within the DEIS (page 4-28). Details should be added to the DEIS regarding the assessment of potential impacts of pipeline construction to shallow groundwater quality. Recently, similar proposed pipeline construction projects (FERC, Sept 2016; FERC, July 2016; FERC, Dec 2016) have included reasonable monitoring plans. Well testing recommendations for private well owners are provided by the ODEQ (Oklahoma Department of Environmental Quality, 2014).

Below is a guideline of recommended groundwater-quality sampling parameters. Total Dissolved Solids (TDS) is a basic and widely used measure of combined content of all inorganic

FA1-1 To address the U.S. Department of the Interior's (DOI) concerns, we[1] are recommending in section 4.3.1.7 of the final EIS that, prior to construction, Midship Pipeline file a spring and well water quality sampling plan. The plan is to incorporate the recommended sampling parameters or provide sufficient explanation as to why a specific parameter would not provide information relevant to restoring wells and springs affected by construction of the MIDSHIP Project.

[1] "We," "us," and "our" refer to the environmental staff of the Federal Energy Regulatory Commission's Office of Energy Projects.

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)

FA1-1 (cont'd) and organic substances in water, and has an EPA secondary drinking water standard. Elevated TDS has been related to Unconventional Oil and Gas (UOG) development and effects of mineral extraction (Cozzarelli and others, 2017; Akob and others, 2016; Cravatta and Brady, 2015). The prevalence of geogenic arsenic sources in certain regions of the United States is well documented (Ayotte and others, 2017). A statewide study of arsenic in soils across Oklahoma showed levels exceeding the EPA carcinogenic screening level (0.67 mg/kg) at all 28 sites (Zhang and Schroder, 2014). Nitrate and nitrite are widespread and common contaminants in U.S. waters, making it difficult to quantify additional amounts from blasting effects. A USGS study in Utah used a comprehensive and widely used EPA method for the analyses of blast residues in water (Naftz and others, 2003). The DEIS acknowledges the possibility of inadvertent spills of hazardous materials used during construction. in addition to obvious soil disturbance, analysis for bacteria and total petroleum hydrocarbons (TPH) is strongly advised.

Recommended sampling parameters

- TDS (total dissolved solids)
- TSS (total suspended solids)
- pH
- SC (specific conductance)
- Bacteria (fecal coliform)
- Arsenic
- Metals (including beryllium, cadmium, chromium, iron, lead, vanadium)
- Major ions (including calcium, chloride, potassium, sodium, sulfate)
- Nitrate and nitrite
- TPH (total petroleum hydrocarbons)
- Explosive residue compounds [EPA method(s) 8330(a)]

Well sampling timing requires knowledge of aquifer parameters and other local conditions to estimate the lag time between construction and measureable changes at wells. The DEIS should describe an approach including the number of samples to be collected and the timing of collection post-construction. A minimum of 2 post-construction samples is recommended with the initial post-construction sampling scheduled based on local conditions and a second approximately 12 months after construction.

FA1-2 **COMMENT: USGS Streamgaging**

The USGS operates streamgaging and water quality stations along streams throughout the United States to collect water quantity and quality data for a variety of purposes. Unimpeded operation of USGS streamgages is essential for our stakeholders. Streamgages have permanent infrastructure and are vulnerable to disruption when significant construction occurs close to these stations. Two active USGS streamgages operate near the project area:

07328100, Washita River at Alex, Oklahoma

2

FA1-2 Streamgage 07328100 is over 2 miles upstream of the proposed Washita River horizontal directional drill (HDD) crossing; therefore, it would not likely be affected by construction or operation of the MIDSHIP Project. Streamgage 07331383 is over 2 miles downstream of the proposed Pennington Creek HDD; therefore, it would not likely be affected by construction or operation of the MIDSHIP Project.

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)

FA1-2 (cont'd)

07331383, Pennington Creek at Capitol Ave at Tishomingo, Oklahoma

We encourage documentation within the draft EIS of any impact to USGS streamgages in the project area and description of the protection and coordination to occur during the project. The USGS Water Science Center in Oklahoma, should be notified prior to construction near these sites.

FA1-3 **COMMENT: Public supply surface water intakes.**

The USGS developed a database containing information about wells, surface-water intakes, and distribution systems of public supply water systems in the United States (Price and Maupin, 2014). Location information for public supply systems is restricted from distribution to the general public, and exact intake locations are not shown in this review. The USGS public supply database (PSDB) locations were intersected with the National Hydrography dataset, and downstream distances calculated between the Midship known route and surface water intakes. The City of Tishomingo has an intake about 2 miles downstream of the known route for the Midship pipeline. Water turbidity should be monitored at Pennington Creek in Tishomingo and the community should be alerted to the potential implications and impact to the intake from the construction. In 2006-2008, the USGS monitored the effects of pipeline construction on turbidity conditions below a crossings in Tazewell County, Virginia and published a report on the findings (Moyer and Hyer, 2009).

Thank you for the opportunity to review and comment on this DEIS. If you have any questions concerning our comments, please contact J. Michael Norris, USGS Coordinator for Environmental Assessment Reviews, at (603) 226-7847 or at mnorris@usgs.gov

Sincerely,

Stephen R. Spencer, Ph.D.
Regional Environmental Officer

Attachments

cc: FERC Service List
William Andrews, Center Director, Oklahoma Water Science Center, Oklahoma City, OK

3

FA1-3 As described in sections 4.3.2.2 and 4.3.2.6 of the EIS, the City of Tishomingo water supply is over 2 miles downstream of the proposed Pennington Creek HDD. Midship Pipeline will continue to coordinate with the City of Tishomingo regarding mitigation of potential impacts on the public water supply; however, the City of Tishomingo stated that the information provided by Midship Pipeline appeared to consider best environmental practices to protect the water intake.

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)

REFERENCES:

Akob, D.M., Mumford, A., Orem, W.H., Engle, M.A., Klinges, J., Kent, D.B., and Cozzarelli, I.M., 2016, Wastewater disposal from unconventional oil and gas development degrades stream quality at a West Virginia injection facility: Environmental Science & Technology, v. 50, p. 5517-5525.

Ayotte, J.D., Medalie, L., Qi, S.L., Backer,L.C., and Nolan, B.T., 2017, Estimating the High-Arsenic Domestic-Well Population in the Conterminous United States: Environmental Science & Technology, v. 51, p. 12443-12454.

Barringer, J.L., Reilly, P.A., Eberl, D.D., Blum, A.E., Bonin, J.L., Rosman, R., Hirst, B., Alebus, M., Cenno, K., and Gorska, M., 2011a, Arsenic in sediments, groundwater, and stream water of a glauconitic Coastal Plain terrain, New Jersey, USA—Chemical "fingerprints" for geogenic and anthropogenic sources: Applied Geochemistry, v. 26, p. 763–776.

Cozzarelli, I.M., Skalak, K., Kent, D.B., Engle, M.A., Benthem,.A.J., Mumford,A., Haase, K.B., Farag, A.M., Harper, D., Nagel, S.C., Iwanowicz, L.R., Orem, W.H., Akob, D.M., Jaeschke, J.B., Galloway, J.M., Kohler, M., Stoliker, D.L., and Jolly, G.D., 2017, Environmental signatures and effects of an oil and gas wastewater spill in the Williston Basin, North Dakota: Science of the Total Environment, v. 579, p. 1781-1793.

Cravatta, C.A., and Brady, K.B.C., 2105, Priority pollutants and associated constituents in untreated and treated discharges from coal mining or processing facilities in Pennsylvania, USA: Applied Geochemistry, v. 62, p. 108-130.

Environmental Protection Agency, 2018, Testing wells to safeguard your water: https://www.epa.gov/privatewells/protect-your-homes-water#welltestanchor

Environmental Protection Agency, 2018, SW-846 Test Method 8330A: Nitroaromatics and Nitroamines by High Performance Liquid Chromatography (HPLC). https://www.epa.gov/privatewells/protect-your-homes-water#welltestanchor

Federal Energy Regulatory Commission, Sept 2016, Mountain Valley Project and Equitrans Expansion Project—Draft Environmental Impact Statement, Water Resources Identification and Testing Plan. Attachment DR3 Water Resources-1, p 1-9.

Federal Energy Regulatory Commission, July 2016, PennEast Pipeline Project—Draft Environmental Impact Statement, volume 1 (Appendix L): Washington, D.C., PennEast Pipeline Company. L.L.C., Docket No. CP15-558-000, FERC\EIS 0271D, 1176 p. [Also available at https://www.ferc.gov/industries/gas/enviro/eis/2016/07-22-16-eis.asp]

Federal Energy Regulatory Commission, Dec 2016, Atlantic Coast Pipeline and Supply Header Project, DEIS. Docket Nos. CP15-554-000, CP15-554-001, and CP15-555-000; FERC/EIS-0274D. 742p.

Heath, R.H., 1983, Basic ground-water hydrology: U.S. Geological Survey Water Supply Paper 2220, 86 p.

Moyer, D.L., and Hyer, K.E., 2009, Continuous turbidity monitoring in the Indian Creek watershed, Tazewell County, Virginia, 2006–08: U.S. Geological Survey Scientific Investigations Report 2009–5085, 42 p.

4

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)

Naftz, D.L., Kanagy, L.K., Susong, D.D., Wydoski, D.S., and Kanagy, C.J., 2003, Explosive-Residue Compounds Resulting From Snow Avalanche Control in the Wasatch Mountains of Utah: U.S. Geological Survey Water-Resources Investigations Report 03-4007, 41p.

Oklahoma Department of Environmental Quality, 2014, Frequently Asked Questions--Home water Testing: Oklahoma City, Oklahoma, Oklahoma Department of Environmental Quality, 3 p., accessed March 2018 at http://www.deq.state.ok.us/csdnew/HomeWaterTestingFAQ.pdf

Price, C.V., and Maupin, M.A., 2014, Documentation for the U.S. Geological Survey Public-Supply Database (PSDB) A database of permitted public-supply wells, surface-water intakes, and systems in the United States: U.S. Geological Survey Open-File Report 2014–1212, 22 p.

Zhang, H., and Schroder, J.L., 2014, Background metal concentrations in Oklahoma soils--Fact Sheet PSS-2276: Stillwater, Oklahoma, Oklahoma State University, 4p. accessed March 2018 at http://factsheets.okstate.edu/documents/pss-2276-background-metal-concentrations-in-oklahoma-soils/

FA1 – U.S. Department of the Interior, Office of Environmental Policy and Compliance (cont'd)

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Notice of Availability of Draft Environmental Impact Statement (DEIS) for the Proposed Midcontinent Supply Header Interstate Pipeline Project, Kingfisher County, Oklahoma	) FERC No. CP17-458-000

Certificate of Service

I hereby certify that I have this day caused the foregoing document to be served upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated on this 15th day of March, 2018.

Stephen R. Spencer
Regional Environmental Officer
U.S. Department of the Interior
1001 Indian School Road NW, Suite 348
Albuquerque, NM 87104

6

FA2 – U.S. Environmental Protection Agency, Region 6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 6
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

April 2, 2018

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St NE, Room 1A
Washington, DC 20426

Subject: Detailed Scoping Comments on the Federal Energy Regulatory Commission Draft Environmental Impact Statement (DEIS) for the Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project, Docket No. PF17-458-000

Dear Ms. Bose:

In accordance with our responsibilities under Section 309 of the Clean Air Act (CAA), the Region 6 office of the U.S. Environmental Protection Agency (EPA) has reviewed the February 9, 2018, Federal Energy Regulatory Commission (FERC) Notice of Availability (NOA) to prepare a Draft Environmental Impact Statement (DEIS) for the proposed Midcontinent Supply Header Interstate Pipeline Project. The project is designed to provide 233.6 miles of new pipeline, three compressor stations, a booster station, and accompanying facilities that would deliver an additional 1,440 million standard cubic feet per day of year-round firm transportation capacity from Kingfisher County, Oklahoma to existing natural gas pipelines near Bennington, Oklahoma for transport to growing Gulf Coast and Southeast Markets.

FA2-1 EPA has environmental concerns and requests additional information in the Final Environmental Impact Statement (FEIS). Detailed comments are enclosed with this letter which clearly identifies our concerns and the informational needs requested for incorporation in to the FEIS. Responses to comments should be placed in a dedicated section of the FEIS and should include the specific location where the revision, if any, was made. If no revision was made, a clear explanation should be included.

FA2-2 EPA appreciates the opportunity to review the DEIS. Please send our office two copies of the FEIS, and an internet link, when it is sent to the Office of Federal Activities, EPA (Mail Code 22252A), William Jefferson Clinton Federal Building, 1200 Pennsylvania Ave., N.W., Washington, D.C. 20004. If you have any questions or concerns, please contact me at (214) 665-8565 or via email at houston.robert@epa.gov or Gabe Gruta of my staff at (214) 665-2174 or via email at gruta.gabriel@epa.gov for assistance.

Sincerely,

Cheryl T. Seager
Director
Compliance Assurance and
Enforcement Division

Enclosure

FA2-1 This document contains our responses to the comments received on the draft EIS for the MIDSHIP Project and includes references to the specific EIS section in which each comment is addressed. Where no revision to the EIS is required, a clear explanation is provided.

FA2-2 We will send two copies of the final EIS, and an internet link to the document, to the U.S. Environmental Protection Agency (EPA), Office of Federal Activities.

FA2 – U.S. Environmental Protection Agency, Region 6 (cont'd)

DETAILED COMMENTS

ON THE
FEDERAL ENERGY REGULATORY COMMISSION
DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE
MIDCONTINENT SUPPLY HEADER INTERSTATE
PIPELINE PROJECT

BACKGROUND

The Federal Energy Regulatory Commission (FERC) released a Draft Environmental Impact Statement (DEIS) for the proposed Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project. The MIDSHIP Project will involve the construction and operation of approximately 233.6 miles of new pipeline, three compressor stations, a booster station, and accompanying facilities that would deliver an additional 1,440 million standard cubic feet per day of year-round firm transportation capacity from Kingfisher County, Oklahoma to existing natural gas pipelines near Bennington, Oklahoma for transport to growing Gulf Coast and Southeast Markets.

COMMENTS

Water Quality

FA2-3 The DEIS states "Where necessary, we are recommending additional mitigation measures to minimize or avoid… impacts." Please note, as per the Clean Water Act Section 404, mitigation does not minimize or avoid impacts but rather compensates for those impacts which are unavoidable.

FA2-4 EPA recommends that blasting in streams be minimized and that any change to streambank or channel should be restored to pre-blasting conditions where possible, with mitigation proposed as compensation for any permanent impacts to stream resources. For all work in-stream, we recommend defining an allowable percent of variation from preconstruction stream parameters and metrics, for example: bank height ratio, entrenchment ratio, stream bank erosion % and/or bank erosion hazard index, riparian vegetation/buffer, bedform diversity, sinuosity, etc., which if not attained, additional restorative actions and/or mitigation would be provided as compensation.

FA2-5 The DEIS states "In-stream construction could also result in the alteration of stream bed contours, which could modify stream dynamics and increase downstream erosion or deposition. The effects of which could eventually alter the stream's course within the local area." EPA recommends stream bed contours be restored in a manner that won't impact stream course, and that a fluvial geomorphologist be consulted for appropriate design. Additionally, stream flow should not be impeded, and no aggradation/degradation should result upstream or downstream after stream restoration activities are completed post-construction. Should alteration of stream contours be unavoidable, EPA recommends that mitigation be proposed as compensation.

FA2-3 Comment noted.

FA2-4 As described in section 4.3.2.5 of the EIS, only 3 of the 344 waterbodies crossed by the proposed pipeline facilities (less than 1 percent) may require blasting or other special construction techniques due to the presence of shallow bedrock. As such, blasting in waterbodies would be minimal.

Section V.C.3 of the FERC's Wetland and Waterbody Construction and Mitigation Procedures (Procedures) requires restoration of streams to preconstruction contours or a stable angle of repose as approved by the Environmental Inspector, as well as post-construction monitoring until restoration is successful.

FA2-5 See the response to comment FA2-4. Additionally, section V.B.3.e of the Procedures requires that flow rates be maintained during construction to allow adequate protection of aquatic life and downstream use. The MIDSHIP Project would not result in permanent losses to streams. Temporary impacts would be mitigated through adherence to the Procedures and specialized construction methods as described in section 4.3.2.6 of the EIS.

FA2 – U.S. Environmental Protection Agency, Region 6 (cont'd)

EPA acknowledges that stream impact totals by linear feet by waterbody type have been FA2-6 included. Should any temporary bridges required over waterbodies stay in place indefinitely, we recommend those impacts should be accounted for and mitigated. Additionally, all stream crossings should be designed in a way that would support continued stream function and minimize impacts.

FA2-7 For all water body crossings, EPA continues to recommend using the least environmentally damaging installation procedure possible (most likely the HDD method) for each site's conditions and acknowledges the inclusion in the DEIS of dry crossing method of pipeline construction with relation to stream crossing as a consideration, which is preferable to the wet open-cut method. The wet open-cut crossing method is likely the more environmentally damaging method to employ in water bodies, and as such, it's use should be minimized on this project.

FA2-8 EPA recommends that the project avoid any and all wetland and stream areas whenever possible and that this language be added to the DEIS and relevant Appendices and Plans.

FA2-9 EPA recommends active restoration activities (planting, invasive species removal and control, hydrologic restoration, etc.) be conducted in all wetland areas impacted to reduce loss of aquatic resources area/function due to temporal loss. Any temporal loss of wetland or stream area or function should be accounted for and mitigated, including function/area lost due to resource type conversion as a result of the project. EPA also recommends that secondary/indirect impacts also be accounted for and compensatory mitigation provided.

FA2-10 EPA recommends that a mitigation plan satisfying 404 requirements should be developed and submitted for review prior to a permit decision. Please provide an update on the status of the compensatory mitigation plan.

FA2-11 For the revegetation of disturbed wetland areas, the applicant has proposed that to be considered successful, vegetation must be at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction. How is this going to be determined? For example, will there be an 80% match to community by species richness and/or abundance, or does the 80% refer to vegetation by overall type/classification? EPA recommends clearly describing methods and protocols.

FA2-12 EPA recommends that invasive species and noxious weeds be controlled in all areas of work and that the maximum acceptable percent cover be clearly defined in the EIS. For invasive species management and removal, an integrated pest management approach is preferable, utilizing a combination of techniques including but not limited to: mechanical removal, herbicide application, and other available techniques, such as prescribed fire, where applicable. Additionally, to control the spread of weedy species, EPA recommends that as a required component of cleaning equipment (including construction machinery and vehicles), crew members are also required to clean off their personal equipment (boots, clothing, personal effects, etc.) to reduce the spread of propagules.

FA2-6 Midship Pipeline would use existing bridges and access roads to cross waterbodies. No new permanent bridges are proposed. Should temporary bridges over waterbodies be proposed, our Procedures require bridge construction be conducted to allow unrestricted flow and prevent soil from entering the waterbody (section V.B.5).

FA2-7 Section 4.3.2.5 of the EIS describes how the Clean Water Act Section 404(b)(1) Guidelines require avoidance and minimization of impacts on waters of the United States. However, the use of the HDD method at every crossing is generally not practical, and is used only for sensitive waterbody crossings. A discussion relating to the impracticality of using the HDD method at every crossing is included in section 4.3.2.6 of the EIS. Additionally, in response to our recommendation in the draft EIS, Midship Pipeline has committed to using the dry crossing method at the 43 streams identified in appendix J, which would reduce impacts on waterbodies.

FA2-8 Avoidance of wetlands and waterbodies is determined during review of the pipeline under section 404 of the Clean Water Act. Clarification of this requirement is included in sections 4.3.2.5 and 4.4.6 of the EIS. In addition, Midship Pipeline has agreed to implement measures (e.g., reroutes, alternative crossing methods) to minimize impacts on wetlands and waterbodies in response to our recommendations in the draft EIS.

FA2-9 Section VI.C of the FERC's Procedures describes wetland restoration requirements, which includes, but is not limited to, consultation with appropriate federal or state agencies to develop a project-specific wetland restoration plan, and ensuring that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species and control the invasion and spread of invasive species and noxious weeds.

FA2-10 As described in section 4.4.6 of the EIS, the compensatory mitigation plan is part of the permitting process associated with section 404 of the Clean Water Act. It would be developed and submitted to the U.S. Army Corps of Engineers, and would be implemented in addition to the construction mitigation measures outlined in the FERC's Procedures and the measures described in the EIS.

FA2-11 Section VI.D.5 of the FERC's Procedures describes the criteria for determining successful wetland restoration, including that vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction. If natural rather than active revegetation was used, the plant species composition must be consistent with early successional wetland plant communities in the affected ecoregion. The U.S. Army Corps of Engineers may require additional monitoring parameters during its permitting process.

FA2-12 FERC would not require control of invasive species in locations that they were established prior to construction.

[Note: This response is continued on the next page.]

FA2 – U.S. Environmental Protection Agency, Region 6 (cont'd)

FA2-13 EPA recommends the required monitoring period be 5 years for non-forested wetland types and streams and 15 years for forested to allow for a greater level of maturity to be reached for each resource type. Early release from monitoring requirements is not recommended. Additionally, we recommend that a wetland ecologist be consulted for all stages of mitigation and restoration, not just in the event remedial revegetation plans must be developed.

FA2-14 Previously, wetland impacts were stated to include 3.5 acres of open wetland and 7.7 acres of forested wetland, which would yield a total of 11.2 acres. The DEIS estimates there to be 8.2 acres of forested wetlands, 2.6 acres of emergent wetlands, and 0.8 acres of scrub-shrub wetlands for a stated total of 11.4 acres of wetlands (although the sum of 8.2 acres, 2.6 acres, and 0.8 acres equals 11.6 acres total). Please clarify the discrepancies in wetland acreage by type in the DEIS as well as with previous totals.

FA2-15 **Environmental Justice and Tribal International Affairs**

FERC stated in DEIS that, "operational emissions associated with the aboveground facilities built for the MIDSHIP Project would contribute to cumulative impacts on air emissions, and operation of these facilities would contribute to cumulative noise impacts where they are in close proximity to other existing or future facilities. Due to the implementation of specialized construction techniques, the relatively short construction timeframe in any one location, and resource protection and mitigation plans designed to minimize and control environmental impacts for the MIDSHIP Project, we conclude that minimal cumulative impacts would occur."

The DEIS Section 4.9.8 page 4-121 reveals that 2 of the aboveground facilities (Calumet and Tatums Compressor Stations) are within 1.0 mile of the rural Environmental Justice populations. The third aboveground facility (Bennington Compressor Station) is not located within a 1.0 mile of an environmental justice population/communities.

In addition to long-term air quality and noise impact (Section 4.8, page 4-123), the impacted rural communities have visual impact. Section 4.8.8.2 of the DEIS reveals that FERC stated that "Because portions of the Bennington Compressor Station may be visible from nearby residences, EPA recommends that: Prior to the end of the draft EIS comment period, MIDSHIP Pipeline should file with the Secretary a visual screening plan for the Bennington Compressor Station that includes specific mitigation measures it would implement to reduce the visibility of the compressor station from nearby residences." FERC made no mitigation recommendations for the rural communities/populations near the Calumet and Tatums Compressor Stations, but justified why the similar situation warranted no action and no significant visual impacts would occur due to the construction and operation.

FERC stated throughout the DEIS that there is no evidence that such risks would be disproportionately borne by any racial, ethnic, or socioeconomic group from visual impact to safety, groundwater, air emission, noise, etc., but it does not appear that equal consideration and mitigation measures are being applied proportionately.

The DEIS reveals that the project impacts eight (8) Counties, which are Canadian, Grady, Garvin, Stephens, Carter, Johnston, Bryan and Kingfisher. The Counties which bear the greatest

FA2-12 (cont'd) As stated in section 4.5.4 of the EIS, Midship Pipeline has committed to using seed products and mulch materials that are certified weed-free and do not contain state-listed invasive or noxious species. In addition, Midship Pipeline would clean equipment (including construction machinery and vehicles) prior to entering the construction area and before moving onto new sites, and it would document any noxious weed populations observed prior to vegetation clearing and construction. In accordance with section VI.D.5.d of the Procedures, wetland revegetation would be considered successful if invasive species and noxious weeds are absent, unless they are abundant in adjacent areas that were not disturbed by construction.

FA2-13 Wetland monitoring would occur for at least 3 years, and would continue until restoration is deemed successful based on the performance measures outlined in section VI.D.5 of the Procedures. FERC would not require additional monitoring after restoration has been documented as successful; however, this could be a condition of other permits obtained by the applicant.

FA2-14 Midship Pipeline has revised its wetland impacts based on reroutes and/or workspace modifications and additional field surveys. The wetland impacts indicated in section 4.4.1 of the EIS have been revised accordingly. As indicated in the EIS, totals may not match the sum of addends due to rounding.

FA2-15 As described in section 3.4 of the EIS, Midship Pipeline's proposed compressor station sites were selected based on optimum horsepower and compressor station location requirements necessary to transport the proposed natural gas volumes; site access and availability; land use; topography; and resources present. As described in sections 4.11.1 and 4.11.2, respectively, emissions from the project's aboveground facilities would meet air quality requirements and comply with required air emissions permits, and the facilities would be designed and constructed to avoid intrusive noise levels at residences, recreational areas, and other special interest areas. As a result, operation of the aboveground facilities would not be expected to have a significant impact on air quality or noise for any population, including environmental justice populations.

As described in section 4.8.8 of the EIS, the existing vegetation present at the Calumet and Tatums Compressor Stations provides sufficient visual screening from nearby residences; therefore, no additional visual screening plans or mitigation were requested of Midship Pipeline. This conclusion is based solely on the existing vegetation or visual screening present at the proposed sites and is not based on the presence of any environmental justice community.

FA2 – U.S. Environmental Protection Agency, Region 6 (cont'd)

FA2-15 (cont'd) direct, indirect and cumulative impacts have the largest Environmental Justice populations and the populations are within 1 mile of the aboveground facilities. FERC stated in the DEIS that "while the project would affect some areas that meet the criteria for environmental justice areas, there is no evidence that the project would cause adverse and disproportionate impacts on minorities or low income populations."

FA2-16 **Recommendations:**

EPA recommends that mitigation of adverse environmental impacts by MIDSHIP be considered and implemented consistently for all affected populations/communities, to ensure that there are no adverse and impacts.

EPA recommends that FERC consider and apply comments received consistently throughout the project to mitigate adverse environmental impacts to the affected communities.

FA2-16 Comments noted.

NATIVE AMERICAN TRIBES (NA)

NA1 – Cheyenne and Arapaho Tribes Tribal Historic Preservation Office

CHEYENNE & ARAPAHO TRIBES
TRIBAL HISTORIC PRESERVATION
P.O. BOX 167
CONCHO, OKLAHOMA 73022

1-800-247-4612 Toll Free
405-422-7484 Telephone

ORIGINAL

2018 MAR 19 P 2:37
REGULATORY COMMISSION

March 6, 2018
THPO ID #: 270

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20426

RE: OEP/DG2E/Gas 1Midship Pipeline Company, LLC, Midcontinent Supply Header Interstate Pipeline Project, Docket No. CP17-458-000

Dear Consultant:

NA1-1 On behalf of the Cheyenne and Arapaho Tribes, thank you for the notification of the Environmental Impact Statement for the Midcontinent Supply Header Interstate Pipeline Project. At this time, we **Concur** with your efforts. We offer our best wishes and look forward to future projects.

Please contact me with the THPO ID number at (405) 422-7416 or mdemery@c-a-tribes.org, if you have any questions or concerns. Alternate contact is Virginia Richey; she can be reached directly at (405) 422-7484 or vrichey@c-a-tribes.org. Thank you again for your notification!

Best Regards,

Micah Looper

Micah Looper
Research Analyst

CC: Virginia Richey
Tribal Historic Preservation Office/THPO

NA1-1 Comment noted.

NA2 – Osage National Historic Preservation Office

ORIGINAL

Osage Nation Historic Preservation Office

FILED
SECRETARY OF THE COMMISSION
2018 APR 11 P 3:49
FEDERAL ENERGY REGULATORY COMMISSION

Date: March 29, 2018 **File: 1718-378OK-10**

RE: FERC Midship Pipeline Company, LLC Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project, Docket No. CP17-458-000, in Kingfisher, Canadian, Grady, Garvin, Stephens, Carter, Johnston, and Bryan Counties, Oklahoma

Federal Energy Regulatory Commission
Kimberly D. Bose, Secretary
888 First Street, NE
Washington, DC 20426

Dear Secretary Bose,

NA2-1 The Osage Nation Historic Preservation Office has received and reviewed the draft Environmental Impact Statement for the proposed **FERC Midship Pipeline Company, LLC Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project, Docket No. CP17-458-000, in Kingfisher, Canadian, Grady, Garvin, Stephens, Carter, Johnston, and Bryan Counties, Oklahoma**. The Osage Nation has no specific comments with regard to the Draft Environmental Impact Statement. **The Osage Nation Historic Preservation Office anticipates receiving, and providing comments on, the results of the remaining identification efforts and continuing consultation with FERC and discussions with Midship with regard to the project. Further, the Osage Nation concurs that Midship should not begin construction of any kind until the provisions of the NHPA are satisfied.**

In accordance with the National Historic Preservation Act, (NHPA) [16 U.S.C. 470 §§ 470-470w-6] 1966, undertakings subject to the review process are referred to in S101 (d) (6) (A), which clarifies that historic properties may have religious and cultural significance to Indian tribes. Additionally, Section 106 of NHPA requires Federal agencies to consider the effects of their actions on historic properties (36 CFR Part 800) as does the National Environmental Policy Act (43 U.S.C. 4321 and 4331-35 and 40 CFR 1501.7(a) of 1969).

The Osage Nation has a vital interest in protecting its historic and ancestral cultural resources, which are protected under the NHPA, NEPA, the Native American Graves Protection and Repatriation Act, and Osage law. **This office looks forward to reviewing the final report for the proposed FERC Midship Pipeline Company, LLC Midcontinent Supply Header Interstate Pipeline (MIDSHIP) Project, Docket No. CP17-458-000, in Kingfisher, Canadian, Grady, Garvin, Stephens, Carter, Johnston, and Bryan Counties, Oklahoma.**

Should you have any questions or need any additional information, please feel free to contact me at the number listed below. Thank you for consulting with the Osage Nation on this matter.

Sincerely,

Andrea A. Hunter, Ph.D.
Director, Tribal Historic Preservation Officer

James Munkres
Archaeologist

627 Grandview • Pawhuska, OK 74056 Telephone 918-287-5328 • Fax 918-287-5376

NA2-1 Comments noted.

STATE AGENCIES (SA)

SA1 – Oklahoma House of Representatives, Representative Tim Downing

CP17-458-000

TIMOTHY J. DOWNING
State Representative
District 42
McClain County
Garvin County

HOUSE *of* REPRESENTATIVES
State of Oklahoma

LEADERSHIP:
Assistant Majority Whip

COMMITTEES:
Vice Chair: Judiciary
Vice Chair: Special Investigation
Energy & Natural Resources
A&B Transportation
Utilities

ORIGINAL

REGULATORY COMMISSION 2018 MAR 20 A 9:2

March 14, 2018

SA1-1 In anticipation of the Federal Energy Regulatory Commission (FERC) meeting happening in Elmore City Wednesday, March 14, 2018, I am writing to express my support for Midship Pipeline. As FERC receives public comments today relating to the draft of the environmental impact statement, I would like to offer my thoughts from a business and community perspective.

Midship Pipeline will create Oklahoma jobs and will directly support the ongoing development of the emerging SCOOP and STACK plays, delivering Oklahoma natural gas to the global market. Midship understands that Oklahoma's economy runs on energy, and are ensuring this continues to be the case by making our state's surplus of natural gas available to the wider marketplace.

Oklahoma has been blessed with natural resources and Midship will have a lasting economic impact on Oklahoma, including bringing increased ad-valorem and sales tax revenues to Garvin County.

Midship employees have a proven track record as an open and accessible community partners, from project managers to public affairs representatives to right-of-way staff. Having dealt with each of these parties, I know they are all ready and willing to take my call or answer any question I may have.

Midship has demonstrated their commitment to Garvin County through first responder engagement and agriculture and livestock support through Oklahoma Youth Expo sponsorships. The company plans to soon add investments in Garvin County STEM education opportunities to this list. In fact, Midship gave more than $15,000 to Garvin County Volunteer Fire Department in November. Midship's philanthropy in the eight counties where the pipeline will run is truly playing an important role in strengthening rural Oklahoma communities.

The Midship team has been best-in-class in updating and briefing local, county, state and federal elected officials on the project at every step. They are truly operating business the "Oklahoma way," — ethical, efficient and effective.

I support Midship and look forward to witnessing the many business and philanthropic benefits the project will bring to Garvin County.

Thank you,

Representative Tim Downing

2300 North Lincoln Blvd., Rm 300A, Oklahoma City, OK 73105-4885
Office: 405-557-7365 Fax: 405-962-7686
email: tim.downing@okhouse.gov

SA1-1 Comments noted.

SA2 – Oklahoma State Senate, Senator Greg McCortney

CP17-458-000

Senator Greg McCortney
State Capitol Room 528
2300 N. Lincoln Blvd.
Oklahoma City, OK 73105

Office 405.521.5541
Fax 405.530.1234
mccortney@oksenate.gov

DISTRICT ADDRESS
117 S. Broadway
Ada, OK 74820

Oklahoma State Senate
STATE OF OKLAHOMA

Senate District 13
Garvin County
Hughes County
Pontotoc County
Pottawatomie County
Seminole County

Committees:
Appropriations
Appropriations Subcommittee on Health
Health & Human Services
Transportation
Public Safety

ORIGINAL

2018 MAR 20 A 9:2
REGULATORY COMMISSION

March 14, 2018

SA2-1 In anticipation of the Federal Energy Regulatory Commission (FERC) meeting happening in Elmore City Wednesday, March 14, 2018, I am writing to express my support for Midship Pipeline. As FERC receives public comments today relating to the draft of the environmental impact statement, I would like to offer my thoughts from a business and community perspective.

Midship Pipeline will create Oklahoma jobs and will directly support the ongoing development of the emerging SCOOP and STACK plays, delivering Oklahoma natural gas to the global market. Midship understands that Oklahoma's economy runs on energy, and are ensuring this continues to be the case by making our state's surplus of natural gas available to the wider marketplace.

Oklahoma has been blessed with natural resources and Midship will have a lasting economic impact on Oklahoma, including bringing increased ad-valorem and sales tax revenues to Garvin County.

Midship employees have a proven track record as an open and accessible community partners, from project managers to public affairs representatives to right-of-way staff. Having dealt with each of these parties, I know they are all ready and willing to take my call or answer any question I may have.

Midship has demonstrated their commitment to Garvin County through first responder engagement and agriculture and livestock support through Oklahoma Youth Expo sponsorships. The company plans to soon add investments in Garvin County STEM education opportunities to this list. In fact, Midship gave more than $15,000 to Garvin County Volunteer Fire Department in November. Midship's philanthropy in the eight counties where the pipeline will run is truly playing an important role in strengthening rural Oklahoma communities.

The Midship team has been best-in-class in updating and briefing local, county, state and federal elected officials on the project at every step. They are truly operating business the "Oklahoma way," — ethical, efficient and effective.

I support Midship and look forward to witnessing the many business and philanthropic benefits the project will bring to Garvin County.

Sincerely,

Greg McCortney

Senator Greg McCortney
SD13

SA2-1 Comments noted.

COMPANIES AND ORGANIZATIONS (CO)

CO1 –Teamsters National Pipeline Training Fund

ORIGINAL

2018 MAR 13 P 4:11

March 9, 2018

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20426

Dear Secretary Bose:

Please find written comments submitted by the "Teamsters National Pipeline Training Fund" on the Draft Environmental Impact Statement for the proposed Midcontinent Supply Header Pipeline Project supporting the project is in the public convenience and necessity **(FERC Project Docket Number PF17-458-000)**.

If you have any questions I can be reached at (703) 508-8690.

Sincerely,

Richard Stern, Administrator
Teamsters National Pipeline Training Fund

Enclosures

CO1 –Teamsters National Pipeline Training Fund (cont'd)

CO1-1 Comments submitted to the Federal Energy Regulatory Commission by the Teamsters National Pipeline Training Fund on the Draft Environmental Impact Statement for the Midcontinent Supply Header Interstate Pipeline Project (FERC Project Docket Number PF17-458-000).

The Teamsters National Pipeline Training Fund representing over 100 contributing Union Pipeline Contractors affiliated with the Pipeline Contractors Association and the International Brotherhood of Teamsters with over 1.25 million members supports the construction of the Project/

The "Project" will provide Teamster Local Union 516 (located in the Tulsa, Oklahoma area) members who if the work is done using union labor would be performing the pipeline construction work along the "Project" route with high wages and health insurance and pension benefits. (See Exhibit A)

The Teamsters National Pipeline Training Fund is committed to building this Project with well-trained and qualified local Teamster workers who can perform their work at a high level to help mitigate any potential environmental concerns.

These workers have a vested interest in building this project in an environmentally safe manner since their own families could be affected by this project.

By utilizing union contractors to build the "Project" it guarantees that at least 50% of the workers will be local hires.

The collective bargaining agreement between the Teamsters and Pipeline Contractors Association states:

CO1-1 Comments noted.

CO1 –Teamsters National Pipeline Training Fund (cont'd)

CO1-1 (cont'd)

"The words "regular employee" shall mean those who are regularly and customarily employed by the Individual Employer and because of their special knowledge and experience in pipeline construction work, are considered key men. It is anticipated that the number of regular employees shall not be more than a majority of the total number required but there shall be no limitation on the classification of such regular employees, with the understanding that these classifications will be distributed as evenly as possible." (See Exhibit B)

Most of the time our projects in Oklahoma use almost 100% of Teamster labor from Oklahoma since their members have vast experience from working on past pipeline projects in this state where they live.

Therefore, when a pipeline such as this "Project" is built using local union labor; the majority of pipeline construction workers will be from the local community and have a greater sensitivity for the environment.

These workers have an incentive building the "Project" environmentally safe because again they live here too.

Thus, any negative environmental impact will be lessened.

You do not get this guarantee with a nonunion pipeline contractor.

We have pipeline contractors who specialize in Horizontal Directional Drilling (HDD) type of work.

HDD is used for the installation of pipelines beneath rivers, highways, and other environmentally sensitive areas requiring

CO1 –Teamsters National Pipeline Training Fund (cont'd)

CO1-1 (cont'd) technology and equipment that can install pipelines without any disturbance to natural habitats.

Some of our specialized signatory contractors and a more detailed explanation of the work they perform in areas of great environmental concern are included in this submission. (See Exhibit C)

Prior to the construction of this "Project" we will provide Classroom training programs based on the U.S. Department Transportation's Regulations on "Compliance, Safety and Accountability" (CSA) and also Defensive Driving.

The Teamsters CSA/Defensive Driving Instructor has been cited as a Trend Setter by the "National Safety Council" an Award he has received from them in the past. (See Exhibit D)

Under pages 6 and 7 in the collective bargaining agreement workers must have certain qualifications prior to working on this project. (See Exhibit E)

Under pages 17 and 18 of the Pipeline Agreement is the language on "Drug and Alcohol Testing" to ensure a drug free work environment and "Training/DOT Rules" to maintain high quality work standards and qualifications. (See Exhibit F)

For your ready-reference we have provided brochures detailing information about our Training Program and us and our support for our Oklahoma Veterans who will be working on the "Project". (See Exhibit G)

We believe that if this "Project" is constructed with our trained and highly skilled local union workers and specialized union contractors the "Project" will be built in a safe and

CO1 –Teamsters National Pipeline Training Fund (cont'd)

CO1-1 (cont'd) environmentally friendly manner and in compliance with all federal and state environmental regulations.

In closing, we support the building of the "Project" based upon this written submission and its supporting exhibits which show the use of union contractors and locally trained union labor will help mitigate any environmental concerns.

CO1 –Teamsters National Pipeline Training Fund (cont'd)

The attachments to this letter have been removed from this environmental impact statement. They are available for viewing on the Federal Energy Regulatory Commission's (FERC) website at http://www.ferc.gov. Using the "eLibrary" link, select "General Search" from the eLibrary menu, enter the selected date range and "Docket No." excluding the last three digits (i.e., CP17-458, PF17-3), and follow the instructions. For assistance please contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll free at 1-866-208-3676 or, for TTY, contact 202-502-8659. The category/accession number for this submittal is 20180314-0010.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

April 2, 2018

To: Federal Energy Regulatory Commission

Subject: Failure to Use the Social Cost of Greenhouse Gases in the Midcontinent Supply Header Interstate Pipeline Project Draft Environmental Impact Statement—Docket No. CP17-458-000

Submitted by: Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club[1]

This draft environmental impact statement (DEIS), prepared by the Federal Energy Regulatory Commission, on the Midcontinent Supply Header Interstate Pipeline, reviews the proposal by the Midship Pipeline Company, LLC to construct over 200 miles of pipeline, as well as compressor stations, a booster station, and accompanying facilities, to transport natural gas. While the DEIS quantifies the tons

CO2-1 of downstream greenhouse gas emissions related to this project—upwards of 28 million metric tons of carbon dioxide per year from combustion of the new volumes of natural gas delivered—FERC fails to use the social cost of greenhouse gas metric to fully account for the climate effects of these emissions. FERC recapitulates flawed arguments used in other inadequate NEPA reviews to implicitly explain why the Commission refuses to use the social cost of greenhouse gases metric for the Midship project. Specifically, FERC claims that it is impossible to determine the significance of this project's climate impacts. Not only is this incorrect, but failing to meaningfully analyze a project's climate effects violates NEPA.

These comments begin by offering a more detailed rejection of FERC's arbitrary and misleading rationale for failing to use the social cost of greenhouse gases, before offering additional guidance on how to monetize climate effects consistent with the currently best available science and economics—specifically, by selecting a central estimate of global damages using a 3% or lower discount rate.

1. **FERC Must Monetize the Social Cost of Greenhouse Gases In Its EIS**

FERC details the alleged benefits of the proposed action, but neither includes a substantive discussion of the project's climate effects nor a monetization of the projected emissions as a way of assessing the project's contribution to climate damages. Although FERC does not include monetized cost-benefit analyses in its NEPA reviews, FERC does monetize socioeconomic benefits in the DEIS, and moreover, FERC Commissioners have recently acknowledged that this practice does not preclude the Commission from monetizing climate effects. Commissioner LaFleur, one of the dissenting Commissioners in the Sabal Trail Pipeline remand order, noted that the Social Cost of Carbon was developed to inform decisions on proposed actions and evaluate the significance of downstream greenhouse gas emissions.[2]

Here, FERC nonetheless fails to discuss the actual climate impacts of the project, even though it quantifies the tons of greenhouse gas emissions from downstream end use. FERC neither quantitatively nor qualitatively discusses the damages to which these additional tons of greenhouse gases would

[1] Our individual organizations may separately submit other comments regarding other aspects of the DEIS.

[2] Sabal Trail Remand Order at (Comm'r LaFleur, dissenting in part) at 3, available at https://www.ferc.gov/CalendarFiles/20180314230126-CP14-554-002.pdf.

1

CO2-1 The general nature of the comments is that greenhouse gas (GHG) emissions should be monetized because other socioeconomic costs and benefits are monetized in the EIS; quantifying the social cost of carbon (SCC) would give context to the climate damages associated with project GHG emissions; SCC is appropriate for analyzing project-level emissions of the magnitude of the MIDSHIP Project; FERC must use the SCC tools that reflect currently available data and methodologies, and; FERC must quantify global damages associated with project GHG emissions.

The SCC tool, as well as the Social Cost of Methane and Nitrous Oxide tools, estimates the monetized climate change damage associated with an incremental increase in carbon dioxide (CO_2) emissions in the given year. It estimates the cost today of future climate change damage, represented by a series of annual costs per metric ton of emissions discounted to present-day value.

We recognize the availability of the SCC tool, but conclude that it is not appropriate for use in project analyses for the following reasons:

(1) The SCC is not meaningful in our National Environmental Policy Act (NEPA) analysis for project decisions under the Natural Gas Act (NGA). We believe that the SCC tool is more appropriately used in NEPA analyses by regulators whose responsibilities are tied more directly to fossil fuel production or consumption. The Commission's authority under section 7 of the NGA has no direct connection to the production or end use of natural gas. The Commission does not control the production or consumption of natural gas. Producers, consumers, and their intermediaries respond freely to market signals about location-specific supply and location-specific demand. The Commission oversees proposals to transport natural gas between those locations. Our NEPA analysis considers all construction emissions and annual operational GHG emissions that are causally related to the proposed action that is before the Commission.

[Note: This response is continued on the next page.]

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) contribute. Meanwhile, FERC has monetized effects like millions of dollars' worth in tax revenue and payroll expenditures.[3] Failing to similarly monetize the climate costs of the project is inconsistent and arbitrary, and deprives the public and decisionmakers of the information and context they need to weigh all of the project's potential effects.

Below is a review of the case law on when it is arbitrary to fail to include the social cost of greenhouse gases in NEPA analysis, and an explanation of why a recent Executive Order does not change the need to monetize climate damages.

NEPA Requires Monetizing Climate Effects If Other Costs and Benefits Are Monetized

NEPA requires "hard look" consideration of beneficial and adverse effects of each alternative option for major federal government actions. The U.S. Supreme Court has called the disclosure of impacts the "key requirement of NEPA," and held that agencies must "consider and disclose the actual environmental effects" of a proposed project in a way that "brings those effects to bear on [the agency's] decisions."[4] Courts have repeatedly concluded that an EIS must disclose relevant climate effects.[5] Though NEPA does not require a formal cost-benefit analysis,[6] agencies' approaches to assessing costs and benefits must be balanced and reasonable. Courts have warned agencies that "[e]ven though NEPA does not require a cost-benefit analysis," an agency cannot selectively monetize benefits in support of its decision while refusing to monetize the costs of its action.[7]

In *High Country Conservation Advocates v. Forest Service*, the U.S. District Court of Colorado found that it was "arbitrary and capricious to quantify the *benefits* of the lease modifications and then explain that a similar analysis of the *costs* was impossible when such an analysis was in fact possible."[8] The court explained that, to support a decision on coal mining activity, the agencies had "weighed several specific economic benefits—coal recovered, payroll, associated purchases of supplies and services, and royalties," but arbitrarily failed to monetized climate costs using the readily available social cost of carbon protocol.[9] Similarly, in *Montana Environmental Information Center v. Office of Surface Mining* (*MEIC v. OSM*), the U.S. District Court of Montana followed the lead set by *High Country* and likewise held an environmental assessment to be arbitrary and capricious because it quantified the benefits of

[3] DEIS at 599-603. *See* Sabal Remand Order (Comm'r Glick, dissenting at 8) ("Rejecting this [SCC] tool on the grounds that the Commission has 'no basis for determining the significance' of the impact amounts is arbitrary and capricious, given that the Commission relies on similar analysis elsewhere in the EIS.").

[4] *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 96 (1983).

[5] As the Ninth Circuit has held: "[T]he fact that climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control . . . does not release the agency from the duty of assessing the effects of *its* actions on global warming within the context of other actions that also affect global warming." *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008); *see also Border Power Plant Working Grp. v. U.S. Dep't of Energy*, 260 F. Supp. 2d 997, 1028-29 (S.D. Cal. 2003) (failure to disclose project's indirect carbon dioxide emissions violates NEPA).

[6] 40 C.F.R. § 1502.23 ("[T]he weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis.").

[7] *High Country Conservation Advocates v. Forest Service*, 52 F. Supp. 3d 1174, 1191 (D. Colo. 2014); *accord. MEIC v. Office of Surface Mining*, 15-106-M-DWM, at 40-46 (D. Mt., August 14, 2017) (holding it was arbitrary for the agency to quantify benefits in an EIS while failing to use the social cost of carbon to quantify costs, as well as arbitrary to imply there would be no effects from greenhouse gas emissions).

[8] 52 F. Supp. 3d at 1191.

[9] *Id.*

2

CO2-1 (cont'd) (2) FERC staff does not use monetized cost-benefit analyses as part of the NEPA review. Siting infrastructure involves making qualitative judgments between different resources as to which there is no agreed-upon quantitative value. As such, we do not conduct a monetary cost-benefit analysis in our NEPA review. The draft EIS did quantify some of the MIDSHIP Project's direct socioeconomic benefits (e.g., employment and tax payments) because those benefits occur in units of dollars and are directly comprehensible in units of dollars. However, because Commission staff lack quantified information about all of the costs and benefits of the project, the final EIS does not use the limited available quantified benefits in a cost-benefit analysis to inform Commission staff's comparison of alternatives, choices of mitigation measures, or determination about the significance of the MIDSHIP Project's environmental impacts.

FERC staff notes that the MIDSHIP Project draft EIS used various tools and measurements to disclose and quantify potential impacts associated with the project. FERC staff chose quantification tools appropriate to each individual resource. For example, the EIS used acres of wetland disturbance, number of existing residences within 50 feet of the proposed construction right-of-way, decibels of noise associated with operation of aboveground facilities, and, as presented in section 4.9.7 of the draft EIS, dollar amounts were estimated to present potential economic effects of the project. For GHG emissions, FERC staff used tons of GHG emissions to quantify and disclose the potential impacts of GHG emissions associated with the project. We believe that providing estimated tons of GHG emissions was an appropriate tool to use to quantify the potential GHG impacts associated with the project.

(3) The SCC tool has technical limitations that limit its usefulness in NEPA analyses for Commission certificate proceedings. FERC staff acknowledges that the SCC methodology does constitute a tool that can be used to estimate incremental physical climate change impacts. The integrated assessment models underlying the SCC tool were developed to estimate certain global and regional physical climate change impacts due to incremental GHG emissions under specific socioeconomic scenarios. However, the EPA states that "no consensus exists on the appropriate [discount] rate to use for analyses spanning multiple generations" and consequently, significant variation in output can result.

[Note: This response is continued on the next page.]

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) action (such as employment payroll, tax revenue, and royalties) while failing to use the social cost of carbon to quantify the costs.[10]

Both *High Country* and *MEIC v. OSM* were in line with *Center for Biological Diversity v. National Highway Traffic Safety Administration.*[11] In that case, the U.S. Court of Appeals for the Ninth Circuit ruled that, because the agency had monetized other uncertain costs and benefits of its vehicle fuel efficiency standard—like traffic congestion and noise costs—its "decision not to monetize the benefit of carbon emissions reduction was arbitrary and capricious."[12] Specifically, it was arbitrary to "assign[ ] no value to *the most significant benefit* of more stringent [vehicle fuel efficiency] standards: reduction in carbon emissions."[13] When an agency bases a rulemaking on cost-benefit analysis, it is arbitrary to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs."[14]

Both those cases were in line with *Center for Biological Diversity v. National Highway Traffic Safety Administration*. In that case, the U.S. Court of Appeals for the Ninth Circuit ruled that, because the agency had monetized other uncertain costs and benefits of its vehicle fuel efficiency standard—like traffic congestion and noise costs—its "decision not to monetize the benefit of carbon emissions reduction was arbitrary and capricious."[15] Specifically, it was arbitrary to "assign[ ] no value to *the most significant benefit* of more stringent [vehicle fuel efficiency] standards: reduction in carbon emissions."[16] When an agency bases a rulemaking on cost-benefit analysis, it is arbitrary to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs."[17]

Three other cases from different courts that have declined to rule against failures to use the social cost of carbon in NEPA analyses are all distinguishable by the scale of the action or by whether other effects were quantified and monetized in the analysis.[18] In particular, in *EarthReports v. FERC*, the D.C. Circuit never addressed or ruled on whether it is arbitrary to monetize benefits while not monetizing costs.[19] More recently, the D.C. Circuit confirmed that NEPA requires a rigorous analysis of climate effects and, in its remand to FERC, required the agency to explain and justify its position if it decides not to use the social cost of greenhouse gases.[20] FERC has now once again repeated that mistake of failing to address the relevance of the social cost of greenhouse gases.

In the DEIS, FERC devoted significant attention to the "economic benefits" of approving the project. In the Socioeconomic Impacts section, FERC claims that "[c]onstruction and operation of the MIDSHIP Project would have a beneficial impact on the local economy as a result of increased payroll, local

[10] 15-106-M-DWM, at 40-46, Aug. 14, 2017 (also holding that it was arbitrary to imply that there would be zero effects from greenhouse gas emissions).

[11] Three other cases from different courts that have declined to rule against failures to use the social cost of carbon in NEPA analyses are all distinguishable by the scale of the action or by whether other effects were quantified and monetized in the analysis. *See League of Wilderness Defenders v. Connaughton*, No. 3:12-cv-02271-HZ (D. Ore., Dec. 9, 2014); *EarthReports v. FERC*, 15-1127, (D.C. Cir. July 15, 2016); *WildEarth Guardians v. Zinke*, 1:16-CV-00605-RJ, at 23-24, (D. N.M. Feb. 16, 2017).

[12] 538 F.3d 1172, 1203 (9th Cir. 2008).

[13] *Id.* at 1199.

[14] *Id.* at 1198.

[15] 538 F.3d 1172, 1203 (9th Cir. 2008).

[16] *Id.* at 1199.

[17] *Id.* at 1198.

[18] *See League of Wilderness Defenders v. Connaughton*, No. 3:12-cv-02271-HZ (D. Ore., Dec. 9, 2014); *EarthReports v. FERC*, 15-1127, (D.C. Cir. July 15, 2016); *WildEarth Guardians v. Zinke*, 1:16-CV-00605-RJ, at 23-24, (D. N.M. Feb. 16, 2017).

[19] 828 F.3d at 956 (basing its ruling on alleged uncertainty over the discount rate and lack of clear significance thresholds).

[20] *Sierra Club v. FERC*, No. 16-1329, 2017 WL 3597014, at *10 (D.C. Cir. Aug. 22, 2017).

3

CO2-1 (cont'd) Additionally, there are no established criteria identifying the monetized values that are to be considered significant for NEPA reviews. Therefore, although the integrated assessment models could be run through a first phase to estimate global and regional physical climate change impacts from MIDSHIP Project-related GHG emissions, we would still have to arbitrarily determine what potential increase in atmospheric GHG concentration, rise in sea level, rise in sea water temperatures, and other calculated physical impacts would be significant for a particular pipeline project. Because we have no basis to designate a particular dollar figure calculated from the SCC tool as "significant," such action would be arbitrary and would meaningfully inform neither the NEPA conclusions nor the public.

For these reasons, FERC staff chose not to use the SCC tool in the MIDSHIP Project NEPA analysis.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND® Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) materials and services purchased, and utilization of local vendors."[21] FERC monetizes economic benefits, including tax revenue ($26.4 million in sales tax during construction), incomes generated by the new operations positions ($1.6 million for 12 to 14 new positions), the purchasing of goods and services locally ($70,000), and ad valorem tax revenue (ranging from $2.7 to $19.3 million). FERC specifically refers to these effects as the project's "long-term cumulative benefits."[22]

Because FERC has monetized the economic benefits of the project, it must treat the climate costs with proportional analytical rigor and apply the social cost of greenhouse gas metrics. Moreover, in obligating agencies to take "hard look" at projects' climate impacts, NEPA requires more than simply disclosing the volume of anticipated emissions.[23] As discussed further below, under NEPA, agencies must provide details on discrete effects of a project's impacts within the relevant context. The social cost of greenhouse gases provides this critical information.

The importance of this "hard look" consideration is not lost on all members of the Commission. FERC Commissioner Glick, in his dissenting opinion to the Sabal Trail Pipeline remand order, strongly condemns the Commission's wholly inadequate treatment of that pipeline's climate effects: "Willful ignorance of readily available analytical tools to support an enhanced qualitative assessment for the single largest environmental threat in our lifetime will undermine informed public comments and informed decisionmaking."[24]

The Social Cost of Greenhouse Gases Metrics Give Necessary Context to Climate Damages

FERC appears to assert that by explaining that the downstream emissions from this project would constitute "no more than . . . a 0.5 percent increase in national emissions," it has satisfied its NEPA obligations to provide the public and decisionmakers with a meaningful discussion of the project's climate impacts. It has not.

Monetizing climate damages provides the informational context required by NEPA, while a purely quantitative estimate of tons or a qualitative description of discrete climate effects like sea-level rise provide little context. Courts review NEPA documents "under an arbitrary and capricious standard," which requires "a reasonably thorough discussion of the significant aspects of the probable environmental consequences," to "foster both informed decisionmaking and informed public participation."[25] In particular, "the impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impact analysis that NEPA requires," and it is arbitrary to fail to "provide the necessary contextual information about the cumulative and incremental environmental impacts."[26]

To "provide the necessary contextual information," economic theory shows that one useful tool is monetization of environmental impacts. As Professor Cass Sunstein has explained, drawing from the work of recent Nobel laureate economist Richard Thaler, a well-documented mental heuristic called "probability neglect" causes people to irrationally reduce small probability risks entirely down to zero.[27]

---

[21] DEIS at 4-119

[22] DEIS at ES-13 ("Some long-term cumulative benefits would be realized through new jobs and wages, purchases of goods and materials, and tax revenues.").

[23] *Supra* notes 4-5.

[24] Glick opinion at 8.

[25] *Ctr. for Biological Diversity*, 538 F.3d at 1194 (citations omitted). *See also Montana Envtl. Info. Ctr. v. Office of Surface Mining*, cv 15-106-M-DWM, at 12-13 (D.Mt., Aug. 14, 2017).

[26] *Ctr. for Biological Diversity*, 538 F.3d at 1217; *see also Montana Envtl. Info. Ctr.*, cv 15-106-M-DWM at 45.

[27] Cass R. Sunstein, *Probability Neglect: Emotions, Worst Cases, and Law*, 112 Yale L. J. 61, 63, 72 (2002).

4

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) In this case, for example, many decisionmakers and interested citizens would wrongly reduce down to zero the climate risks associated with the 0.5% of total national emisisons that FERC calculates here,[28] simply due to the leading zeros before the decimals. Yet the monetized expected cost of the climate risks associated with the millions of tons of additional emissions per year—representing damages of hundreds of millions of dollars—is less likely overlooked. As the Environmental Protection Agency's website explains, "abstract measurements" of so many tons of greenhouse gases can be rather inscrutable for the public, unless "translat[ed] . . . into concrete terms you can understand."[29] Monetization contextualizes the significance of the additional tons of emissions.

Similarly, non-monetized effects are often irrationally treated as worthless.[30] On several occasions, courts have struck down administrative decisions for failing to give weight to non-monetized effects.[31] Most relevantly, in *Center for Biological Diversity v. NHTSA*, the U.S. Court of Appeals for the Ninth Circuit found it arbitrary and capricious to give zero value "to the most significant benefit of more stringent [fuel economy] standards: reduction in carbon emissions."[32]

FERC is required by NEPA to provide enough context to ensure that the public and decisionmakers would not overlook the associated climate risks. Monetization is one way that FERC could provide the necessary context to foster both informed decisionmaking and informed public participation.[33] By comparison, simply tallying the volume of emissions fails to give the public and decisionmakers the required information about the magnitude of discrete climate effects from those emissions. The social cost of greenhouse gas metric provides that necessary context.

New Executive Order Encourages Continued Monetization of the Social Cost of Greenhouse Gases

Executive Order 13,783 officially disbanded the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG) and withdrew its technical support documents that underpinned their range of estimates.[34] Nevertheless, Executive Order 13,783 assumes that federal agencies will continue to "monetiz[e] the value of changes in greenhouse gas emissions" and instructs agencies to ensure such estimates are "consistent with the guidance contained in OMB Circular A-4."[35] Consequently, while FERC and other federal agencies no longer benefit from ongoing technical support from the IWG on use of the social cost of greenhouse gases, by no means does the new Executive Order imply that agencies should not monetize important effects in their regulatory analyses or environmental impact statements. In fact,

---

[28] DEIS at 4-187.

[29] EPA, Greenhouse Gas Equivalencies Calculator, https://web.archive.org/web/20180212182940/https:/www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last updated Sept. 2017).

[30] Richard Revesz, *Quantifying Regulatory Benefits*, 102 Cal. L. Rev. 1424, 1434-35, 1442 (2014).

[31] *See id.* at 1428, 1434.

[32] 538 F.3d at 1199.

[33] While the regulations promulgated by the Council on Environmental Quality to implement NEPA do not require a "monetary cost-benefit analysis," 40 C.F.R. § 1502.23, monetization nevertheless remains an available tool for contextualizing information. As the Council on Environmental Quality has explained, monetization may be "appropriate and relevant" and, in particular, "the Federal social cost of carbon . . . provides a harmonized, interagency metric that can give decision makers and the public useful information for their NEPA review." CEQ, *Final Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* 32-33 & fn.86 (2016), *available* at https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf.

[34] Exec. Order. No. 13,783 § 5(b), 82 Fed. Reg. 16,093 (Mar. 28, 2017).

[35] *Id.* § 5(c).

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) Circular A-4 instructs agencies to monetize costs and benefits whenever feasible.[36] The Executive Order does not prohibit agencies from relying on the same choice of models as the IWG, the same inputs and assumptions as the IWG, the same statistical methodologies as the IWG, or the same ultimate values as derived by the IWG. To the contrary, because the Executive Order requires consistency with Circular A-4, as agencies follow the Circular's standards for using the best available data and methodologies, they will necessarily choose similar data, methodologies, and estimates as the IWG, since the IWG's work continues to represent the best available estimates.[37] The Executive Order does not preclude agencies from using the same range of estimates as developed by the IWG, so long as the agency explains that the data and methodology that produced those estimates are consistent with Circular A-4 and, more broadly, with standards for rational decisionmaking.

Similarly, the Executive Order's withdrawal of the CEQ guidance on greenhouse gases does not —and legally cannot—remove agencies' statutory requirement to fully disclose the environmental impacts of greenhouse gas emissions. As CEQ explained in its withdrawal, the "guidance was not a regulation," and "[t]he withdrawal of the guidance does not change any law, regulation, or other legally binding requirement."[38] In other words, when the guidance originally recommended the appropriate use of the social cost of greenhouse gases in environmental impact statements,[39] it was simply explaining that the social cost of greenhouse gases is consistent with longstanding NEPA regulations and case law, all of which are still in effect today.

As explained in the final sections of these comments, the IWG's estimates of the social cost of greenhouse gases are, in fact, already consistent with the Circular A-4 and represent the best existing estimates of the lower bound of the range for the social cost of greenhouse gases. Therefore, the IWG estimates or those of a similar or higher value[40] should be used in regulatory analyses and environmental impact statements.

2. The Social Cost of Greenhouse Gas Metric Is Appropriate for a Project-Level EIS with Emissions of this Magnitude

Although FERC admits that downstream emissions would contribute to climate change, the Commission claims that because it "cannot determine the MIDSHIP Project's incremental physical impacts on the

---

[36] OMB, Circular A-4 at 27 (2003) ("You should monetize quantitative estimates whenever possible.").

[37] Richard L. Revesz et al., *Best Cost Estimate of Greenhouse Gases*, 357 SCIENCE 6352 (2017) (explaining that, even after Trump's Executive Order, the social cost of greenhouse gas estimate of around $50 per ton of carbon dioxide is still the best estimate).

[38] 82 Fed. Reg. 16,576, 16,576 (Apr. 5, 2017).

[39] *See* CEQ, *Revised Draft Guidance on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* at 16 (Dec. 2014), *available at* https://obamawhitehouse.archives.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf ("When an agency determines it appropriate to monetize costs and benefits, then, although developed specifically for regulatory impact analyses, the Federal social cost of carbon, which multiple Federal agencies have developed and used to assess the costs and benefits of alternatives in rulemakings, offers a harmonized, interagency metric that can provide decisionmakers and the public with some context for meaningful NEPA review. When using the Federal social cost of carbon, the agency should disclose the fact that these estimates vary over time, are associated with different discount rates and risks, and are intended to be updated as scientific and economic understanding improves."); *see also* CEQ, *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews* at 33 n.86 (Aug. 2016), *available at* https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/nepa_final_ghg_guidance.pdf.

[40] *See, e.g.*, Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014) (explaining that current estimates omit key damage categories and, therefore, are very likely underestimates).

6

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) environment caused by climate change, it cannot determine whether the project's contribution to cumulative impacts on climate change would be significant."[41] This same spurious argument was made in the Sabal Trail remand order. One dissenting opinion to that order, from Commissioner LaFleur,[42] rejects the Commission's claims that it is unable to determine the significance of greenhouse gas emissions.

Despite FERC's claims in the Sabal Trail remand order that the social cost of greenhouse gases only apply to rulemakings,[43] the social cost of greenhouse gas methodology is well suited to measure the marginal climate damages of individual projects. These protocols were developed to assess the cost of actions with "marginal" impacts on cumulative global emissions, and the metrics estimate the dollar figure of damages for one extra unit of greenhouse gas emissions. This marginal cost is calculated using integrated assessment models. These models translate emissions into changes in atmospheric greenhouse concentrations, atmospheric concentrations into changes in temperature, and changes in temperature into economic damages. A range of plausible socio-economic and emissions trajectories are used to account for the scope of potential scenarios and circumstances that may actually result in the coming years and decades. The marginal cost is attained by first running the models using a baseline emissions trajectory, and then running the same models again with one additional unit of emissions. The difference in damages between the two runs is the marginal cost of one additional unit. The approach assumes that the marginal damages from increased emissions will remain constant for small emissions increases relative to gross global emissions. In other words, the monetization tools are in fact perfectly suited to measuring the marginal effects of individual projects or other discrete agency actions.

The Tons of Greenhouse Gas Emissions at Stake Here Are Clearly Significant

FERC quantifies that downstream emissions from this project could reach nearly 28 million metric tons per year. But FERC refuses to take the straightforward next step of applying the social cost of greenhouse gas values to those quantified tons. In the Midcontinent DEIS, FERC implies that it does not monetize the effects of the project's downstream emissions because, while "[t]he GHG emissions from the downstream end-use of the products transported by the MIDSHIP Project would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources, and contribute incrementally to climate change that produces the impacts previously described," FERC "cannot determine the MIDSHIP Project's incremental physical impacts on the environment caused by climate change," and therefore, "cannot determine whether the project's contribution to cumulative impacts on climate change would be significant."[44]

While there may not be a bright-line test for significance, the emissions FERC estimates for this project are clearly significant and warrant monetization. This is especially true since, once emissions have been

---

[41] DEIS at 4-187. *But see* Sabal Remand Order at 48 ("[W]e accept that the Social Cost of Carbon methodology does constitute a tool that can be used to estimate incremental physical climate change impacts.").

[42] Sabal Trail Remand Order, Comm'r LaFleur dissent at 2. *See also* Comm'r LaFleur, dissenting in part, at 4 (SCC "is a scientifically-derived tool to translate tonnage of carbon dioxide or other GHGs to the cost of long-term climate harm.... [W]e are able to estimate what the long-term consequence of a ton of carbon dioxide emissions is likely to be, by use of the Social Cost of Carbon tool."); Comm'r Glick dissent at 8 ("[T]he output from the Social Cost of Carbon tool can serve as an indicator of the climate change impacts ... informing the overall qualitative evaluation under NEPA as well as the public interest balancing under the NGA"; rejecting this tool on grounds that FERC has no basis for determining significance is arbitrary and capricious.).

[43] *Id.* at 491.

[44] DEIS at 4-186.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) quantified, the additional step of monetization through application of the Interagency Working Group's 2016 estimates entails a simple arithmetic calculation.[45] Importantly, members of the Commission have recently made clear that "the Commission must take a 'hard look' at climate change – the ultimate environmental impact."[46] FERC Commissioner Glick, in his dissenting opinion to the Sabal Trail Pipeline remand order, states that "[c]limate change is the single most significant threat to humanity, fundamentally threatening our environment, economy, national security and human health. It is difficult to understand how NEPA's demand that an agency take a 'hard look' at the environmental impacts of its actions can be satisfied if the impacts of GHG emissions are ignored."[47]

In *High Country*, the District Court for the District of Colorado found that it was arbitrary for the Forest Service not to monetize the "1.23 million tons of carbon dioxide equivalent emissions [from methane] the West Elk mine emits annually."[48] That suggests a threshold for monetization far below what FERC estimates here. In *MEIC v. OSM*, the District Court for the District of Montana found it was arbitrary for the Office of Surface Mining not to monetize the 23.16 million metric tons, which constituted "approximately 0.35 percent of the total U.S. emissions."[49] In terms of relative percentage, FERC's estimate of 0.5% from downstream emissions alone is higher. In *Center for Biological Diversity*, the Ninth Circuit found that it was arbitrary for the Department of Transportation not to monetize the 35 million metric ton difference in lifetime emissions from increasing the fuel efficiency of motor vehicles:[50] given the estimated lifetime of vehicles sold in the years 2008-2011 (sometimes estimated at about 15 years on average), this could represent as little two million metric tons per year. In a recent environmental impact statement from the Bureau of Ocean Energy Management published in August 2017, the agency explained that the social cost of carbon was "a useful measure" to apply to a NEPA analysis of an action anticipated to have a difference in greenhouse gas emissions compared to the no-action baseline of about 25 million metric tons over a 5-year period,[51] or about 5 million metric tons per year. Once again, FERC's estimate for the Midcontinent Supply Header Interstate Pipeline project is much higher.

FERC estimates that the gas transported through the Midcontinent Pipeline at full capacity would release 27.9 million metric tons of CO_2e annually. These comments in no way endorse any of those calculations as an accurate estimate of downstream emissions from the project. FERC may have overlooked factors, such as supply-and-demand effects, that could increase downstream emissions, perhaps significantly. Regardless, any plausible estimate of downstream emissions from the Midcontinent Supply Header Interstate Pipeline project will be a significant quantity and warrant monetization.

Under any reasonable application of the social cost of greenhouse gas metrics, the emissions from the Midcontinent Supply Header Interstate Pipeline project will cause hundreds of millions of dollars in climate damages. Tellingly, FERC had no problem concluding in its DEIS that it was appropriate to

---

[45] Agencies simply need to multiply their estimate of tons in each year by the IWG's 2016 values for the corresponding year of emissions (adjusted for inflation to current dollars). If the emissions change occurs in the future, agencies would then discount the products back to present value.

[46] Comm'r Glick, dissenting, at 5.

[47] Sabal Trail Remand Order, Glick Opinion at 3.

[48] 52 F. Supp. 3d at 1191 (quoting an e-mail comment on the draft statement for the quantification of tons).

[49] *MEIC v. Office of Surface Mining* at 36-37.

[50] 538 F.3d at 1187.

[51] BOEM, *Liberty Development and Production Plan Draft EIS* at 3-129, 4,50 (2017) (89,940,000 minus 64,570,000 is about 25 million).

8

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) monetize, for example, the $400 million in estimated payroll from construction and operation of the Chisholm Meter Station (in addition to millions of dollars of other monetized economic benefits).[52] A potential climate cost of hundreds of millions of dollars is also significant, particularly in the context of a document the very purpose of which is to evaluate a project's *environmental* impacts.

3. FERC Must Use Current Estimates of the Social Cost of Greenhouse Gases That Reflect the Best Available Data and Methodologies

As explained above, FERC is required to monetize the climate effects of the increased greenhouse gas emissions predicted to occur under the Midcontinent Supply Header Interstate Pipeline project. When FERC monetizes those climate effects, it must use estimates of the social cost of carbon and social cost of methane that reflect the best available data and methodologies.

In 2016, the IWG published updated central estimates for the social cost of greenhouse gases: $50 per ton of carbon dioxide, $1440 per ton of methane, and $18,000 per ton of nitrous oxide (in 2017 dollars for year 2020 emissions).[53] Agencies must continue to use estimates of a similar or higher value[54] in their regulatory analyses and environmental impact statements. In particular, when estimating the social cost of greenhouse gases, agencies must use multiple peer-reviewed models, a global estimate of climate damages, and a 3% or lower discount rate for the central estimate. These methodological approaches are consistent with NEPA's directive that agencies adopt a global perspective and consider the effects of their actions on future generations.

This section discusses the appropriate use of models, the need to use a global estimate of climate damages, and the proper treatment of uncertainty. The need to use a 3% or lower discount rate for the central estimate is discussed in the section above.

Agencies Must Not Rely on a Single Model, but Must Use Multiple, Peer-Reviewed Models

NEPA requires "scientific accuracy" in environmental impact statements, and agencies must "insure the professional integrity, including scientific integrity, of the discussions and analyses."[55] As the U.S. Court of Appeals for the Tenth Circuit has explained, NEPA requires agencies to use "the best available scientific information."[56] OMB's *Circular A-4* provides helpful guidance on the standards for accuracy in monetizing costs and benefits. *Circular A-4* requires agencies to use "the best reasonably obtainable scientific, technical, and economic information available. To achieve this, you should rely on peer-reviewed literature, where available."[57]

Since the IWG first issued the federal social cost of carbon protocol in 2010, this methodology has relied on the three most cited, most peer-reviewed integrated assessment models (IAMs). These three IAMs—

---

[52] DEIS at 4-111.

[53] U.S. Interagency Working Group on the Social Cost of Greenhouse Gases, "Technical support document: Technical update of the social cost of carbon for regulatory impact analysis under executive order 12866 & Addendum: Application of the methodology to estimate the social cost of methane and the social cost of nitrous oxide" (2016), *available at* https://obamawhitehouse.archives.gov/omb/oira/social-cost-of-carbon.

[54] *See, e.g.*, Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014) (explaining that current estimates omit key damage categories and, therefore, are very likely underestimates).

[55] 40 C.F.R. § 1502.24.

[56] *Custer Cty. Action Ass'n v. Garvey*, 256 F.3d 1024, 1034 (10th Cir. 2001).

[57] OMB, Circular A-4, at 17.

9

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

called DICE (the Dynamic Integrated Model of Climate and the Economy[58]), FUND (the Climate Framework for Uncertainty, Negotiation, and Distribution[59]), and PAGE (Policy Analysis of the Greenhouse Effect[60])—draw on the best available scientific and economic data to link physical impacts to the economic damages of each marginal ton of greenhouse gas emissions. As noted previously, each model translates emissions into changes in atmospheric greenhouse gas concentrations, atmospheric concentrations into temperature changes, and temperature changes into economic damages, which can then be adjusted according to a discount rate. These three models have been combined with inputs derived from peer-reviewed literature on climate sensitivity, socio-economic and emissions trajectories, and discount rates. The results of the three models have been given equal weight in federal agencies' estimates and have been run through statistical techniques like Monte Carlo analysis to account for uncertainty.

In a 2017 report, the National Academies of Sciences (NAS) recommended future improvements to this methodology. Specifically, over the next five years the NAS recommends unbundling the four essential steps in the IAMs into four separate "modules": a socio-economic and emissions scenario module, a climate change module, an economic damage module, and a discount rate module.[61] Unbundling these four steps into separate modules could allow for easier, more transparent updates to each individual component in order to better reflect the best available science and capture the full range of uncertainty in the literature. These four modules could be built from scratch or drawn from the existing IAMs. Either way, the integrated modular framework envisioned by NAS for the future will require significant time and resource commitments from federal agencies.

In the meantime, the NAS has supported the continued near-term use of the existing social cost of greenhouse gas estimates based on the DICE, FUND, and PAGE models, as used by federal agencies to date.[62] In short, DICE, FUND, and PAGE continue to represent the state-of-the-art models. The Government Accountability Office found in 2014 that the estimates derived from these models and used by federal agencies are consensus-based, rely on peer-reviewed academic literature, disclose relevant limitations, and are designed to incorporate new information via public comments and updated research.[63] In fact, the social cost of greenhouse gas estimates used in federal regulatory proposals and EISs have been subject to over 80 distinct public comment periods.[64] The economics literature confirms

[58] William D. Nordhaus, *Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches*, 1 JOURNAL OF THE ASSOCIATION OF ENVIRONMENTAL AND RESOURCE ECONOMISTS 1 (2014).

[59] David Anthoff & Richard S.J. Tol, THE CLIMATE FRAMEWORK FOR UNCERTAINTY, NEGOTIATION AND DISTRIBUTION (FUND), TECHNICAL DESCRIPTION, VERSION 3.6 (2012), *available at* http://www.fund-model.org/versions.

[60] Chris Hope, *The Marginal Impact of CO_2 from PAGE2002: An Integrated Assessment Model Incorporating the IPCC's Five Reasons for Concern*, 6 INTEGRATED ASSESSMENT J. 19 (2006).

[61] Nat'l Acad. Sci., Eng. & Medicine, *Valuing Climate Damages: Updating Estimates of the Social Cost of Carbon Dioxide* 3 (2017) [hereinafter "NAS, Second Report"] (recommending an "integrated modular approach").

[62] Specifically, NAS concluded that a near-term update was not necessary or appropriate and the current estimates should continue to be used while future improvements are developed over time. Nat'l Acad. Sci., Eng. & Medicine, *Assessment of Approaches to Updating the Social Cost of Carbon: Phase 1 Report on a Near-Term Update* 1 (2016) [hereinafter "NAS, First Report"].

[63] Gov't Accountability Office, *Regulatory Impact Analysis: Development of Social Cost of Carbon Estimates* (2014).

[64] Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017), at Appendix A.

10

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

that estimates based on these three IAMs remain the best available estimates.[65] In 2016, the U.S. Court of Appeals for the Seventh Circuit held the estimates used to date by agencies are reasonable.[66] Just last month, the District of Montana rejected an agency's Environmental Assessment for failure to incorporate the federal social cost of carbon estimates into its cost-benefit analysis of a proposed mine expansion.[67]

Regardless of Executive Order 13,783's withdrawal of the guidance requiring federal agencies to rely on IWG's technical support documents to estimate the social cost of greenhouse gases, IWG's choice of DICE, FUND, and PAGE, its use of inputs and assumptions, and its statistical analysis still represent the state-of-the-art approach based on the best available, peer-reviewed literature. This approach satisfies both NEPA's and Circular A-4's requirements for information quality and transparency. Therefore, in complying with the Executive Order's instructions to ensure that social cost of greenhouse gas estimates are consistent with Circular A-4, agencies will necessarily have to rely on models like DICE, FUND, and PAGE, to use the same or similar inputs and assumptions as the IWG, and to apply statistical analyses like Monte Carlo.

The unavoidable fact is that DICE, FUND, and PAGE are still the dominant, most peer-reviewed models,[68] and most estimates in the literature continue to rely on those models.[69] Each of these models has been developed over decades of research, and has been subject to rigorous peer review, documented in the published literature. While other models exist, they lack DICE's, FUND's, and PAGE's long history of peer review or exhibit other limitations. For example, the World Bank has created ENVISAGE, which models a more detailed breakdown of market sectors,[70] but unfortunately does not account for non-market impacts and so would omit a large portion of significant climate effects. Models like ENVISAGE are therefore not currently appropriate choices under the criteria of Circular A-4.[71]

An approach based on multiple, peer-reviewed models (like DICE, FUND, and PAGE) is more rigorous and more consistent with Circular A-4 than reliance on a single model or estimate. DICE, FUND, and PAGE each include many of the most significant climate effects, use appropriate discount rates and other

---

[65] *E.g.*, Richard G. Newell et al., *Carbon Market Lessons and Global Policy Outlook*, 343 SCIENCE 1316 (2014); Bonnie L. Keeler et al., *The Social Costs of Nitrogen*, 2 SCIENCE ADVANCES e1600219 (2016); Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014) (co-authored with Nobel Laureate Kenneth Arrow, among others).

[66] *Zero Zone*, 832 F.3d at 679 (7th Cir. 2016) (finding that the agency "acted reasonably" in using global estimates of the social cost of carbon, and that the estimates chosen were not arbitrary or capricious).

[67] *Montana Envtl. Info. Cent.*, 2017 WL 3480262,at *12-15, 19.

[68] *See* Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 7 (July 2015) ("DICE, FUND, and PAGE are the most widely used and widely cited models in the economic literature that link physical impacts to economic damages for the purposes of estimating the SCC."), *citing* Nat'l Acad. Sci., Eng. & Medicine, *Hidden Cost of Energy: Unpriced Consequences of Energy Production and Use* (2010) ("the most widely used impact assessment models").

[69] R.S. Tol, *The Social Cost of Carbon*, 3 Annual Rev. Res. Econ. 419 (2011); T. Havranek et al., *Selective Reporting and the Social Cost of Carbon*, 51 Energy Econ. 394 (2015).

[70] World Bank, *The Environmental Impact and Sustainability Applied General Equilibrium (ENVISAGE) Model* (2008), *available at* http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1193838209522/Envisage7b.pdf.

[71] Similarly, Intertemporal Computable Equilibrium System (ICES) does not account for non-market impacts. *See* https://www.cmcc.it/models/ices-intertemporal-computable-equilibrium-system. Other models include CRED, which is worthy of further study for future use. Frank Ackerman, Elizabeth A. Stanton & Ramón Bueno, *CRED: A New Model of Climate and Development*, 85 ECOLOGICAL ECONOMICS 166 (2013). Accounting for omitted impacts more generally, E.A. Stanton, F. Ackerman, R. Bueno, *Reason, Empathy, and Fair Play: The Climate Policy Gap*, (Stockholm Environment Inst. Working Paper 2012-02), find a doubling of the SCC using the CRED model.

11

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) assumptions, address uncertainty, are based on peer-reviewed data, and are transparent.[72] However, each IAM also has its own limitations and is sensitive to its own assumptions. No model fully captures all the significant climate effects.[73] By giving weight to multiple models—as the IWG did—agencies can balance out some of these limitations and produce more robust estimates.[74]

Finally, while agencies should be careful not to cherry-pick a single estimate from the literature, it is noteworthy that various estimates in the literature are consistent with the numbers derived from a weighted average of DICE, FUND, and PAGE—namely, with a central estimate of about $40 per ton of carbon dioxide, and a high-percentile estimate of about $120, for year 2015 emissions (in 2016 dollars, at a 3% discount rate). The latest central estimate from DICE's developers is $87 (at a 3% discount rate);[75] from FUND's developers, $12;[76] and from PAGE's developers, $123, with a high-percentile estimate of $332.[77]

In fact, much of the literature suggests that a central estimate of $40 per ton is a very conservative *underestimate* of the true social cost of carbon. A 2013 meta-analysis of the broader literature found a mean estimate of $59 per ton of carbon dioxide,[78] and a soon-to-be-published update by the same author finds a mean estimate of $108 (at a 1% discount rate).[79] A 2015 meta-analysis—which sought out estimates besides just those based on DICE, FUND, and PAGE—found a mean estimate of $83 per ton of carbon dioxide.[80] Various studies relying on expert elicitation[81] from a large body of climate economists and scientists have found mean estimates of $50 per ton of carbon dioxide,[82] $96-$144 per ton of carbon dioxide,[83] and $80-$100 per ton of carbon dioxide.[84] There is a growing consensus in the literature that even the best existing estimates of the social cost of greenhouse gases may severely underestimate the true marginal cost of climate damages.[85] Overall, a central estimate of $40 per ton of

---

[72] While sensitivity analysis can address parametric uncertainty within a model, using multiple models helps address structural uncertainty.

[73] *See* Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/.

[74] Moore, F., Baldos, U., & Hertel, T. (2017). Economic impacts of climate change on agriculture: a comparison of process-based and statistical yield models. *Environmental Research Letters*.

[75] William Nordhaus, *Revisiting the Social Cost of Carbon*, Proc. Nat'l Acad. Sci. (2017) (estimate a range of $21 to $141).

[76] D. Anthoff & R. Tol, *The Uncertainty about the Social Cost of Carbon: A Decomposition Analysis Using FUND*, 177 Climatic Change 515 (2013).

[77] C. Hope, *The social cost of CO2 from the PAGE09 model*, 39 Economics (2011); C. Hope, *Critical issues for the calculation of the social cost of CO2*, 117 *Climatic Change*, 531 (2013).

[78] R. Tol, *Targets for Global Climate Policy: An Overview*, 37 J. Econ. Dynamics & Control 911 (2013).

[79] R. Tol, *Economic Impacts of Climate Change* (Univ. Sussex Working Paper No. 75-2015, 2015).

[80] S. Nocera et al., *The Economic Impact of Greenhouse Gas Abatement through a Meta-Analysis: Valuation, Consequences and Implications in terms of Transport Policy*. 37 Transport Policy 31 (2015).

[81] Circular A-4, at 41, supports use of expert elicitation as a valuable tool to fill gaps in knowledge.

[82] Scott Holladay & Jason Schwartz, *Economists and Climate Change* 43 (Inst. Policy Integrity Brief, 2009 (directly surveying experts about the SCC).

[83] Peter Howard & Derek Sylvan, *The Economic Climate: Establishing Expert Consensus on the Economics of Climate Change* (Inst. Policy Integrity Working Paper 2015/1) (using survey results to calibrate the DICE-2013R damage function).

[84] R. Pindyck, *The Social Cost of Carbon Revisited* (Nat'l Bureau of Econ. Res. No. w22807, 2016) ($80-$100 is the trimmed range of estimates at a 4% discount rate; without trimming of outlier responses, the estimate is $200).

[85] *E.g.*, Howard & Sylvan, *supra* note 83; Pindyck, *supra* note 84. The underestimation results from a variety of factors, including omitted and outdated climate impacts (including ignoring impacts to economic growth and tipping points), simplified utility functions (including ignoring relative prices), and applying constant instead of a declining discount rate. *See* Howard, *supra* note 73; Revesz et al., *supra* note 65; J.C. Van Den Bergh & W.J. Botzen, A Lower Bound to the Social Cost of CO2 Emissions, 4 Nature Climate Change 253 (2014) (proposing $125 per metric ton of carbon dioxide in 1995 dollars, or about $200

12

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) carbon dioxide at a 3% discount rate, with a high-percentile estimate of about $120 for year 2015 emissions, is consistent with the best available literature; if anything, the best available literature supports considerably higher estimates.[86]

Similarly, a comparison of international estimates of the social cost of greenhouse gases suggests that a central estimate of $40 per ton of carbon dioxide is a very conservative value. Sweden places the long-term valuation of carbon dioxide at $168 per ton; Germany calculates a "climate cost" of $167 per ton of carbon dioxide in the year 2030; the United Kingdom's "shadow price of carbon" has a central value of $115 by 2030; Norway's social cost of carbon is valued at $104 per ton for year 2030 emissions; and various corporations have adopted internal shadow prices as high as $80 per ton of carbon dioxide.[87]

Indeed, a number of our organizations have previously commented on ways in which the IWG's approach could be improved to more accurately reflect the true social cost of greenhouse gases. For instance, the IWG's values should reflect risk aversion and account for the additional price that society is willing to pay to avoid uncertainty around increasingly more severe impacts from climate change.[88] In addition, noted Harvard economist Martin Weitzmann has observed, the three IAMs assume a relatively smooth upward slope in economic damages even as global climates increase well past critical tipping points. An improved social cost of greenhouse gases could reflect modified damage functions that better address tipping points.[89]

For these reasons, the IWG's estimates are very likely to underrepresent the true impact that greenhouse gas emissions have on society, and we strongly encourage further efforts to make those efforts more robust. Nevertheless, the IWG's approach represents the best and most rigorous effort that the U.S. government has engaged in thus far to realistically estimate the social cost of greenhouse gases. As such, agencies must incorporate those values into their rulemaking analyses; simply refusing to monetize the greenhouse gas emissions of their actions, as FERC has done in this case, does not pass legal or technical muster.

A Global Estimate of Climate Damages Is Required by NEPA

NEPA contains a provision on "International and National Coordination of Efforts" that broadly requires that "all agencies of the Federal Government *shall* . . . recognize the worldwide and long-range character of environmental problems."[90] Using a global social cost of greenhouse gases to analyze and set policy fulfills these instructions. Furthermore, the Act requires agencies to, "where consistent with the foreign

---

in today's dollars, as the lower bound estimate). *See also* F.C. Moore & D.B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 Nature Climate Change 127 (2015) (concluding the SCC may be six times higher after accounting for potential growth impacts of climate change). Accounting for both potential impacts of climate change on economic growth and other omitted impacts, S. Dietz and N. Stern find a two- to seven-fold increase in the SCC. *Endogenous growth, convexity of damage and climate risk: how Nordhaus' framework supports deep cuts in carbon emissions*. 125 *The Economic Journal* 574 (2015).

[86] Note that the various estimates cited in the paragraph have not all been converted to standard 2017$, and may not all reflect the same year emissions. Nevertheless, the magnitude of this range suggests that $40 per ton of year 2015 emissions is a conservative estimate.

[87] *See* Howard & Schwartz, *supra* note 64, at Appendix B. All these estimates are in 2016$.

[88] *See, e.g.*, Howarth, R. B., Gerst, M. D., & Borsuk, M. E., 2014. *Risk mitigation and the social cost of carbon*. Global Environmental Change 24, 123-131.

[89] Weitzmann, M.L., *GHG Targets as Insurance Against Catastrophic Climate Damages*, National Bureau of Economic Research Working Paper No. 16136, 12-16 (2010).

[90] 42 U.S.C. § 4332(2)(f) (emphasis added).

13

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment."[91] By continuing to use the global social cost of greenhouse gases to spur reciprocal foreign actions, federal agencies "lend appropriate support" to the NEPA's goal of "maximize[ing] international cooperation" to protect "mankind's world environment." Furthermore, not only is it consistent with Circular A-4 and best economic practices to estimate the global damages of U.S. greenhouse gas emissions in regulatory analyses and environmental impact statements, but no existing methodology for estimating a "domestic-only" value is reliable, complete, or consistent with Circular A-4.

From 2010 through 2016, federal agencies based their regulatory decision and NEPA reviews on global estimates of the social cost of greenhouse gases. Though agencies often also disclosed a "highly speculative" range that tried to capture exclusively U.S. climate costs, emphasis on a global value was recognized as more accurate given the science and economics of climate change, as more consistent with best economic practices, and as crucial to advancing U.S. strategic goals.[92]

Opponents of climate regulation challenged the global number in court and other forums, and often attempted to use Circular A-4 as support.[93] Specifically, opponents have seized on Circular A-4's instructions to "focus" on effects to "citizens and residents of the United States," while any significant effects occurring "beyond the borders of the United States . . . should be reported separately."[94] Importantly, despite this language and such challenges, the U.S. Court of Appeals for the Seventh Circuit had no trouble concluding that a global focus for the social cost of greenhouse gases was reasonable:

> AHRI and Zero Zone [the industry petitioners] next contend that DOE [the Department of Energy] arbitrarily considered the global benefits to the environment but only considered the national costs. They emphasize that the [statute] only concerns "national energy and water conservation." In the New Standards Rule, DOE did not let this submission go unanswered. It explained that climate change "involves a global externality," meaning that carbon released in the United States affects the climate of the entire world. According to DOE, national energy conservation has global effects, and, therefore, those global effects are an appropriate consideration when looking at a national policy. Further, AHRI and Zero Zone point to no global costs that should have

---

[91] *Id.*; *see also Environmental Defense Fund v. Massey*, 986 F.2d 528, 535 (D.C. Cir. 1993) (confirming that Subsection F is mandatory); Natural Resources Defense Council v. NRC, 647 F.2d 1345, 1357 (D.C. Cir. 1981) ("This NEPA prescription, I find, looks toward cooperation, not unilateral action, in a manner consistent with our foreign policy."); *cf.* COUNCIL ON ENVIRONMENTAL QUALITY, GUIDANCE ON NEPA ANALYSIS FOR TRANSBOUNDARY IMPACTS (1997), *available at* http://www.gc.noaa.gov/documents/transguide.pdf; Exec. Order No. 12,114, *Environmental Effects Abroad of Major Federal Actions*, 44 Fed. Reg. 1957 §§ 1-1, 2-1 (Jan. 4, 1979) (applying to "major Federal actions . . . having significant effects on the environment outside the geographical borders of the United States," and enabling agency officials "to be informed of pertinent environmental considerations and to take such considerations into account . . . in making decisions regarding such actions").

[92] *See generally* Howard & Schwartz, *supra* note 64.

[93] Ted Gayer & W. Kip Viscusi, *Determining the Proper Scope of Climate Change Policy Benefits in U.S. Regulatory Analyses: Domestic versus Global Approaches*, 10 Rev. Envtl. Econ. & Pol'y 245 (2016) (citing Circular A-4 to argue against a global perspective on the social cost of carbon); *see also, e.g.*, Petitioners Brief on Procedural and Record-Based Issues at 70, in *West Virginia v. EPA*, case 15-1363, D.C. Cir. (filed February 19, 2016) (challenging EPA's use of the global social cost of carbon).

[94] Circular A-4 at 15. Note that A-4 slightly conflates "accrue to citizens" with "borders of the United States": U.S. citizens have financial and other interests tied to effects beyond the borders of the United States, as discussed further below.

14

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

been considered alongside these benefits. Therefore, DOE acted reasonably when it compared global benefits to national costs.[95]

Circular A-4's reference to effects "beyond the borders" confirms that it is appropriate for agencies to consider the global effects of U.S. greenhouse gas emissions. While Circular A-4 may suggest that most typical decisions should focus on U.S. effects, the Circular cautions agencies that special cases call for different emphases:

> [Y]ou cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment. ***Different regulations may call for different emphases*** in the analysis, ***depending on the nature and complexity*** of the regulatory issues and the sensitivity of the benefit and cost estimates to the key assumptions.[96]

In fact, Circular A-4 elsewhere assumes that agencies' analyses will not always be conducted from purely the perspective of the United States, as one of its instructions only applies "as long as the analysis is conducted from the United States perspective,"[97] suggesting that in some circumstances it is appropriate for the analysis to be global. For example, EPA and DOT have adopted a global perspective on the analysis of potential monopsony benefits to U.S. consumers resulting from the reduced price of foreign oil imports following energy efficiency increases, and EPA assesses the global potential for leakage of greenhouse gas emissions owing to U.S. regulation.[98]

Perhaps more than any other issue, the nature of the issue of climate change requires precisely such a "different emphasis" from the default domestic-only assumption. To avoid a global "tragedy of the commons" that could irreparably damage all countries, including the United States, every nation should ideally set policy according to the global social cost of greenhouse gases.[99] Climate and clean air are global common resources, meaning they are freely available to all countries, but any one country's use—i.e., pollution—imposes harms on the polluting country as well as the rest of the world. Because greenhouse pollution does not stay within geographic borders but rather mixes in the atmosphere and affects climate worldwide, each ton emitted by the United States not only creates domestic harms, but also imposes large externalities on the rest of the world. Conversely, each ton of greenhouse gases abated in another country benefits the United States along with the rest of the world.

If all countries set their greenhouse emission levels based on only domestic costs and benefits, ignoring the large global externalities, the aggregate result would be substantially sub-optimal climate protections and significantly increased risks of severe harms to all nations, including the United States. Thus, basic economic principles demonstrate that the United States stands to benefit greatly if all countries apply global social cost of greenhouse gas values in their regulatory decisions and project

[95] Zero Zone v. Dept. of Energy, 832 F.3d 654, 679 (7th Cir. 2016),

[96] Circular A-4 at 3 (emphasis added).

[97] *Id.* at 38 (counting international transfers as costs and benefits "as long as the analysis is conducted from the United States perspective").

[98] *See* Howard & Schwartz, *supra* note 64, at 268-69.

[99] *See* Garrett Hardin, *The Tragedy of the Commons*, 162 Science 1243 (1968) ("[E]ach pursuing [only its] own best interest . . . in a commons brings ruin to all.").

15

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) reviews. Indeed, the United States stands to gain hundreds of billions or even trillions of dollars in direct benefits from efficient foreign action on climate change.[100]

In order to ensure that other nations continue to use global social cost of greenhouse gas values, it is important that the United States itself continue to do so.[101] The United States is engaged in a repeated strategic dynamic with several significant players—including the United Kingdom, Germany, Sweden, and others—that have already adopted a global framework for valuing the social cost of greenhouse gases.[102] For example, Canada and Mexico have explicitly borrowed the IWG's global SCC metric to set their own fuel efficiency standards.[103] For the United States to now depart from this collaborative dynamic by reverting to a domestic-only estimate would undermine the country's long-term interests and could jeopardize emissions reductions underway in other countries, which are already benefiting the United States.

For these and other reasons, the IWG properly relied on global estimates to develop its SCC metric, and many federal agencies have since relied on this global metric to evaluate and justify their decisions. At the same time, some agencies have, in addition to the global estimate, also disclosed a "highly speculative" estimate of the domestic-only effects of climate change. In particular, the Department of Energy always includes a chapter on a domestic-only value of carbon emissions in the economic analyses supporting its energy efficiency standards; EPA has also often disclosed similar estimates.[104] Such an approach is consistent with Circular A-4's suggestion that agencies should usually disclose domestic effects separately from global effects. However, as we have discussed, reliance on a domestic-only methodology would be inconsistent with both the inherent nature of climate change and the standards of Circular A-4. Consequently, it is appropriate under Circular A-4 for agencies to continue to rely on global estimates of the social cost of greenhouses to justify their regulatory decisions or their choice of alternatives under NEPA.

Moreover, no current methodology can accurately estimate a "domestic-only" value of the social cost of greenhouse gases. OMB, the National Academies of Sciences, and the economic literature all agree that existing methodologies for calculating a "domestic-only" value of the social cost of greenhouse gases are deeply flawed and result in severe and misleading underestimates. In developing the social cost of carbon, the IWG did offer some such domestic estimates. Using the results of one economic model (FUND) as well as the U.S. share of global gross domestic product (GDP), the group generated an "approximate, provisional, and ***highly speculative***" range of 7–23% of the global social cost of carbon as an estimate of the purely direct climate effects to the United States.[105] Yet, as the IWG itself acknowledged, this range is almost certainly an underestimate because it ignores significant, indirect

[100] Policy Integrity, *Foreign Action, Domestic Windfall: The U.S. Economy Stands to Gain Trillions from Foreign Climate Action* (2015), http://policyintegrity.org/files/publications/ForeignActionDomesticWindfall.pdf

[101] *See* Robert Axelrod, *The Evolution of Cooperation* 10-11 (1984) (on repeated prisoner's dilemma games).

[102] *See* Howard & Schwartz, *supra* note 64, at Appendix B.

[103] *See* Heavy-Duty Vehicle and Engine Greenhouse Gas Emission Regulations, SOR/2013-24, 147 Can. Gazette pt. II, 450, 544 (Can.), *available at* http://canadagazette.gc.ca/rp-pr/p2/2013/2013-03-13/html/sor-dors24-eng.html ("The values used by Environment Canada are based on the extensive work of the U.S. Interagency Working Group on the Social Cost of Carbon."); Jason Furman & Brian Deese, *The Economic Benefits of a 50 Percent Target for Clean Energy Generation by 2025*, White House Blog, June 29, 2016 (summarizing the North American Leader's Summit announcement that U.S., Canada, and Mexico would "align" their SCC estimates).

[104] Howard & Schwartz, *supra* note 64, at 220-21.

[105] INTERAGENCY WORKING GROUP ON SOCIAL COST OF CARBON, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12,866 at 11 (2010) (emphasis added).

16

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) costs to trade, human health, and security that are likely to "spill over" into the United States as other regions experience climate change damages, among other effects.[106]

Neither the existing IAMs nor a share of global GDP are appropriate bases for calculating a domestic-only estimate. The IAMs were never designed to calculate a domestic SCC, since a global SCC is the economic efficient value. FUND, like other IAMS, includes some simplifying assumptions: of relevance, FUND and the other IAMs are not able to capture the adverse effects that the impacts of climate change in other countries will have on the United States through trade linkages, national security, migration, and other forces.[107] This is why the IWG characterized the domestic-only estimate from FUND as a "highly speculative" underestimate. Similarly, a domestic-only estimate based on some rigid conception of geographic borders or U.S. share of world GDP will fail to capture all the climate-related costs and benefits that matter to U.S. citizens.[108] U.S. citizens have economic and other interests abroad that are not fully reflected in the U.S. share of global GDP. GDP is a "monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time."[109] GDP therefore does not reflect significant U.S. ownership interests in foreign businesses, properties, and other assets, as well as consumption abroad including tourism,[110] or even the 8 million Americans living abroad.[111] At the same time, GDP is also over-inclusive, counting productive operations in the United States that are owned by foreigners. Gross National Income (GNI), by contrast, defines its scope not by location but by ownership interests.[112] However, not only has GNI fallen out of favor as a metric used in international economic policy,[113] but using a domestic-only SCC based on GNI would make the SCC metrics incommensurable with other costs in regulatory impact analyses, since most regulatory costs are calculated by U.S. agencies regardless of whether they fall to U.S.-owned entities or to foreign-owned entities operating in the United States.[114] Furthermore, both GDP and GNI are dependent on what happens in other countries, due to trade and the international flow of capital. The artificial constraints of both metrics counsel against a rigid split based on either U.S. GDP or U.S. GNI.[115]

---

[106] *Id.* (explaining that the IAMs, like FUND, do "not account for how damages in other regions could affect the United States (e.g., global migration, economic and political destabilization").

[107] *See, e.g.*, Dept. of Defense, *National Security Implications of Climate-Related Risks and a Changing Climate* (2015), *available at* http://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf?source=govdelivery.

[108] A domestic-only SCC would fail to "provide to the public and to OMB a careful and transparent analysis of the anticipated consequences of economically significant regulatory actions." Office of Information and Regulatory Affairs, *Regulatory Impact Analysis: A Primer* 2 (2011).

[109] Tim Callen, *Gross Domestic Product: An Economy's All*, IMF, http://www.imf.org/external/pubs/ft/fandd/basics/gdp.htm (last updated Mar. 28, 2012).

[110] "U.S. residents spend millions each year on foreign travel, including travel to places that are at substantial risk from climate change, such as European cities like Venice and tropical destinations like the Caribbean islands." David A. Dana, *Valuing Foreign Lives and Civilizations in Cost-Benefit Analysis: The Case of the United States and Climate Change Policy* (Northwestern Faculty Working Paper 196, 2009), http://scholarlycommons.law.northwestern.edu/cgi/viewcontent.cgi?article=1195&context=facultyworkingpapers.

[111] Assoc. of Americans Resident Oversees, https://www.aaro.org/about-aaro/6m-americans-abroad. Admittedly 8 million is only 0.1% of the total population living outside the United States.

[112] *GNI, Atlas Method (Current US$)*, THE WORLD BANK, http://data.worldbank.org/indicator/NY.GNP.ATLS.CD.

[113] *Id.*

[114] U.S. Office of Management and Budget & Secretariat General of the European Commission, *Review of Application of EU and US Regulatory Impact Assessment Guidelines on the Analysis of Impacts on International Trade and Development* 13 (2008).

[115] Advanced Notice of Proposed Rulemaking on Regulating Greenhouse Gas Emissions Under the Clean Air Act, 73 Fed. Reg. 44,354, 44,415 (July 30, 2008) ("Furthermore, international effects of climate change may also affect domestic benefits

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) Of course, there already are and will continue to be significant, quantifiable, localized effects of climate change. For example, a peer-reviewed EPA report, *Climate Change in the United States: Benefits of Global Action*, found that by the end of the century, the U.S. economy could face damages of $110 billion annually in lost labor productivity alone due to extreme temperatures, plus $11 billion annually in agricultural damages, $180 billion in losses to key economic sectors due to water shortages, and $5 trillion in damages U.S. coastal property.[116] But the existence of those examples of quantifiable estimates of localized damages does not mean that the current IAMs are able to extrapolate a U.S.-only number that accurately reflects total domestic damages—especially since, as already explained, the IAMs do not reflect spill overs.

As a result, in 2015, OMB concluded, along with several other agencies, that "good methodologies for estimating domestic damages do not currently exist."[117] Similarly, the NAS recently concluded that current IAMs cannot accurately estimate the domestic social cost of greenhouse gases, and that estimates based on U.S. share of global GDP would be likewise insufficient.[118] William Nordhaus, the developer of the DICE model, cautioned earlier this year that "regional damage estimates are both incomplete and poorly understood," and "there is little agreement on the distribution of the SCC by region."[119] In short, any domestic-only estimate will be inaccurate, misleading, and out of step with the best available economic literature, in violation of Circular A-4's standards for information quality.

For more details on the justification for a global value of the social cost of greenhouse gases, please see Peter Howard & Jason Schwartz, *Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon*, 42 Columbia J. Envtl. L. 203 (2017). Another strong defense of the global valuation as consistent with best economic practices appears in a letter published in a recent issue of *The Review of Environmental Economics and Policy*, co-authored by the late Nobel laureate economist Kenneth Arrow.[120]

There Is Clear Consensus on Using a 3% or Lower (or Declining) Discount Rate as a Central Estimate

In the Southeast Market Pipeline draft supplemental EIS, which this group commented on last year, FERC cites a 2013 EPA factsheet for the proposition that there is such a lack of consensus around the appropriate discount rate that the resulting range of estimates of the social cost of greenhouse gases is too wide to be helpful.[121] Not only was this line of thinking rejected by the Ninth Circuit in *Center for*

---

directly and indirectly to the extent U.S. citizens value international impacts (e.g., for tourism reasons, concerns for the existence of ecosystems, and/or concern for others); U.S. international interests are affected (e.g., risks to U.S. national security, or the U.S. economy from potential disruptions in other nations).").

116 EPA, *Climate Change in the United States: Benefits of Global Action* (2015).

117 In November 2013, OMB requested public comments on the social cost of carbon. In 2015, OMB along with the rest of the Interagency Working Group issued a formal response to those comments. Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 36 (July 2015) [hereinafter, OMB 2015 Response to Comments].

118 NAS Second Report, *supra* note 61, at 53.

119 William Nordhaus, *Revisiting the Social Cost of Carbon*, 114 PNAS 1518, 1522 (2017).

120 Richard Revesz, Kenneth Arrow et al., *The Social Cost of Carbon: A Global Imperative*, 11 REEP 172 (2017).

121 Southeast Market EIS at 5. *But see* Sabal Remand Order (Comm'r LaFleur, dissenting in part) ("[T]he Commission could estimate the appropriate discount rate or to use more than one discount rate in our calculations or to provide a range of numbers for consideration."); *id.* (Comm'r Glick, dissenting) ("perceived technical challenges including the presence of assumptions or unknowns, such as discount rate, … does not diminish the Commission's responsibility to provide a qualitative assessment, rather the Commission simply must make a disclosure 'so that readers can take the resulting estimates with the appropriate amount of salt.'").

18

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) *Biological Diversity*—"while . . . there is a range of values, the value of carbon emissions reduction is certainly not zero"[122]—but the range of values recommended by the Interagency Working Group[123] and endorsed by the National Academies of Sciences[124] is rather manageable. In 2016, the IWG recommended values at discount rates from 2.5% to 5%, calculated as between $12 and $62 for year 2020 emissions.[125] Numerous federal agencies have had no difficulty either applying this range in their environmental impact statements or else focusing on the central estimate at a 3% discount rate.[126] Most recently, in August 2017, the Bureau of Ocean Energy Management applied the IWG's range of estimates calculated at three discount rates (2.5%, 3%, and 5%) to its environmental impact statement for an offshore oil development plan,[127] and called this range of estimates "a useful measure to assess the benefits of CO_2 reductions and inform agency decisions."[128]

More importantly, there is widespread consensus that a central estimate calculated at a 3% or lower discount rate, or else using a declining discount rate, is most appropriate, while a 7% discount rate would be wholly inappropriate in the context of intergenerational climate damages. Because of the long lifespan of greenhouse gases and the long-term or irreversible consequences of climate change, the effects of today's emissions changes will stretch out over the next several centuries. The time horizon for an agency's analysis of climate effects, as well as the discount rate applied to future costs and benefits, determines how an agency treats future generations. Current central estimates of the social cost of greenhouse gases are based on a 3% discount rate and a 300-year time horizon. Executive Order 13,783 disbanded the Interagency Working Group in March 2017 and instructs agencies to reconsider the "appropriate discount rates" when monetizing the value of climate effects.[129] By citing the official guidance on typical regulatory impact analyses (namely, Circular A-4), the Order implicitly called into question the IWG's choice not to use a 7% discount rate. However, use of a 7% discount would not only be inconsistent with best economic practices but would violate NEPA's required consideration of impacts on future generations.

NEPA requires agencies to weigh the "relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity," as well as "any irreversible and

[122] 538 F.3d at 1200.

[123] *See* Interagency Working Group on the Social Cost of Greenhouse Gases, *Technical Update* (2016) (hereinafter 2016 TSD).

[124] *See* National Academies of Sciences, *Assessment of Approaches to Updating the Social Cost of Carbon* (2016) (hereinafter First NAS Report) (endorsing continued near-term use of the IWG numbers; in 2017, the NAS recommended moving to a declining discount rate, *see* National Academies of Sciences, *Valuing Climate Damages* (2017) (hereinafter Second NAS Report).

[125] 2016 TSD. The values given here are in 2007$. The IWG also recommended a 95th percentile value of $123.

[126] BLM, *Envtl. Assessment—Waste Prevention, Prod. Subject to Royalties, and Res. Conservation* at 52 (2016); BLM, *Final Envtl. Assessment: Little Willow Creek Protective Oil and Gas Lease*, DOI-BLM-ID-B010-2014-0036-EA, at 82 (2015); Office of Surface Mining, *Final Envtl. Impact Statement—Four Corners Power Plant and Navajo Mine Energy Project* at 4.2-26 to 4.2-27 (2015) (explaining the social cost of greenhouse gases "provide[s] further context and enhance[s] the discussion of climate change impacts in the NEPA analysis."); U.S. Army Corps of Engineers, *Draft Envtl. Impact Statement for the Missouri River Recovery Mgmt. Project* at 3-335 (2016); U.S. Forest Serv., *Rulemaking for Colorado Roadless Areas: Supplemental Final Envtl. Impact Statement* at 120-123 (Nov. 2016) (using both the social cost of carbon and social cost of methane relating to coal leases); NHTSA EIS, *Available at* http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/FINAL_EIS.pdf at 9-77.

[127] BOEM, *Liberty Development Project: Draft Environmental Impact Statement*, at 4-247 (2017).

[128] *Id.* at 3-129.

[129] Executive Order 13,783 § 5(c).

19

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) irretrievable commitments of resources."[130] That requirement is prefaced with a congressional declaration of policy that explicitly references the needs of future generations:

> The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment . . . declares that it is the continuing policy of the Federal Government . . . to use all practicable means and measures . . . to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and **future generations** of Americans.[131]

When the Congressional Conference Committee adopted that language, it reported that the first "broad national goal" under the statute is to "fulfill the responsibilities of each generation as trustee of the environment for future generations. It is recognized in this [congressional] statement [of policy] that each generation has a responsibility to improve, enhance, and maintain the quality of the environment *to the greatest extent possible for the continued benefit of future generations*."[132]

Because applying a 7% discount rate to the social cost of greenhouse gases could drop the valuation essentially to $0, use of such a rate effectively ignores the needs of future generations. Doing so would arbitrarily fail to consider an important statutory factor that Congress wrote into the NEPA requirements.

Moreover, a 7% discount rate is inconsistent with best economic practices, including under Circular A-4. In 2015, OMB explained that "Circular A-4 is a ***living document***. . . . [T]he use of ***7 percent is <u>not</u> considered appropriate*** for intergenerational discounting. There is wide support for this view in the academic literature, and it is recognized in Circular A-4 itself. "[133] While Circular A-4 tells agencies generally to use a 7% discount rate in addition to lower rates for typical rules,[134] the guidance does not intend for default assumptions to produce analyses inconsistent with best economic practices. Circular A-4 clearly supports using lower rates to the exclusion of a 7% rate for the costs and benefits occurring over the extremely long, 300-year time horizon of climate effects.

Circular A-4 clearly requires agency analysts to do more than rigidly apply default assumptions: "You cannot conduct a good regulatory analysis according to a formula. Conducting high-quality analysis requires competent professional judgment."[135] As such, analysis must be "based on the best reasonably obtainable scientific, technical, and economic information available,"[136] and agencies must "*[u]**se sound and defensible values*** or procedures to monetize benefits and costs, and ensure that key analytical assumptions are defensible."[137] Rather than assume a 7% discount rate should be applied automatically to every analysis, Circular A-4 requires agencies to justify the choice of discount rates for each analysis: "[S]tate in your report what assumptions were used, *such as . . . the discount rates* applied to future

---

[130] 42 U.S.C. § 4332(2)(C).

[131] 42 U.S.C.A. § 4331.

[132] See 115 Cong. Rec. 40419 (1969) (emphasis added); *see also* same in Senate Report 91-296 (1969).

[133] Interagency Working Group on the Social Cost of Carbon, *Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12,866* at 36 (July 2015) [hereinafter, OMB 2015 Response to Comments].

[134] Circular A-4 at 36 ("For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent....If your rule will have important intergenerational benefits or costs you might consider a further sensitivity analysis using a lower but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent.").

[135] *Id.* at 3.

[136] *Id.* at 17.

[137] *Id.* at 27 (emphasis added).

20

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) benefits and costs," and explain "clearly how you arrived at your estimates."[138] Based on Circular A-4's criteria, there are numerous reasons why applying a 7% discount rate to climate effects that occur over a 300-year time horizon would be unjustifiable.

First, basing the discount rate on the **consumption rate of interest** is the correct framework for analysis of climate effects; a discount rate based on the private return to capital is inappropriate. Circular A-4 does suggest that 7% should be a "default position" that reflects regulations that primarily displace capital investments; however, the Circular explains that "[w]hen regulation primarily and directly affects private consumption . . . *a lower discount rate is appropriate*."[139] The 7% discount rate is based on a private sector rate of return on capital, but private market participants typically have short time horizons. By contrast, climate change concerns the public well-being broadly. Rather than evaluating an optimal outcome from the narrow perspective of investors alone, economic theory requires analysts to make the optimal choices based on societal preferences and social discount rates. Moreover, because climate change is expected to largely affect large-scale consumption, as opposed to capital investment,[140] a 7% rate is inappropriate.

In 2013, OMB called for public comments on the social cost of greenhouse gases. In its 2015 Response to Comment document,[141] OMB (together with the other agencies from the IWG) explained that

> the consumption rate of interest is the correct concept to use . . . as the impacts of climate change are measured in consumption-equivalent units in the three IAMs used to estimate the SCC. This is consistent with OMB guidance in Circular A-4, which states that when a regulation is expected to primarily affect private consumption—for instance, via higher prices for goods and services—it is appropriate to use the consumption rate of interest to reflect how private individuals trade-off current and future consumption.[142]

The Council of Economic Advisers similarly interprets Circular A-4 as requiring agencies to choose the appropriate discount rate based on the nature of the regulation: "[I]n Circular A-4 by the Office of Management and Budget (OMB) the appropriate discount rate to use in evaluating the net costs or benefits of a regulation depends on whether the regulation primarily and directly affects private consumption or private capital."[143] The NAS also explained that a consumption rate of interest is the

---

[138] *Id.* at 3 (emphasis added).

[139] *Id.* at 33 (emphasis added).

[140] "There are two rationales for discounting future benefits—one based on consumption and the other on investment. The consumption rate of discount reflects the rate at which society is willing to trade consumption in the future for consumption today. Basically, we discount the consumption of future generations because we assume future generations will be wealthier than we are and that the utility people receive from consumption declines as their level of consumption increases. . . . The investment approach says that, as long as the rate of return to investment is positive, we need to invest less than a dollar today to obtain a dollar of benefits in the future. Under the investment approach, the discount rate is the rate of return on investment. If there were no distortions or inefficiencies in markets, the consumption rate of discount would equal the rate of return on investment. There are, however, many reasons why the two may differ. As a result, using a consumption rather than investment approach will often lead to very different discount rates." Maureen Cropper, *How Should Benefits and Costs Be Discounted in an Intergenerational Context?*, 183 RESOURCES 30, 33.

[141] Note that this document was not withdrawn by Executive Order 13,783.

[142] OMB 2015 Response to Comments, *supra* note 133, at 22.

[143] Council of Econ. Advisers, *Discounting for Public Policy: Theory and Recent Evidence on the Merits of Updating the Discount Rate* at 1 (CEA Issue Brief, 2017), *available at* https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf. In theory, the two rates would be the same, but "given distortions in the economy from taxation, imperfect capital markets, externalities, and other sources, the SRTP and the marginal product of

21

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) appropriate basis for a discount rate for climate effects.[144] For this reason, 7% is an inappropriate choice of discount rate for the impacts of climate change.

Second, **uncertainty over the long time horizon** of climate effects should drive analysts to select a lower discount rate. As an example of when a 7% discount rate is appropriate, Circular A-4 identifies an EPA rule with a 30-year timeframe of costs and benefits.[145] By contrast, greenhouse gas emissions generate effects stretching out across 300 years. As Circular A-4 notes, while "[p]rivate market rates provide a reliable reference for determining how society values time within a generation, but for extremely long time periods no comparable private rates exist."[146]

Circular A-4 discusses how uncertainty over long time horizons drives the discount rate lower: "the longer the horizon for the analysis," the greater the "uncertainty about the appropriate value of the discount rate," which supports a lower rate.[147] Circular A-4 cites the work of renowned economist Martin Weitzman and concludes that the "certainty-equivalent discount factor corresponds to ***the minimum discount rate having any substantial positive probability***."[148] The NAS makes the same point about discount rates and uncertainty.[149]

Third, a 7% percent discount rate would be inappropriate for climate change because it is based on **outdated data and diverges from the current economic consensus**. Circular A-4 requires that assumptions—including discount rate choices—are "based on the best reasonably obtainable scientific, technical, and economic information available."[150] Yet Circular A-4's own default assumption of a 7% discount rate was published 14 years ago and was based on data from decades ago.[151] Circular A-4's guidance on discount rates is in need of an update, as the Council of Economic Advisers detailed earlier this year after reviewing the best available economic data and theory:

> The discount rate guidance for Federal policies and projects was last revised in 2003. Since then a general reduction in interest rates along with a reduction in the forecast of

capital need not coincide, and analysts face a choice between the appropriate opportunity cost of a project and the appropriate discount rate for its benefits." *Id.* at 9. The correct discount rate for climate change is the social return to capital (i.e., returns minus the costs of externalities), not the private return to capital (which measures solely the returns).

[144] NAS Second Report, *supra*, at 28; see also Kenneth Arrow et al., Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?, 272 Science 221 (1996) (explaining that a consumption-based discount rate is appropriate for climate change).

[145] Circular A-4 at 34. See also OMB 2015 Response to Comments, *supra* note 133, at 21 ("While most regulatory impact analysis is conducted over a time frame in the range of 20 to 50 years").

[146] Circular A-4 at 36.

[147] *Id.*

[148] *Id.* (emphasis added); *see also* CEA, *supra* note 143, at 9: "Weitzman (1998, 2001) showed theoretically and Newell and Pizer (2003) and Groom et al. (2007) confirm empirically that discount rate uncertainty can have a large effect on net present values. A main result from these studies is that if there is a persistent element to the uncertainty in the discount rate (e.g., the rate follows a random walk), then it will result in an effective (or certainty-equivalent) discount rate that declines over time. Consequently, lower discount rates tend to dominate over the very long term, regardless of whether the estimated investment effects are predominantly measured in private capital or consumption terms (see Weitzman 1998, 2001; Newell and Pizer 2003; Groom et al. 2005, 2007; Gollier 2008; Summers and Zeckhauser 2008; and Gollier and Weitzman 2010)."

[149] NAS Second Report, *supra*, at 27.

[150] CEQ regulations implementing NEPA similarly require that information in NEPA documents be "of high quality" and states that "[a]ccurate scientific analysis . . . [is] essential to implementing NEPA." 40 C.F.R. § 1500.1(b).

[151] The 7% rate was based on a 1992 report; the 3% rate was based on data from the thirty years preceding the publication of Circular A-4 in 2003. Circular A-4 at 33.

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

> long-run interest rates, warrants serious consideration for a reduction in the discount rates used for benefit-cost analysis.[152]

In addition to recommending a value below 7% as the discount factor based on private capital returns, the Council of Economic Advisers further explains that, because long-term interest rates have fallen, a discount rate based on the consumption rate of interest "should be at most 2 percent,"[153] which further confirms that applying a 7% rate to a context like climate change would be wildly out of step with the latest data and theory. Similarly, recent expert elicitations—a technique supported by Circular A-4 for filling in gaps in knowledge[154]—indicate that a growing consensus among experts in climate economics for a discount rate between 2% and 3%; 5% represents the upper range of values recommended by experts, and few to no experts support discount rates greater than 5% being applied to the costs and benefits of climate change.[155] Tellingly, none of the integrated assessment models (DICE, FUND, and PAGE) used to build the IWG's estimates of the social cost of greenhouse gases uses a 7% discount rate. Based on current economic data and theory, the most appropriate discount rate for climate change is 3% or lower.

Fourth, Circular A-4 requires more of analysts than giving all possible assumptions and scenarios equal attention in a sensitivity analysis; if alternate assumptions would fundamentally change the decision, Circular A-4 requires analysts to select the **most appropriate assumptions from the sensitivity analysis**.

Circular A-4 indicates that significant intergenerational effects will warrant a special sensitivity analysis focused on discount rates even lower than 3%:

> Special ethical considerations arise when comparing benefits and costs across generations. . . It may not be appropriate for society to demonstrate a similar preference when deciding between the well-being of current and future generations. . . If your rule will have important intergenerational benefits or costs you might consider a further sensitivity analysis using a lower but positive discount rate in addition to calculating net benefits using discount rates of 3 and 7 percent.[156]

Elsewhere in Circular A-4, OMB clarifies that sensitivity analysis should not result in a rigid application of all available assumptions regardless of plausibility. Circular A-4 instructs agencies to depart from default assumptions when special issues "call for different emphases" depending on "the sensitivity of the benefit and cost estimates to the key assumptions."[157] More specifically:

---

[152] CEA, *supra* note 143, at 1; *id.* at 3 ("In general the evidence supports lowering these discount rates, with a plausible best guess based on the available information being that the lower discount rate should be at most 2 percent while the upper discount rate should also likely be reduced."); *id.* at 6 ("The Congressional Budget Office, the Blue Chip consensus forecasts, and the Administration forecasts all place the ten year treasury yield at less than 4 percent in the future, while at the same time forecasting CPI inflation of 2.3 or 2.4 percent per year. The implied real ten year Treasury yield is thus below 2 percent in all these forecasts.").

[153] *Id.* at 1.

[154] Circular A-4 at 41.

[155] Peter Howard & Derek Sylvan, *The Economic Climate: Establishing Expert Consensus on the Economics of Climate Change* (Inst. Policy Integrity Working Paper 2015/1); M.A. Drupp, et al., *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%).

[156] Circular A-4 at 35-36.

[157] *Id.* at 3.

23

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd)

> If benefit or cost estimates depend heavily on certain assumptions, you should make those assumptions explicit and carry out *sensitivity analyses using plausible alternative assumptions*. If the value of net benefits changes from positive to negative (or vice versa) or if the relative ranking of regulatory options changes with alternative plausible assumptions, you should conduct further analysis to determine ***which of the alternative assumptions is more appropriate***.[158]

In other words, if using a 7% discount rate would fundamentally change the agency's decision compared to using a 3% or lower discount rate, the agency must evaluate which assumption is most appropriate. Since OMB, the Council of Economic Advisers, the National Academies of Sciences, and the economic literature all conclude that a 7% rate is inappropriate for climate change, agencies should select a 3% or lower rate. Applying a 7% rate to climate effects cannot be justified "based on the best reasonably obtainable scientific, technical, and economic information available" and is inconsistent with the proper treatment of uncertainty over long time horizons.

Finally, to the extent there is uncertainty around the discount rate over long periods of time, the growing economic consensus supports shifting to a declining discount rate framework. Circular A-4 contemplates the use of declining discount rates in its reference to the work of Weitzman.[159] As the Council of Economic Advisers explained earlier this year, Weitzman and others developed the foundation for a declining discount rate approach, wherein rates start relatively higher for near-term costs and benefits but steadily decline over time according to a predetermined schedule until, in the very long-term, very low rates dominate due to uncertainty.[160] The National Academies of Sciences' report also strongly endorses a declining discount rate approach due to uncertainty.[161] In other words, the rational response to a concern about uncertainty over the discount rate is not to abandon the social cost of greenhouse gas methodology, but to apply declining discount rates and to treat the estimates calculated at a constant 3% rate as conservative lower-bound estimates.

One possible schedule of declining discount rates was proposed by Weitzman.[162] It is derived from a broad survey of top economists and other climate experts and explicitly incorporates arguments around interest rate uncertainty. Work by Arrow *et al*, Cropper *et al*, and Gollier and Weitzman, among others,

---

[158] *Id.* at 42 (emphasis added).

[159] Circular A-4, at page 36, cites to Weitzman's chapter in Portney & Weyant, eds. (1999); that chapter, at page 29, recommends a declining discount rate approach: "a sliding-scale social discounting strategy" with the rate at 3-4% through year 25; then around 2% until year 75; then around 1% until year 300; and then 0% after year 300.

[160] CEA, *supra* note 143, at 9 ("[A]nother way to incorporate uncertainty when discounting the benefits and costs of policies and projects that accrue in the far future—applying discount rates that decline over time. This approach uses a higher discount rate initially, but then applies a graduated schedule of lower discount rates further out in time. The first argument is based on the application of the Ramsey framework in a stochastic setting (Gollier 2013), and the second is based on Weitzman's 'expected net present value' approach (Weitzman 1998, Gollier and Weitzman 2010). In light of these arguments, the governments of the United Kingdom and France apply declining discount rates to their official public project evaluations.").

[161] NAS Second Report, *supra*.

[162] Martin L. Weitzman, *Gamma Discounting*, 91 AM. ECON. REV. 260, 270 (2001). Weitzman's schedule is as follows:

1-5 years	6-25 years	26-75 years	76-300 years	300+ years
4%	3%	2%	1%	0%

24

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work — Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW — SIERRA CLUB

CO2-1 (cont'd) similarly argue for a declining interest rate schedule and lay out the fundamental logic.[163] Another schedule of declining discount rates has been adopted by the United Kingdom.[164]

The technical appendix on discounting attached to these comments more thoroughly reviews the various schedules of declining discount rates available for agencies to select and explains why agencies not only can but should adopt a declining discount framework to address uncertainty. An additional technical appendix on uncertainty explains in detail why uncertainty around the social cost of greenhouse gas points toward higher values. Shifting to a declining discount rate framework would increase the social cost of greenhouse gases.[165] Consequently, a central estimate calculated at 3% should be considered a lower-bound of the social cost of greenhouse gases. But even providing a lower-bound estimate of the social cost of greenhouse gases helps inform decisionmakers and the public, and FERC is required by NEPA to provide some monetization of climate damages, consistent with economic best practices.

Similarly, a 300-year time horizon is required by best economic practices. In 2017, the National Academies of Sciences issued a report stressing the importance of a longer time horizon for calculating the social cost of greenhouse gases. The report states that, "[i]n the context of the socioeconomic, damage, and discounting assumptions, the time horizon needs to be long enough to capture the vast majority of the present value of damages."[166] The report goes on to note that the length of the time horizon is dependent "on the rate at which undiscounted damages grow over time and on the rate at which they are discounted. Longer time horizons allow for representation and evaluation of longer-run geophysical system dynamics, such as sea level change and the carbon cycle."[167] In other words, after selecting the appropriate discount rate based on theory and data (in this case, 3% or below), analysts should determine the time horizon necessary to capture all costs and benefits that will have important net present values at the discount rate. Therefore, a 3% or lower discount rate for climate change implies the need for a 300-year horizon to capture all significant values. NAS reviewed the best available, peer-reviewed scientific literature and concluded that the effects of greenhouse gas emissions over a 300-year period are sufficiently well established and reliable as to merit consideration in estimates of the social cost of greenhouse gases.[168]

Agencies Should Follow the Social Cost of Greenhouse Gas Protocol's Treatment of Uncertainty

---

[163] Kenneth J. Arrow et al., *Determining Benefits and Costs for Future Generations*, 341 SCIENCE 349 (2013); Kenneth J. Arrow et al., *Should Governments Use a Declining Discount Rate in Project Analysis?*, REV ENVIRON ECON POLICY 8 (2014); Maureen L. Cropper et al., *Declining Discount Rates*, AMERICAN ECONOMIC REVIEW: PAPERS AND PROCEEDINGS (2014); Christian Gollier & Martin L. Weitzman, *How Should the Distant Future Be Discounted When Discount Rates Are Uncertain?* 107 ECONOMICS LETTERS 3 (2010).

[164] Joseph Lowe, H.M. Treasury, U.K., Intergenerational Wealth Transfers and Social Discounting: Supplementary Green Book Guidance 5 (2008), *available at* http://www.hm-treasury.gov.uk/d/4(5).pdf. The U.K. declining discount rate schedule that subtracts out a time preference value is as follows:

0-30 years	31-75 years	76-125 years	126-200 years	201-300 years	301+ years
3.00%	2.57%	2.14%	1.71%	1.29%	0.86%

[165] This assumes the use of reasonable values in the Ramsey equation. But in general, as compared to a constant discount rate, a declining rate approach should decrease the effective discount rate.

[166] NAS Second Report, *supra* note 61, at 78.

[167] *Id.*

[168] NAS First Report, *supra* note 62, at 32.

25

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) The approach developed and utilized by the IWG remains the best methodology, based on the best currently available scientific and economic data. In particular, the IWG modeled the uncertainty over the value of the equilibrium climate sensitivity parameter using the Roe and Baker distribution calibrated to the IPCC reports. Using well-established analytic tools to capture and reflect uncertainty, including a Monte Carlo simulation to randomly select the equilibrium climate sensitivity parameter and other uncertainty parameters selected by the model developers, the IWG quantitatively modeled the uncertainty underlying how greenhouse gas emissions affect temperature. Rather than guess about "a range of potential global temperature changes that may result," NHTSA must undertake a quantitative assessment of uncertainty and can rely on the same models and methodologies as the IWG to connect each ton of greenhouse gases avoided or emitted as a result of the CAFE standards with the associated global climate effects.[169]

To further deal with uncertainty, the IWG recommended to agencies a range of four estimates: three central or mean-average estimates at a 2.5%, 3%, and 5% discount rate respectively, and a 95th percentile value at the 3% discount rate. While the IWG's technical support documents disclosed fuller probabilities distributions, these four estimates were chosen by agencies to be the focus for decisionmaking. In particular, application of the 95th percentile value was not part of an effort to show the probability distribution around the 3% discount rate; rather, the 95th percentile value serves as a methodological shortcut to approximate the uncertainties around low-probability but high-damage, catastrophic, or irreversible outcomes that are currently omitted or undercounted in the economic models.

The shape of the distribution of climate risks and damages includes a long tail of lower-probability, high-damage, irreversible outcomes due to "tipping points" in planetary systems, inter-sectoral interactions, and other deep uncertainties. Climate damages are not normally distributed around a central estimate, but rather feature a significant right skew toward catastrophic outcomes. In fact, a 2015 survey of economic experts concludes that catastrophic outcomes are increasingly likely to occur.[170] Because the three integrated assessment models that the IWG's methodology relied on are unable to systematically account for these potential catastrophic outcomes, a 95th percentile value was selected instead to account for such uncertainty. There are no similarly systematic biases pointing in the other direction which might warrant giving weight to a low-percentile estimate. Consequently, in any treatment of uncertainty, NHTSA should give sufficient attention to the long tail on the probability distribution that extends into high temperature ranges and catastrophic damages.

Additionally, the 95th percentile value addresses the strong possibility of widespread risk aversion with respect to climate change. The integrated assessment models do not reflect that individuals likely have a higher willingness to pay to reduce low-probability, high-impact damages than they do to reduce the likelihood of higher-probability but lower impact damages with the same expected cost. Beyond individual members of society, governments also have reasons to exercise some degree of risk aversion to irreversible outcomes like climate change.

[169] NHTSA may have used other methodologies for quantitative assessment of uncertainty in the past.

[170] Policy Integrity, *Expert Consensus on the Economics of Climate Change* 2 (2015), *available at* http://policyintegrity.org/files/publications/ExpertConsensusReport.pdf [hereinafter *Expert Consensus*] ("Experts believe that there is greater than a 20% likelihood that this same climate scenario would lead to a 'catastrophic' economic impact (defined as a global GDP loss of 25% or more)."). *See also* Robert Pindyck, *The Social Cost of Carbon Revisited* (National Bureau of Economic Research, No. w22807, 2016).

26

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work · Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW · SIERRA CLUB

CO2-1 (cont'd) In short, the 95th percentile estimate attempts to capture risk aversion and uncertainties around lower-probability, high-damage, irreversible outcomes that are currently omitted or undercounted by the models. There is no need to balance out this estimate with a low-percentile value, because the reverse assumptions are not reasonable:

- There is no reason to believe the public or the government will be systematically risk seeking with respect to climate change.[171]
- The consequences of overestimating the risk of climate damages (i.e., spending more than we need to on mitigation and adaptation) are not nearly as irreversible as the consequences of underestimating the risk of climate damage (i.e., failing to prevent catastrophic outcomes).
- Though some uncertainties might point in the direction of lower social cost of greenhouse gas values, such as those related to the development of breakthrough adaptation technologies, the models already account for such uncertainties around adaptation; on balance, most uncertainties strongly point toward higher, not lower, social cost of greenhouse gas estimates.[172]
- There is no empirical basis for any "long tail" of potential benefits that would counteract the potential for extreme harm associated with climate change.

Moreover, even the best existing estimates of the social cost of greenhouse gases are likely underestimated because the models currently omit many significant categories of damages—such as depressed economic growth, pests, pathogens, erosion, air pollution, fire, dwindling energy supply, health costs, political conflict, and ocean acidification—and because of other methodological choices.[173] There is little to no support among economic experts to give weight to any estimate lower than the 5% discount rate estimate.[174] Rather, even a discount rate at 3% or below likely continues to underestimate the true social cost of greenhouse gases.

---

[171] As a 2009 survey revealed, the vast majority of economic experts support the idea that "uncertainty associated with the environmental and economic effects of greenhouse gas emissions increases the value of emission controls, assuming some level of risk-aversion." *See Expert Consensus, supra* note 170, at 3 (citing 2009 survey).

[172] *See* Richard L. Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, 508 NATURE 173 (2014). R. Tol, *The Social Cost of Carbon*, 3 Annual Rev. Res. Econ. 419 (2011) ("[U]ndesirable surprises seem more likely than desirable surprises. Although it is relatively easy to imagine a disaster scenario for climate change—for example, involving massive sea level rise or monsoon failure that could even lead to mass migration and violent conflict—it is not at all easy to imagine that climate change will be a huge boost to human welfare.").

[173] *See* Revesz et al., *Global Warming: Improve Economic Models of Climate Change*, *supra* note 172; Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* (Cost of Carbon Project Report, 2014); Frances C. Moore & Delavane B. Diaz, *Temperature Impacts on Economic Growth Warrant Stringent Mitigation Policy*, 5 NATURE CLIMATE CHANGE 127 (2015) (demonstrating SCC may be biased downward by more than a factor of six by failing to include the climate's effect on economic growth).

[174] The existing estimates based on the 5% discount rate already provides a lower-bound; indeed, if anything the 5% discount rate is already far too conservative as a lower-bound. A recent survey of 365 experts on the economics of climate change found that 90% of experts believe a 3% discount rate or lower is appropriate for climate change; a 5% discount rate falls on the extremely high end of what experts would recommend. *Expert Consensus, supra* note 170, at 21; *see also* Drupp, M.A., et al. *Discounting Disentangled: An Expert Survey on the Determinants of the Long-Term Social Discount Rate* (London School of Economics and Political Science Working Paper, May 2015) (finding consensus on social discount rates between 1-3%). Only 8% of the experts surveyed believe that the central estimate of the social cost of carbon is below $40, and 69% of experts believed the value should be at or above the central estimate of $40. *Expert Consensus, supra* note 170, at 18.

27

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) The National Academies of Sciences did recommend that the IWG document its full treatment of uncertainty in an appendix and disclose low-probability as well as high-probability estimates of the social cost of greenhouse gases.[175] However, that does not mean it would be appropriate for individual agencies to rely on low-percentile estimates to justify decisions. While disclosing low-percentile estimates as a sensitivity analysis may promote transparency, relying on such an estimate for decisionmaking—in the face of contrary guidance from the best available science and economics on uncertainty and risk—would not be a "credible, objective, realistic, and scientifically balanced" approach to uncertainty.

More generally, agencies in general—and FERC in this particular instance—should remember that uncertainty is *not* a reason to abandon the social cost of greenhouse gas methodologies; quite the contrary uncertainty supports higher estimates of the social cost of greenhouse gases, because most uncertainties regarding climate change entail tipping points, catastrophic risks, and unknown unknowns about the damages of climate change. Because the key uncertainties of climate change include the risk of irreversible catastrophes, applying an options value framework to the regulatory context strengthens the case for ambitious regulatory action to reduce greenhouse gas emissions. There are numerous well-established, rigorous analytical tools available to help agencies characterize and quantitatively assess uncertainty, such as Monte Carlo simulations, and the IWG's social cost of greenhouse gas protocol incorporates those tools. For more details, please see the attached technical appendix on uncertainty.

Sincerely,

Elly Benson, Staff Attorney, Sierra Club

Susanne Brooks, Director of U.S. Climate Policy and Analysis, Environmental Defense Fund

Tomás Carbonell, Senior Attorney and Director of Regulatory Policy, Environmental Defense Fund

Denise Grab, Western Regional Director, Institute for Policy Integrity, NYU School of Law*

Peter H. Howard, Ph.D., Economic Director, Institute for Policy Integrity, NYU School of Law*

Iliana Paul, Policy Associate, Institute for Policy Integrity, NYU School of Law*

Richard L. Revesz, Director, Institute for Policy Integrity, NYU School of Law*

Martha Roberts, Senior Attorney, Environmental Defense Fund

Jason A. Schwartz, Legal Director, Institute for Policy Integrity, NYU School of Law*

Jeffrey Shrader, Economics Fellow, Institute for Policy Integrity, NYU School of Law*

Peter Zalzal, Director of Special Projects and Senior Attorney, Environmental Defense Fund

For any questions regarding these comments, please contact jason.schwartz@nyu.edu.

* No part of this document purports to present New York University School of Law's views, if any.

[175] Nat'l Acad. Of Sci., *Assessment of Approaches to Updating the Social Cost of Carbon* 49 (2016) ("[T]he IWG could identify a high percentile (e.g., 90th, 95th) and corresponding low percentile (e.g., 10th, 5th) of the SCC frequency distributions on each graph.").

28

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work
Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW
SIERRA CLUB

29

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

Technical Appendix: Uncertainty

CO2-1 (cont'd)

Contrary to the arguments made by many opposed to strong federal climate action, uncertainty about the full effects of climate change *raises* the social cost of greenhouse gases and warrants *more* stringent climate policy.[176] Integrated assessment models (IAMs) currently used to calculate the SCC show that the net effect of uncertainty about economic damage resulting from climate change, costs of mitigation, future economic development, and many other parameters raises the SCC compared to the case where models simply use our current best guesses of these parameters.[177] Even so, IAMs still underestimate the impact of uncertainty on the SCC by not accounting for a host of fundamental features of the climate problem: the irreversibility of climate change, society's aversion to risk and other social preferences, option value, and many catastrophic impacts.[178] Rather than being a reason not to take action, uncertainty increases the SCC and should lead to more stringent policy to address climate change.[179]

Types of Uncertainty in the IAMs

IAMs incorporate two types of uncertainty: parametric uncertainty and stochastic uncertainty. Parametric uncertainty covers uncertainty in model design and inputs, including the selected parameters, correct functional forms, appropriate probability distribution functions, and model structure. With learning, these uncertainties should decline over time as more information becomes available.[180] Stochastic uncertainty is persistent randomness in the economic-climate system, including various environmental phenomena such as volcanic eruptions and sun spots.[181] Uncertainties are

---

[176] Peterson (2006) states "Most modeling results show (as can be expected) that there is optimally more emission abatement if uncertainties in parameters or the possibility of catastrophic events are considered." Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, *11*(1), 1-17.

[177] Tol, R. S. (1999). Safe policies in an uncertain climate: an application of FUND. *Global Environmental Change*, *9*(3), 221-232; Peterson, S. (2006). Uncertainty and economic analysis of climate change: A survey of approaches and findings. *Environmental Modeling & Assessment*, *11*(1), 1-17; IWG, 2016 TSD, *supra*.

[178] Pindyck, R. S. (2007). Uncertainty in environmental economics. *Review of environmental economics and policy*, *1*(1), 45-65; Golub, A., Narita, D., & Schmidt, M. G. (2014). Uncertainty in integrated assessment models of climate change: Alternative analytical approaches. *Environmental Modeling & Assessment*, *19*(2), 99-109; Lemoine, D., & Rudik, I. (2017). Managing Climate Change Under Uncertainty: Recursive Integrated Assessment at an Inflection Point. *Annual Review of Resource Economics* 9:18.1-18.26.

[179] *See* cites *supra* note 178.

[180] Learning comes in multiple forms: passive learning of anticipated information that arrives exogenous to the emission policy (such as academic research), active learning of information that directly stems from the choice of the GHG emission level (via the policy process), and learning of unanticipated information (Kann and Weyant, 2000; Lemoine and Rudik, 2017).

[181] Kann, A., & Weyant, J. P. (2000). Approaches for performing uncertainty analysis in large-scale energy/economic policy models. *Environmental Modeling & Assessment*, *5*(1), 29-46; Peterson (2006), *supra* note 176; Golub et al. *supra* note 178.

A potential third type of uncertainty arises due to ethical or value judgements: normative uncertainty. Peterson (2006) *supra* note 176; Heal, G., & Millner, A. (2014). Reflections: Uncertainty and decision making in climate change economics. *Review of Environmental Economics and Policy*, *8*(1), 120-137. For example, there is some normative debate over the appropriate consumption discount rate to apply in climate economics, though widespread consensus exists that using the social opportunity cost of capital is inappropriate (see earlier discussion). Preference uncertainty should be modeled as a declining discount rate over time (see earlier discussion), not using uncertain parameters. Kann & Weyant, *supra* note 181.

30

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work

Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW

SIERRA CLUB

CO2-1 (cont'd) present in each component of the IAMs: socio-economic scenarios, the simple climate model, the damage and abatement cost functions, and the social welfare function (including the discount rate).[182]

When modeling climate change uncertainty, scientists and economists have long emphasized the importance of accounting for the potential of catastrophic climate change.[183] Catastrophic outcomes combine several overlapping concepts including unlucky states of the world (i.e., bad draws), deep uncertainty, and climate tipping points and elements.[184] Traditionally, IAM developers address uncertainty by specifying probability distributions over various climate and economic parameters. This type of uncertainty implies the possibility of an especially bad draw if multiple uncertain parameters turn out to be lower than we expect, causing actualclimate damages to greatly exceed expected damages.

Our understanding of the climate and economic systems is also affected by so-called "deep uncertainty," which can be thought of as uncertainty over the true probability distributions for specific climate and economic parameters.[185] The mean and variance of many uncertain climate phenomena are unknown due to lack of data, resulting in "fat-tailed distributions"—i.e., the tail of the distributions decline to zero slower than the normal distribution. Fat-tailed distributions result when the best guess of the distribution is derived under learning.[186] Given the general opinion that bad surprises are likely to outweigh good surprises in the case of climate change,[187] modelers capture deep uncertainty by selecting probability distributions with a fat upper tail which reflects the greater likelihood of extreme events.[188] The possibility of fat tails increases the likelihood of a "very" bad draw with high economic costs, and can result in a very high (and potentially infinite) expected cost of climate change (a phenomenon known as the dismal theory).[189]

Climate tipping elements are environmental thresholds where a small change in climate forcing can lead to large, non-linear shifts in the future state of the climate (over short and long periods of time) through positive feedback (i.e., snowball) effects.[190] Tipping points refer to economically relevant thresholds

---

[182] Peterson (2006), *supra* note 176; Pindyck (2007), *supra* note 178; Heal & Millner, *supra* note 181.

[183] Nordhaus, W. D. (2008). A question of balance: Weighing the options on global warming policies. Yale University Press; Kopp, R. E., Shwom, R. L., Wagner, G., & Yuan, J. (2016). Tipping elements and climate–economic shocks: Pathways toward integrated assessment. *Earth's Future*, 4(8), 346-372.

[184] Kopp et al. (2016), *supra* note 183.

[185] *Id.*

[186] Nordhaus, W. D. (2009). An Analysis of the Dismal Theorem (No. 1686). Cowles Foundation Discussion Paper; Weitzman, M. L. (2011). Fat-tailed uncertainty in the economics of catastrophic climate change. Review of Environmental Economics and Policy, 5(2), 275-292; Pindyck, R. S. (2011). Fat tails, thin tails, and climate change policy. *Review of Environmental Economics and Policy*, *5*(2), 258-274.

[187] Mastrandrea, M. D. (2009). Calculating the benefits of climate policy: examining the assumptions of integrated assessment models. Pew Center on Global Climate Change Working Paper; Tol, R. S. (2012). On the uncertainty about the total economic impact of climate change. *Environmental and Resource Economics*, *53*(1), 97-116.

[188] Weitzman (2011), *supra* note 186, makes clear that "deep structural uncertainty about the unknown unknowns of what might go very wrong is coupled with essentially unlimited downside liability on possible planetary damages. This is a recipe for producing what are called 'fat tails' in the extreme of critical probability distributions."

[189] Weitzman, M. L. (2009). On modeling and interpreting the economics of catastrophic climate change. The Review of Economics and Statistics, 91(1), 1-19; Nordhaus (2009), *supra* note 186; Weitzman (2011), *supra* note 186.

[190] Tipping elements are characterized by: (1) deep uncertainty, (2) absence from climate models, (3) larger resulting changes relative to the initial change crossing the relevant threshold, and (4) irreversibility. Kopp et al. (2016), *supra* note 183.

31

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) after which change occurs rapidly (i.e., Gladwellian tipping points), such that opportunities for adaptation and intervention are limited.[191] Tipping point examples include the reorganization of the Atlantic meridional overturning circulation (AMOC) and a shift to a more persistent El Niño regime in the Pacific Ocean.[192] Social tipping points—including climate-induced migration and conflict—also exist. These various tipping points interact, such that triggering one tipping point may affect the probabilities of triggering other tipping points.[193] There is some overlap between tipping point events and fat tails in that the probability distributions for how likely, how quick, and how damaging tipping points will be are unknown.[194] Accounting fully for these most pressing, and potentially most dramatic, uncertainties in the climate-economic system matter because humans are risk averse and tipping points—like many other aspects of climate change—are, by definition, irreversible

How IAMs and the IWG Account for Uncertainty

Currently, IAMs (including all of those used by the IWG) capture uncertainty in two ways: deterministically and through uncertainty propagation. For the deterministic method, the modeler assumes away uncertainty (and thus the possibility of bad draws and fat tails) by setting parameters equal to their most likely (median) value. Using these values, the modeler calculates the median SCC value. Typically, the modeler conducts sensitivity analysis over key parameters—one at a time or jointly—to determine the robustness of the modeling results. This is the approach employed by Nordhaus in the preferred specification of the DICE model[195] used by the IWG.

Uncertainty propagation is most commonly carried out using Monte Carlo simulation. In these simulations, the modeler randomly draws parameter values from each of the model's probability distributions, calculates the SCC for the draw, and then repeats this exercise thousands of times to calculate a mean social cost of carbon.[196] Tol, Anthoff, and Hope employ this technique in FUND and PAGE—as did the IWG (2010, 2013, and 2016)—by specifying probability distributions for the climate and economic parameters in the models. These models are especially helpful for assessing the net effect of different parametric and stochastic uncertainties. For instance, both the costs of mitigation and the damage from climate change are uncertain. Higher costs would warrant less stringent climate policies,

---

[191] *Id.*

[192] *Id.*; Kriegler, E., Hall, J. W., Held, H., Dawson, R., & Schellnhuber, H. J. (2009). Imprecise probability assessment of tipping points in the climate system. *Proceedings of the national Academy of Sciences*, *106*(13), 5041-5046; Diaz, D., & Keller, K. (2016). A potential disintegration of the West Antarctic Ice Sheet: Implications for economic analyses of climate policy. *The American Economic Review*, *106*(5), 607-611. See Table 1 of Kopp et al. (2016) *supra* note 183, for a full list of known tipping elements and points.

[193] Kriegler et al. (2009), *supra* note 192; Cai, Y., Lenton, T. M., & Lontzek, T. S. (2016). Risk of multiple interacting tipping points should encourage rapid CO2 emission reduction; Kopp et al. (2016) *supra* note 183.

[194] Peter Howard, *Omitted Damages: What's Missing from the Social Cost of Carbon* 5 (Cost of Carbon Project Report, 2014), http://costofcarbon.org/; Kopp et al. (2016) *supra* note 183.

[195] Nordhaus, W. & Sztorc, P. (2013). DICE 2013: Introduction & User's Manual. Retrieved from Yale University, Department of Economics website: http://www.econ.yale.edu/~nordhaus/homepage/documents/Dicemanualfull

[196] In alternative calculation method, the modeler "performs optimization of polices for a large number of possible parameter combinations individually and estimates their probability weighted sum." Golub et al. *supra* note 178. In more recent DICE-2016, Nordhaus conducts a three parameter analysis using this method to determine a SCC confidence interval. Given that PAGE and FUND model hundred(s) of uncertainty parameters, this methodology appears limited in the number of uncertain variables that can be easily specified.

32

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) while higher damages lead to more stringent policy, so theoretically, the effect of these two factors on climate policy could be ambiguous. Uncertainty propagation in an IAM calibrated to empirically motivated distributions, however, shows that climate damage uncertainty outweighs the effect of cost uncertainty, leading to a stricter policy when uncertainty is taken into account than when it is ignored.[197] This can be seen in the resulting right-skewed distribution of the SCC (see Figure 1 in IWG (2016)) where the mean (Monte Carlo) SCC value clearly exceeds the median (deterministic) SCC value.

The IWG was rigorous in addressing uncertainty. First, it conducted Monte Carlo simulations over the above IAMs specifying different possible outcomes for climate sensitivity (represented by a right skewed, fat tailed distribution to capture the potential of higher than expected warming). It also used scenario analysis: five different emissions growth scenarios and three discount rates. Second, the IWG (2016) reported the various moments and percentiles—including the 95th percentile—of the resulting SCC estimates. Third, the IWG put in place an updating process, e.g., the 2013 and 2016 revisions, which updates the models as new information becomes available.[198] As such, the IWG used the various tools that economists have developed over time to address the uncertainty inherent in estimating the economic cost of pollution: reporting various measures of uncertainty, using Monte Carlo simulations, and updating estimates as evolving research advances our knowledge of climate change. Even so, the IWG underestimate the SCC by failing to capture key features of the climate problem.

Current IAMs Underestimate the SCC by Failing to Sufficiently Model Uncertainty

Given the current treatment of uncertainty by the IWG (2016) and the three IAMs that they employ, the IWG (2016) estimates represent an underestimate of the SCC. DICE clearly underestimates the true value of the SCC by effectively eliminating the possibility of bad draws and fat tails through a deterministic model that relies on the median SCC value. Even with their calculation of the mean SCC, the FUND and PAGE also underestimate the metric's true value by ignoring key features of the climate-economic problem. Properly addressing the limitations of these models' treatment of uncertainty would further increase the SCC.

First, current IAMs insufficiently model catastrophic impacts. DICE fails to model both the possibility of bad draws and fat tails by applying the deterministic approach. Alternatively, FUND and PAGE ignore deep uncertainty by relying predominately on the thin-tailed triangular and gamma distributions.[199] The IWG (2010) only partially addresses this oversight by replacing the ECS parameter in DICE, FUND, and PAGE with a fat-tailed, right-skewed distribution calibrated to the IPCC's assumptions (2007), even though many other economic and climate phenomenon in IAMs are likely characterized by fat tails, including climate damages from high temperature levels, positive climate feedback effects, and tipping

---

[197] Tol (1999), *supra* note 177, in characterizing the FUND model, states, "Uncertainties about climate change impacts are more serious than uncertainties about emission reduction costs, so that welfare-maximizing policies are stricter under uncertainty than under certainty."

[198] IWG (2010).

[199] Howard (2014), *supra* note 194. While both FUND and PAGE employ thin tailed distributions, the resulting distribution of the SCC is not always thin-tailed. In PAGE09, the ECS parameter is endogenous, such that the distribution of the ECS has a long tail following the IPCC (2007). *See* Chen, Z., Marquis, M., Averyt, K. B., Tignor, M., & Miller, H. L. (2007). Contribution of working group I to the fourth assessment report of the intergovernmental panel on climate change. *Cambridge, UK and New York: Cambridge University Press, 996p.* Similarly, while Anthoff and Tol do not explicitly utilize fat-tail distributions, the distribution of net present welfare from a Monte Carlos simulation is fat tailed. Anthoff, D., & Tol, R. S. (2014). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.8. Available at www.fund-model.org. Explicitly modeling parameter distributions as fat tailed may further increase the SCC.

33

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

points.[200] Recent work in stochastic dynamic programming tends to better integrate fat tails – particularly with respect to tipping points (see below) – and address additional aversion to this type of uncertainty (also known as ambiguity aversion); doing so can further increase the SCC under uncertainty.[201]

In contrast to their approach to fat tails, the IAMs used by the IWG (2010; 2013; 2016) sometimes address climate tipping points, though they do not apply state-of-the-art methods for doing so. In early versions of DICE (DICE-2010 and earlier), Nordhaus implicitly attributes larger portions of the SCC to tipping points by including certainty equivalent damages of catastrophic events - representing two-thirds to three-quarter of damages in DICE – calibrated to an earlier Nordhaus (1994) survey of experts.[202] In PAGE09, Hope also explicitly models climate tipping points as a singular, discrete event (of a 5% to 25% loss in GDP) that has a probability (which grows as temperature increases) of occurring in each time period.[203] Though not in the preferred versions of the IAMs employed by the IWG, some research also integrates specific tipping points into these IAMs finding even higher SCC estimates.[204] Despite the obvious methodological basis for addressing tipping points, the latest versions of DICE[205] and FUND exclude tipping points in their preferred specifications. Research shows that if these models were to correctly account for the full range of climate impacts—including tipping points—the resulting SCC estimates would increase.[206]

---

[200] Weitzman (2011), *supra* note 186; Kopp et al. (2016) *supra* note 183.

[201] Lemoine, D., & Traeger, C. P. (2016a). Ambiguous tipping points. *Journal of Economic Behavior & Organization*, *132*, 5-18; Lemoine & Rudik (2017), *supra* note 178. IAM modelers currently assume that society is equally averse to known unknown and known unknowns. Lemoine & Traeger, *id*.

[202] Nordhaus, W. D., & Boyer, J. (2000). Warning the World: Economic Models of Global Warming. MIT Press (MA); Nordhaus, W. D. (2008). A question of balance: Weighing the options on global warming policies. Yale University Press; Howard (2014), *supra* note 194; Kopp et al. (2016) *supra* note 183.

[203] Hope (2006) also calibrated a discontinuous damage function in PAGE-99 used by IWG (2010). Howard (2014), *supra* note 194.

[204] Kopp et al. (2016) *supra* note 183.

[205] For DICE-2013 and DICE-2016, Nordhaus calibrates the DICE damage function using a meta-analysis based on estimates that mostly exclude tipping point damages. Howard, P. H., & Sterner, T. (2016). Few and Not So Far Between: A Meta-analysis of Climate Damage Estimates. *Environmental and Resource Economics*, 1-29.

[206] Using FUND, Link and Tol (2010) find that a collapse of the AMOC would decrease GDP (and thus increase the SCC) by a small amount. Earlier modeling of this collapse in DICE find a more significance increase. Keller, K., Tan, K., Morel, F. M., & Bradford, D. F. (2000). Preserving the ocean circulation: implications for climate policy. *Climatic Change*, *47*, 17-43; Mastrandrea, M. D., & Schneider, S. H. (2001). Integrated assessment of abrupt climatic changes. *Climate Policy*, *1*(4), 433-449; Keller, K., Bolker, B. M., & Bradford, D. F. (2004). Uncertain climate thresholds and optimal economic growth. *Journal of Environmental Economics and management*, *48*(1), 723-741. With respect to thawing of the permafrost, Hope and Schaefer (2016), Economic impacts of carbon dioxide and methane released from thawing permafrost. *Nature Climate Change*, *6*(1), 56-59, and Gonzalez-Eguino and Neumann (2016), González-Eguino, M., & Neumann, M. B. (2016). Significant implications of permafrost thawing for climate change control. *Climatic Change*, *136*(2), 381-388, find increases in damages (and thus an increase in the SCC) when integrating this tipping element into the PAGE09 and DICE-2013R, respectively. Looking at the collapse of the West Antarctic Ice sheet, Nicholls et al. (2008) find a potential for significant increases in costs (and thus the SCC) in FUND. Nicholls, R. J., Tol, R. S., & Vafeidis, A. T. (2008). Global estimates of the impact of a collapse of the West Antarctic ice sheet: an application of FUND. *Climatic Change*, *91*(1), 171-191. Ceronsky et al. (2011) model three tipping points (collapse of the Atlantic Ocean Meridional Overturning Circulation, large scale dissociation of oceanic methane hydrates; and a high equilibrium climate sensitivity parameter), and finds a large increase in the SCC in some cases. Ceronsky, M., Anthoff, D.,

34

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) The IWG approach also fails to include a risk premium—that is, the amount of money society would require in order to accept the uncertainty (i.e., variance) over the magnitude of warming and the resulting damages from climate change relative to mean damages (IWG, 2010; IWG, 2015)). The mean of a distribution, which is a measure of a distribution's central tendency, represents only one descriptor or "moment" of a distribution's shape. Each IAM parameter and the resulting SCC distributions have differing levels of variance (i.e., spread around the mean), skewness (i.e., a measure of asymmetry), and kurtosis (which, like skewness, is another descriptor of a distribution's tail) as well as means.[207] It is generally understood that people are risk averse in that they prefer input parameter distributions and (the resulting) SCC distributions with lower variances, holding the mean constant.[208] While the IWG assumes a risk-neutral central planner by using a constant discount rate (setting the risk premium to zero), this assumption does not correspond with empirical evidence,[209] current IAM assumptions,[210] the NAS (2017) recommendations, nor with the IWG's own discussion (2010) of the possible values of the elasticity of the marginal utility of consumption. Evidence from behavioral experiments indicate that people and society are also averse to other attributes of parameter distributions – specifically to the thickness of the tails of distributions – leading to an additional ambiguity premium (Heal and Millner, 2014).[211] Designing IAMs to properly account for the risk and ambiguity premiums from uncertain climate damages would increase the resulting SCC values they generate.

Even under the IWG's current assumption of risk neutrality, the mean SCC from uncertainty propagation excludes the (real) option value of preventing marginal CO_2 emissions.[212] Option value reflects the value

---

Hepburn, C., & Tol, R. S. (2011). *Checking the price tag on catastrophe: The social cost of carbon under non-linear climate response* (No. 392). ESRI working paper.

[207] Golub, A., & Brody, M. (2017). Uncertainty, climate change, and irreversible environmental effects: application of real options to environmental benefit-cost analysis. *Journal of Environmental Studies and Sciences*, 1-8; see Figure 1 in IWG (2016).

[208] In other words, society prefers a narrow distribution of climate damages around mean level of damages X to a wider distribution of damages also centered on the same mean of X because they avoid the potential for very high damages even at the cost of eliminating the chance of very low damages.

[209] IWG, 2010, at fn 22; Cai et al., 2016, *supra* note 193, at 521.

[210] The developers of each of the three IAMs used by the IWG (2010; 2013; 2016) assume a risk aversion society. Nordhaus and Sztorc, 2013, *supra*; Anthoff, D., & Tol, R. S. (2010). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.5. Available at www.fund-model.org; Anthoff, D., & Tol, R. S. (2014). The Climate Framework for Uncertainty, Negotiation and Distribution (FUND): Technical description, Version 3.8. Available at www.fund-model.org; Hope, C. (2013). Critical issues for the calculation of the social cost of CO2: why the estimates from PAGE09 are higher than those from PAGE2002. *Climatic Change*, *117*(3), 531-543.

[211] According to Heal and Millner (2014), *supra*, there is an ongoing debate of whether ambiguity aversion is rational or a behavioral mistake. Given the strong possibility that this debate is unlikely to be resolved, the authors recommend exploring both assumptions.

[212] Arrow, K. J., & Fisher, A. C. (1974). Environmental preservation, uncertainty, and irreversibility. *The Quarterly Journal of Economics*, 312-319; Dixit, A.K., Pindyck, R.S., 1994. *Investment Under Uncertainty*. Princeton University Press, Princeton, NJ; Traeger, C. P. (2014). On option values in environmental and resource economics. *Resource and Energy Economics*, *37*, 242-252.

In the discrete emission case, there are two overlapping types of option value: real option value and quasi-option value. Real option value is the full value of future flexibility of maintaining the option to mitigate, and mathematically equals the maximal value that can be derived from the option to [emit] now or later (incorporating learning) less the maximal value that can be derived from the possibility to [emit] now or never. Traeger, C. P. (2014). On option values in environmental and resource economics. *Resource and Energy Economics*, *37*, 242-252, equation 5. Quasi-option value is the value of future learning conditional on delaying the emission decision, which mathematically equals the value of mitigation to the decision

35

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

CO2-1 (cont'd) of future flexibility due to uncertainty and irreversibility; in this case, the irreversibility of CO2 emissions due to their long life in the atmosphere.[213] If society exercises the option of emitting an additional unit of CO2 emissions today, "we will lose future flexibility that the [mitigation] option gave" leading to possible "regret and…a desire to 'undo'" the additional emission because it "constrains future behavior."[214] Given that the SCC is calculated on the Business as Usual (BAU) emission pathway, option value will undoubtedly be positive for an incremental emission because society will regret this emission in most possible futures.

Though sometimes the social cost of carbon and a carbon tax are thought of as interchangeable ways to value climate damages, agencies should be careful to distinguish two categories of the literature. The first is the economic literature that calculates the optimal carbon tax in a scenario where the world has shifted to an optimal emissions pathway. The second is literature that assesses the social cost of carbon on the business-as-usual (BAU) emissions pathway; the world is currently on the BAU pathway, since optimal climate policies have not been implemented. There are currently no numerical estimates of the risk premium and option value associated with an incremental emission on the BAU emissions path. Although there are stochastic dynamic optimization models that implicitly account for these two values, they analyze *optimal*, sequential decision making under climate uncertainty.[215] By nature of being optimization models (instead of policy models), these complex models focus on calculating the optimal tax and not the social cost of carbon, which differ in that the former is the present value of marginal damages on the optimal emissions path rather than on the BAU emissions path.[216] While society faces the irreversibility of emissions on the BAU emissions path when abatement is essentially near zero (i.e., far below the optimal level even in the deterministic problem),[217] the stochastic dynamic optimization model must also account for a potential counteracting abatement cost irreversibility – the sunk costs of investing in abatement technology if we learn that climate change is less severe than expected – by the

---

maker who anticipates learning less the value of mitigation to the decision maker who anticipates only the ability to delay his/her decision, and not learning. *Id.* The two values are related, such that real option value can be decomposed into:

$$\mathrm{DPOV} = \mathbf{Max}\{QOV + SOV - \mathbf{Max}\{NPV, 0\}, 0\} = \mathbf{Max}\{QOV + SOV - \mathrm{SCC}, 0\}$$

where DPOV is the real option value, QOV is quasi-option value, SOV is simple option value (the value of the option to emit in the future condition on mitigating now), and NPV is the expected net present value of emitting the additional unit or the mean SCC in our case. *Id.*

[213] Even if society drastically reduced CO2 emissions, CO2 concentrations would continue to rise in the near future and many impacts would occur regardless due to lags in the climate system. Pindyck, R. S. (2007). Uncertainty in environmental economics. *Review of environmental economics and policy*, *1*(1), 45-65.

[214] Pindyck (2007).

[215] Kann & Weyant, *supra*; Pindyck (2007), *supra*; Golub et al. (2014), *supra*.

[216] Nordhaus (2014) makes this difference clear when he clarifies that "With an optimized climate policy…the SCC will equal the carbon price…In the more realistic case where climate policy is not optimized, it is conventional to measure the SCC as the marginal damage of emissions along the actual path. There is some inconsistency in the literature on the definition of the path along which the SCC should be calculated. This paper will generally define the SCC as the marginal damages along the baseline path of emissions and output and not along the optimized emissions path." Nordhaus, W. (2014). Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches. *Journal of the Association of Environmental and Resource Economists*, *1*(1/2), 273-312.

[217] On the BAU path, emissions far exceed their optimal level even without considering uncertainty. As a consequence, society is likely to regret an additional emission of CO2 in most future states of the world. Alternatively, society is unlikely to regret current abatement levels unless the extremely unlikely scenarios that there is little to no warming and/or damages from climate change.

36

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) nature of being on the optimal emissions path that balances the cost of emissions and abatement. In the optimal case, uncertainty and irreversibility of abatement *can theoretically* lead to a lower optimal emissions tax, unlike the social cost of carbon. The difference in the implication for the optimal tax and the SCC means that the stochastic dynamic modeling results are less applicable to the SCC.

What can we learn from new literature on stochastic dynamic programming models?

Bearing in mind the limitations of stochastic dynamic modeling, some new research provides valuable insights that are relevant to calculation of the social cost of greenhouse gases. The new and growing stochastic dynamic optimization literature implies that the IWG's SCC estimates are downward biased. The literature is made up of three models – real option, finite horizon, and infinite horizon models – of which the infinite time horizon (i.e., stochastic dynamic programming (SDP)) models are the most comprehensive for analyzing the impact of uncertainty on optimal sequential abatement policies.[218] Recent computational advancements in SDP are helping overcome the need for strong simplifying assumptions in this literature for purpose of tractability. Traditionally, these simplifications led to unrealistically fast rates of learning – leading to incorrect outcomes – and difficulty in comparing results across papers (due to differing uncertain parameters, models of learning, and model types). Even so, newer methods still only allow for a handful of uncertain parameters compared to the hundreds of uncertain parameters in FUND and PAGE. Despite these limitations, the literature supports the above finding that the SCC, if anything, increases under uncertainty.[219]

First, uncertainty increases the optimal emissions tax under realistic parameter values and modeling scenarios. While the impact of uncertainty on the optimal emissions tax (relative to the deterministic problem) depends on the uncertain parameters considered, the type of learning, and the model type (real option, finite horizon, and infinite horizon), the optimal tax clearly increases when tipping points or black swan events are included in stochastic optimization problems.[220] For SDP models, uncertainty tends to strengthen the optimal emissions path relative to the determinist case even without tipping points,[221] and these results are strengthened under realistic preference assumptions.[222] Given that there is no counter-balancing tipping abatement cost,[223] the complete modeling of climate uncertainty –

---

[218] Kann and Weyant, 2000, *supra*; Pindyck, 2007, *supra*; Golub et al., 2014, *supra*.

[219] Kann and Weyant, 2000, *supra*; Pindyck, 2007, *supra*; Golub et al., 2014, *supra*; Lemoine and Rudik, 2017, supra. Comparing the optimal tax to the mean SCC is made further difficult by the frequent use of DICE as the base from which most stochastic dynamic optimization models are built. As a consequence, deterministic model runs are frequently the base of comparison for these models (Lemoine and Rudik, 2017).

[220] The real options literature tends to find an increase in the optimal emissions path under uncertainty relative to the deterministic case (Pindyck, 2007), though the opposite is true when modelers account for the possibility of large damages (i.e., tipping point or black swan events) even with a risk-neutral society (Pindyck, 2007; Golub et al., 2014). Solving finite horizon models employing non-recursive methods, modelers find that the results differ depending on the model of learning – the research demonstrates stricter emission paths under uncertainty without learning (with emission reductions up to 30% in some cases) and the impact under passive learning has a relatively small impact due the presence of sunken mitigation investment costs - except when tipping thresholds are included (Golub et al., 2014).

[221] Using SDP, modelers find that uncertainty over the equilibrium climate sensitivity parameter generally increases the optimal tax by a small amount, though the magnitude of this impact is unclear (Golub et al., 2014; Lemoine and Rudik, 2017). Similarly, non-catastrophic damages can have opposing effects dependent on the parameters changed, though emissions appear to decline overall when you consider their uncertainty jointly.

[222] Pindyck, 2007; Golub et al., 2017; Lemoine and Rudik, 2017

[223] Pindyck, 2007

37

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) which fully accounts for tipping points and fat tails – increases the optimal tax. Uncertainty leads to a stricter optimal emissions policy even if with irreversible mitigation costs, highlighting that the SCC would also increase when factoring in risk aversion and irreversibility given that abatement costs are very low on the BAU emissions path.

Second, given the importance of catastrophic impacts under uncertainty (as shown in the previous paragraph), the full and accurate modeling of tipping points and unknown knowns is critical when modeling climate change. The most sophisticated climate-economic models of tipping points – which include the possibility of multiple correlated tipping points in stochastic dynamic IAMs – find an increase in the optimal tax by 100%[224] to 800%[225] relative to the deterministic case without them. More realistic modeling of tipping points will also increase the SCC.

Finally, improved modeling of preferences will amplify the impact of uncertainty on the SCC. Adopting Epstein-Zin preferences that disentangle risk aversion and time preferences can significantly increase the SCC under uncertainty.[226] Recent research has shown that accurate estimation of decisions under uncertainty crucially depends on distinguishing between risk and time preferences.[227] By conflating risk and time preferences, current models substantially understate the degree of risk aversion exhibited by most individuals, artificially lowering the SCC. Similarly, adopting ambiguity aversion increase the SCC, but to a much lesser extent than risk aversion.[228] Finally, allowing for the price of non-market goods to increase with their relative scarcity can amplify the positive effect that even small tipping points have on the SCC if the tipping point impacts non-market services.[229] Including more realistic preference assumptions in IAMs would further increase the SCC under uncertainty.

---

[224] Lemoine, D., & Traeger, C. P. (2016b). Economics of tipping the climate dominoes. *Nature Climate Change*.

[225] Cai et al., 2016

[226] Cai et al., 2016; Lemoine and Rudik, 2017. The standard utility function adopted in IAMs with constant relative risk version implies that the elasticity of substitution equals the inversion of relative risk aversion. As a consequence, the society's preferences for the intra-generational distribution of consumption, the intergenerational distribution of consumption, and risk aversion hold a fixed relationship. For purposes of stochastic dynamic programming, this is problematic because this assumption conflates intertemporal consumption smoothing and risk aversion. Botzen, W. W., & van den Bergh, J. C. (2014). Specifications of social welfare in economic studies of climate policy: overview of criteria and related policy insights. *Environmental and Resource Economics, 58*(1), 1-33. By adopting the Epstein-Zinn utility function which separates these two parameters, modelers can calibrate them according to empirical evidence. For example, Cai et al. (2016) replace the DICE risk aversion of 1.45 and elasticity parameter of 1/1.45 with values of 3.066 and 1.5, respectively.

[227] James Andreoni & Charles Sprenger, *Risk Preferences Are Not Time Preferences*, 102 AM. ECON. REV. 3357–3376 (2012).

[228] Lemoine, D., & Traeger, C. P. (2016b). Economics of tipping the climate dominoes. *Nature Climate Change*.; Lemoine and Rudik, 2017

[229] Typically, IAMs assume constant relative prices of consumption goods. Gerlagh, R., and B.C.C. Van der Zwaan. 2002. "Long-term substitutability between environmental and man-made goods." *Journal of Environmental Economics and Management 44*(2):329-345; Sterner, T., and U.M. Persson. 2008. "An Even Sterner Review: Introducing Relative Prices into the Discounting Debate." *Review of Environmental Economics and Policy 2*(1):61-76. By replacing the standard isoelastic utility function in IAMs with a nested CES utility function following Sterner and Persson (2008), Cai et al. (2015) find that even a relatively small tipping point (i.e., a 5% loss) can substantially increase the SCC in the stochastic dynamic setting. Cai, Y., Judd, K. L., Lenton, T. M., Lontzek, T. S., & Narita, D. (2015). Environmental tipping points significantly affect the cost– benefit assessment of climate policies. *Proceedings of the National Academy of Sciences, 112*(15), 4606-4611.

38

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) Introducing stochastic dynamic modeling (which captures option value and risk premiums), updating the representation of tipping points, and including more realistic preference structures in traditional IAMs will – as in the optimal tax – further increase the SCC under uncertainty

Conclusion: Uncertainty Raises the Social Cost of Greenhouse Gases

Overall, the message is clear: climate uncertainty is *never* a rationale for ignoring the SCC or shortening the time horizon of IAMs. Instead, our best estimates suggest that increased variability implies a higher SCC and a need for more stringent emission regulations.[230] Current omission of key features of the climate problem under uncertainty (the risk and climate premiums, option value, and fat tailed probability distributions) and incomplete modeling of tipping points imply that the SCC will further increase with the improved modeling of uncertainty in IAMs.

[230] Golub et al. (2014) states "The most important general policy implication from the literature is that despite a wide variety of analytical approaches addressing different types of climate change uncertainty, none of those studies supports the argument that no action against climate change should be taken until uncertainty is resolved. On the contrary, uncertainty despite its resolution in the future is often found to favor a stricter policy."

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work | Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW | SIERRA CLUB

Technical Appendix: Discounting

CO2-1 (cont'd)

The Underlying IAMs All Use a Consumption Discount Rate

Employing a consumption discount rate would also ensure that the U.S. government is consistent with the assumptions employed by the underlying IAM models: DICE, FUND, and PAGE. Each of these IAMs employs consumption discount rates calibrated using the standard Ramsey formula (Newell, 2017). In DICE-2010, the elasticity of the pure rate of time preference is 1.5 and an elasticity of the marginal utility of consumption (η) of 2.0. Together with its assumed per capita consumption growth path, the average discount rate over the next three hundred years is 2.4%.[231] However, more recent versions of DICE (DICE-2013R and DICE-2016) update η to 1.45; this implies an increase of the average discount rate over the timespan of the models to between 3.1% and 3.2% depending on the consumption growth path.[232] In FUND 3.8 and (the mode values in) PAGE09, both model parameters are equal to 1.0. Based on the assumed growth rate of the U.S. economy (without climate damages), the average U.S. discount rate in FUND 3.8 is 2.0% over the timespan of the model (without considering climate damages). Unlike FUND 3.8, PAGE09 specifies triangular distributions for both parameters with a pure rate of time preference of between 0.1 and 2 with a mean of 1.03 and an elasticity of the marginal utility of consumption of between 0.5 and 2 with a mean 1.17. Using the PAGE09's mode values (without accounting for climate damages), the average discount rate over the timespan of the models is approximately 3.3% with a range of 1.2% to 6.5%. Rounding up the annual growth rate over the last 50 years to approximately 2%,[233] the range of best estimates of the SDR implied in the short-run by these three models is approximately 3% (PAGE09's mode estimate and FUND 3.8) to 4.4% (DICE-2016), though the PAGE09 model alone implies a range of 1.1% to 6.0% with a central estimate of 3%. The range of potential consumption discount rates in these IAMs is relatively consistent with IWG (2010; 2013; 2016) in the short-run, though the discount rates of the IAMs employed by the IWG decline over time (due to declining growth rates over time) implying a potential upward bias to the IWG consumption discount rates.

A Declining Discount Rate is Justified to Address Discount Rate Uncertainty

A strong consensus has developed in economics that the appropriate way to discount intergenerational benefits is through a declining discount rate (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014).[234] Not only are declining discount rate theoretically correct, they are actionable (i.e., doable given our current knowledge) and consistent with OMB's *Circular A-4*. Perhaps

[231] Due to a slowing of global growth, DICE-2010 implies a declining discount rate schedule of 5.1% in 2015, 3.9% from 2015 to 2050; 2.9% from 2055 to 2100; 2.2% from 2105 to 2200, and 1.9% from 2205 to 2300. This would be a steeper decline if Nordhaus accounted for the positive and normative uncertainty underlying the SDR.

[232] Due to a slowing of global growth, DICE-2016 implies a declining discount rate schedule of 5.1% in 2015, 4.7% from 2015 to 2050; 4.1% from 2055 to 2100; 3.1% from 2105 to 2200, and 2.5% from 2205 to 2300.

[233] According to the World Bank, the average global and United States per capita growth rates were 1.7% and 1.9%, respectively.

[234] Arrow et al. (2014) at 160-161 states that "We have argued that theory provides compelling arguments for using a declining certainty-equivalent discount rate," and concludes the paper by stating "Establishing a procedure for estimating a [declining discount rate] for project analysis would be an improvement over the OMB's current practice of recommending fixed discount rates that are rarely updated."

40

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) the best reason to adopt a declining discount rate is the simple fact that there is considerable uncertainty around which discount rate to use. The uncertainty in the rate points directly to the need to use a declining rate, as the impact of the uncertainty grows exponentially over time such that the correct discount rate is not an arithmetic average of possible discount rates.[235] Uncertainty about future discount rates could stem from a number of sources particularly salient in the context of climate change, including uncertainty about future economic growth, consumption, the consumption rate of interest, and preferences. Additionally, economic theory shows that if there is debate or disagreement over which discount rate to use, this should lead to the use of a declining discount rate (Weitzman, 2001; Heal & Millner, 2014). Though, the range of potential discount rates is limited by theory to potential consumption discount rates (see earlier discussion), which is certainly less than 7%.

There is a consensus that declining discount rates are appropriate for intergenerational discounting

Since the IWG undertook its initial analysis and before the most recent estimates of the SCC, a large and growing majority of leading climate economists consensus (Arrow et al., 2013) has come out in favor of using a declining discount rate for climate damages to reflect long-term uncertainty in interest rates. This consensus view is held whether economists favor descriptive (i.e., market) or prescriptive (i.e., normative) approaches to discounting (Freeman et al., 2015). Several key papers (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014) outline this consensus and present the arguments that strongly support the use of declining discount rates for long-term benefit-cost analysis in both the normative and positive contexts. Finally, in a recent survey of experts on the economics of climate change, Howard and Sylvan (2015), found that experts support using a declining discount rate relative to a constant discount rate at a ratio of approximately 2 to 1.

Economists have recently highlighted two main motivations for using a declining discount rate, which we elaborate on in what follows. First, if the discount rate for a project is fixed but uncertain, then the certainty-equivalent discount rate will decline over time, meaning that benefits should be discounted using a declining rate.[236] Second, uncertainty about the growth rate of consumption or output also implies that a declining discount rate should be used, so long as shocks to consumption are positively correlated over time.[237] In addition to these two arguments, other motivations for declining discount rates have long been recognized. For instance, if the growth rate of consumption declines over time, the Ramsey rule[238] for discounting will lead to a declining discount rate.[239]

[235] Karp (2005) states that mathematical "intuition for this result is that as [time] increases, smaller values of r in the support of the distribution are relatively more important in determining the expectation of e−rt" where r is the constant discount rate." Or as Hepburn et al. (2003) puts it, "The intuition behind this idea is that scenarios with a higher discount rate are given less weight as time passes, precisely because their discount factor is falling more rapidly" over time.

[236] This argument was first developed in Weitzman (1998) and Weitzman (2001).

[237] *See, e.g.*, Gollier (2009).

[238] The Ramsey discount rate equation for the social discount rate is $r = \delta + \eta * g$ where r is the social discount rate, δ is the pure rate of time preference, η is the aversion to inter-generational inequality, and *g* is the growth rate of per capita consumption. For the original development, *see*, Ramsey, F. P. (1928). A Mathematical Theory of Saving. *The Economic Journal, 38*(152).

[239] Higher growth rates lead to higher discounting of the future in the Ramsey model because growth will make future generations wealthier. If marginal utility of consumption declines in consumption, then, one should more heavily discount consumption gains by wealthier generations. Thus, if growth rates decline over time, then the rate at which the future is

41

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

In the descriptive setting adopted by the IWG (2010), economists have demonstrated that calculating the expected net present value of a project is equivalent to discounting at a declining certainty equivalent discount rate when (1) discount rates are uncertain, and (2) discount rates are positively correlated (Arrow et al., 2014 at 157). Real consumption interest rates are uncertain given that there are no multi-generation assets to reflect long-term discount rates and the real returns to all assets—including government bonds—are risky due to inflation and default risk (Gollier & Hammitt, 2014). Furthermore, recent empirical work analyzing U.S. government bonds demonstrates that they are positively correlated over time; this empirical work has estimated several declining discount rate schedules that the IWG can use (Cropper et al., 2014; 2014; Arrow et al., 2013; Arrow et al., 2014; Jouini and Napp, 2014; Freeman et al. 2015).

Currently when evaluating projects, the U.S. government applies the descriptive approach using constant rates of 3% and 7% based on the private rates of return on consumer savings and capital investments. As discussed previously, applying a capital discount rate to climate change costs and benefits is inappropriate (Newell, 2017). Instead, analysis should focus on the uncertainty underlying the future consumption discount rate (Newell, 2017). Past U.S. government analyses (IWG, 2010; IWG, 2013; IWG, 2016) modeled three consumption discount rates reflecting this uncertainty. If the U.S. government correctly returns its focus on multiple consumption discount rates, then the expected net present value argument given above implies that a declining discount rate is the appropriate way to perform discounting. As an alternative, given that the Ramsey discount rate approach is the appropriate methodology in intergenerational settings, the U.S. government could use a fixed, low discount rate as an approximation of the Ramsey equation following the recommendation of Marten et al. (2015); see our discussion on Martin et al. 2015). This is roughly IWG (2010)'s goal for using the constant 2.5% discount rate.

If the normative approach to discounting is used in the future (i.e., the current approach of IAMs), economists have demonstrated that an extended Ramsey rule[240] implies a declining discount rate when (1) the growth rate of per capita consumption is stochastic,[241] and (2) consumption shocks are positively correlated over time (or their mean or variances are uncertain) (Arrow et al., 2013; Arrow et al., 2014; Gollier & Hammitt, 2014; Cropper et al., 2014).[242] While a constant adjustment downwards (known as

---

discounted should also decline. *See, e.g.,* Arrow et al. (2014) at 148. It is standard in IAMs to assume that the growth rate of consumption will fall over time. *See, e.g.,* Nordhaus (2017) at 1519, "Growth in global per capita output over the 1980–2015 period was 2.2% per year. Growth in global per capita output from 2015 to 2050 is projected at 2.1% per year, whereas that to 2100 is projected at 1.9% per year." Similarly, Hope (2011) at 22 assumes that growth will decline. For instance, in the U.S., growth is 1.9% per year in 2008 and declines to 1.7% per year by 2040. Using data provided by Dr. David Anthoff (one of the founders of FUND), FUND assumes that the global growth rate was 1.8% per year from 1980–2015 period, 1.4% per year from 2015 to 2050 and 2015 to 2100, and then dropping to 1.0% from 2100 to 2200 and then 0.7% from 2200 to 2300.

[240] If the future growth of consumption is uncertainty with mean μ and variance σ^2, an extended Ramsey equation $r = \delta + \eta * \mu - 0.5\eta^2\sigma^2$ applies where r is the social discount rate, δ is the pure rate of time preference, η is the aversion to inter-generational inequality, and g is the growth rate of per capita consumption. Gollier (2012, Chapter 3) shows that we can rewrite the extended discount rate as $r = \delta + \eta * g - 0.5\eta(\eta + 1)\sigma^2$ where g is the growth rate of expected consumption and $\eta + 1$ is prudence.

[241] The IWG assumption of five possible socio-economic scenarios implies an uncertain growth path.

[242] The intuition of this result requires us to recognize that the social planner is prudent in these models (i.e., saves more when faces riskier income). When there is a positive correlation between growth rates in per capita consumption, the representative agent faces more cumulative risk over time with respect to the "duration of the time spent in the bad state."

42

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd)

the precautionary effect[243]) can be theoretically correct when growth rates are independent and identically distributed (Cropper et al., 2014), empirical evidence supports the two above assumptions for the United States, thus implying a declining discount rate (Cropper et al., 2014; Arrow et al., 2014; IPCC, 2014).[244] We should further expect this positive correlation to strengthen over time due to the negative impact of climate change on consumption, as climate change causes an uncertain permanent reduction in consumption (Gollier, 2009).[245]

Several papers have estimated declining discount rate schedules for specific values of the pure rate of time preference and elasticity of marginal utility of consumption (e.g., Arrow et al., 2014), though recent work demonstrates that the precautionary effect increases and discount rates decrease further when catastrophic economic risks (such as the Great Depression and the 2008 housing crisis) are modeled (Gollier & Hammitt, 2014; Arrow et al., 2014). It should be noted that this decline in discount rates due to uncertainty in the global growth path is in addition to that resulting from a declining central growth path over time (Nordhaus, 2014; Marten, 2015).[246]

Additionally, a related literature has developed over the last decade demonstrating that normative uncertainty (i.e., heterogeneity) over the pure rate of time preference (δ)—a measure of impatience—also leads to a declining social discount rate (Arrow et al., 2014; Cropper et al., 2014; Freeman and Groom, 2016). Despite individuals differing in their pure rate of time preference (Gollier and Zeckhauser, 2005), an equilibrium (consumption) discount exists in the economy. In the context of IAMs, modelers aggregate social preferences (often measured using surveyed experts) by calibrating the preferences of a representative agent to this equilibrium (Millner and Heal, 2015; Freeman and Groom, 2016). The literature generally finds a declining social discount rate due to a declining collective pure rate of time preference (Gollier and Zeckhauser, 2005; Jouini et al., 2010; Jouini and Napp, 2014; Freeman and Groom, 2016).[247] The heterogeneity of preferences and the uncertainty surrounding economic growth

(Gollier et al., 2008). In other words, "the existence of a positive correlation in the changes in consumption tends to magnify the long-term risk compared to short-term risks. This induces the prudent representative agent to purchase more zero-coupon bonds with a long maturity, thereby reducing the equilibrium long-term rate." (Gollier, 2007). Mathematically, the intuition is that under prudence, the third term in the extended Ramsey equation (*see* footnote 323) is negative, and a "positive [first-degree stochastic] correlation in changes in consumption raises the riskiness of consumption at date T, without changing its expected value. Under prudence, this reduces the interest rate associated to maturity T" (Gollier et al., 2007) by "increasing the strength of the precautionary effect" in the extended Ramsey equation (Arrow et al., 2014; Cropper et al., 2014).

[243] The precautionary effect measures aversion to future "wiggles" in consumption (i.e., preference for consumption smoothing) (Traeger, 2014).

[244] Essentially, the precautionary effect increases over time when shocks to the growth rate are positively correlated, implying that future societies require higher returns to face the additional uncertainty (Cropper et al., 2014; Arrow et al., 2014; IPCC, 2014).

[245] Due to the deep uncertainty characterizing future climate damages, some analysts argue that the stochastic processes underlying the long-run consumption growth path cannot be econometrically estimated (Weitzman, 2007; Gollier, 2012). In other words, economic damages, and thus future economic growth, are ambiguous. Agents must then form subjectivity probabilities, which may be better interpreted as a belief (Cropper et al., 2014). Again, theory shows that ambiguity leads to a declining discount rate schedule by Jensen's inequality (Cropper et al., 2014).

[246] A common assumption in IAMs is that global growth will slow over time leading to a declining discount rate schedule over time; *see* footnote 7. Uncertainty over future consumption growth and heterogeneous preferences (discussed below) would lead to a more rapid decline in the social discount rate.

[247] The intuition for declining discount rates due to heterogeneous pure rates of time preference is laid out in Gollier and Zeckhauser (2005). In equilibrium, the least patient individuals trade future consumption to the most patient individuals for

43

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) hold simultaneously (Jouini et al., 2010; Jouini and Napp, 2014), leading to potentially two sources of declining discount rates in the normative context.

Declining Rates are Actionable and Time-Consistent

There are multiple declining discount rate schedules from which the U.S. government can choose, of which several are provided in Arrow et al. (2014) and Cropper et al. (2014). One possible declining interest rate schedule for consideration by the IWG is the one proposed by Weitzman (2001).[248] It is derived from a broad survey of top economists in context of climate change, and explicitly incorporates arguments around interest rate uncertainty.[249] Other declining discount rate schedule include Newell and Pizer (2003); Groom et al. (2007); Freeman et al. (2015). Many leading economists support the United States government adopting a declining discount rate schedule (Arrow et al., 2014; Cropper et al., 2014). Moreover, the United States would not be alone in using a declining discount rate. It is standard practice for the United Kingdom and French governments, among others (Gollier & Hammitt, 2014; Cropper et al., 2014). The U.K. schedule explicitly subtracts out an estimated time preference.[250] France's schedule is roughly similar to the United Kingdom's. Importantly, all of these discount rate schedules yield lower present values than the constant 2.5% discount rate employed by IWG (2010), suggesting that even the lowest discount rate evaluated by the IWG is too high.[251] The consensus of leading economists is that a declining discount rate schedule should be used, harmonious with the approach of other countries like the United Kingdom. Adopting such a schedule would likely increase the SCC substantially from the administration's 3% estimate, potentially up to two to three fold (Arrow et al., 2013; Arrow et al., 2014; Freeman et al., 2015).

A declining discount rate motived by discount rate or growth rate uncertainty avoids the time inconsistency problem that can arise if a declining pure rate of time preference (δ) is used. *Circular A-4* cautions that "[u]sing the same discount rate across generations has the advantage of preventing time-inconsistency problems."[252] A time inconsistent decision is one where a decision maker changes his or her plan over time, solely because time has passed. For instance, consider a decision maker choosing whether to make an investment that involves an up-front payment followed by future benefits. A time

---

current consumption, subject to the relative value of their tolerance for consumption fluctuations. Thus, while public policies in the near term mostly impact the most impatient individuals (i.e., the individuals with the most consumption in the near term), long-run public policies in the distant future are mostly going to impact the most patient individuals (i.e., the individuals with the most consumption in the long-run).

248 Weitzman (2001)'s schedule is as follows: 4% for 1-5 years; 3% for 6-25 years; 2% for 26-75 years; 1% for 76-300 years; and 0% for 300+ years.

249 Freeman and Groom (2014) demonstrate that this schedule only holds if the heterogeneous responses to the survey were due to differing ethical interpretations of the corresponding discount rate question. A recent survey by Drupp et al. (2015) – which includes Freeman and Groom as co-authors – supports the Weitzman (2001) assumption.

250 The U.K. declining discount rate schedule that subtracts out a time preference value is as follows (Lowe, 2008): 3.00% for 0-30 years; 2.57% for 31-75 years; 2.14% for 76-125 years; 1.71% for 126- 200 years; 1.29% for 201- 300 years; and 0.86% for 301+ years.

251 Using the IWG's 2010 SCC model, Johnson and Hope (2012) find that the U.K. and Weitzman schedules yield SCCs of $55 and $175 per ton of CO_2, respectively, compared to $35 at a 2.5% discount rate. Because the 2.5% discount rate was included by the IWG (2010) to proxy for a declining discount rate, this result indicates that constant discount rate equivalents may be insufficient to address declining discount rates.

252 *Circular A-4* at 35.

44

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

CO2-1 (cont'd) consistent decision maker would invest in the project if it had a positive net-present value, and that decision would be the same whether it was made 10 years before investment or 1 year before investment. A time inconsistent decision maker might change his or her mind as the date of the investment arrived, despite no new information becoming available. Consider a decision maker who has a declining pure rate of time preference (δ) trying to decide whether to invest in a project that has large up-front costs followed by future benefits. 10 years prior to the date of investment, the decision maker will believe that this project is a relatively unattractive investment because both the benefits and costs would be discounted at a low rate. Closer to the date of investment, however, the costs would be relatively highly discounted, possibly leading to a reversal of the individual's decision. Again, the discount rate schedule is time consistent as long as δ is constant.

The arguments provided here for using a declining consumption discount rate are not subject to this time inconsistency critique. First, time inconsistency occurs if the decision maker has a declining pure rate of time preference, not due to a decreasing discount rate term structure.[253] Second, uncertainty about growth or the discount rate avoids time inconsistency because uncertainty is only resolved in the future, after investment decisions have already been made. As the NAS (2017) notes, "One objection frequently made to the use of a declining discount rate is that it may lead to problems of time inconsistency....This apparent inconsistency is not in fact inconsistent....At present, no one knows what the distribution of future growth rates...will be; it may be different or the same as the distribution in 2015. Even if it turns out to be the same as the distribution in 2015, that realization is new information that was not available in 2015."[254]

We should note that time-inconsistency is not a reason to ignore heterogeneity (i.e., normative uncertainty) over the pure rate of time preference (δ). If the efficient declining discount rate schedule is time-inconsistent, the appropriate solution is to select the best time-consistent policy. Millner and Heal (2014) do just this by demonstrating that a voting procedure – whereby the median voter determines the collective preference – is: (1) time consistent, (2) welfare enhancing relative to the non-commitment, time-inconsistent approach, and (3) preferred by a majority of agents relative to all other time-consistent plans. Due to the right skewed distribution of the pure rate of time preference and the social discount rate as shown in all previous surveys (Weitzman, 2001; Drupp et al., 2015; Howard and Sylvan, 2015), the median is less than the mean social discount rate (and pure rate of time preference); the mean social discount rate is what holds in the very short-run under various aggregation methods, such as Weitzman (2001) and Freeman and Groom (2015). Combining an uncertain growth rate and heterogeneous preference together implies a declining discount rate starting at a lower value in the short-run. In addition to the reasons discussed earlier in the comments, this is another reason to exclude a discount rate as high as 7%.

[253] Gollier (2012) states "It is often suggested in the literature that economic agents are time inconsistent if the term structure of the discount rate is decreasing. This is not the case. What is crucial for time consistency is the constancy of the rate of impatience, which is a cornerstone of the classic analysis presented in this book. We have seen that this assumption is compatible with a declining monetary discount rate."

[254] NAS Second Report, *supra* note 61, at 182.

45

CO2 –Environmental Defense Fund, Institute for Policy Integrity at New York University School of Law, Sierra Club (cont'd)

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work
Institute for Policy Integrity NEW YORK UNIVERSITY SCHOOL OF LAW
SIERRA CLUB

CO2-1 (cont'd) *There is an economic consensus on the appropriateness of employing a consumption discount rate (and the inappropriateness of a capital discount rate) in the context of climate change*

There is a strong consensus among economists that it is theoretically correct to use consumption discount rates in the intergenerational setting of climate change, such as in the calculation of the SCC. Similarly, there is a strong consensus that a capital discount rate is inappropriate according to "good economics" (Newell, 2017).[255] This consensus holds across panels of experts on the social cost of carbon (NAS, 2017); surveys of experts on climate change and discount rates (Weitzman, 2001; Drupp et al., 2015; Howard and Sylvan, 2015; and Pindyck, 2016); the three most commonly cited IAMs employed in calculating the federal SCC; and the government's own analysis (IWG, 2010; CEA, 2017). For more analysis of this issue, see the discussion in the main body our Comments on the inappropriateness using a discount rate premised on the return to capital in intergenerational settings.

[255] The former co-chair of the National Academy of Sciences' Committee on Assessing Approaches to Updating the Social Cost of Carbon – Richard Newell (2017) – states that "[t]hough the addition of an estimate calculated using a 7 percent discount rate is consistent with past regulatory guidance under OMB *Circular A-4*, there are good reasons to think that such a high discount rate is inappropriate for use in estimating the SCC...It is clearly inappropriate, therefore, to use such modeling results with OMB's 7 percent discount rate, which is intended to represent the historical before-tax return on private capital...This is a case where unconsidered adherence to the letter of OMB's simplified discounting approach yields results that are inconsistent with and ungrounded from good economics."

46

INDIVIDUALS (IND)

IND1 – Elena Franco

Elena Franco, Washington, DC.
RE: Draft Environmental Impact Statement for the Midcontinent Supply Header Interstate Pipeline Project (PF17-3, CP17-458)

I am submitting the following comments on the Federal Energy Regulatory Commission's ("FERC") draft supplemental environmental impact statement ("DSEIS") for the Midship Pipeline Company, LLC's Midcontinent Supply Header Interstate Pipeline Project.

After a careful review of the DEIS, I would like to recognize FERC's efforts in its DEIS to include important considerations of the impacts of the Midship Pipeline on the human environment in Oklahoma. FERC has demonstrated its efforts to balance its obligations under National Environmental Policy Act ("NEPA") to consider the environmental impacts (1), and under the Natural Gas Act ("NGA") to protect consumers' access to an adequate supply of gas at a reasonable price (2). I appreciate the depth of FERC's analysis, especially related to the downstream effects, and their careful consideration of comments in the previous round related to environmental issues. I recognize that NEPA requirements mean FERC must confront some very hard questions on how to value and balance the environment with our energy needs.

As a citizen, I am concerned with the long term health of our human environment. As someone with knowledge of the NEPA statute, the Council on Environmental Quality ("CEQ") regulations, and case law related to the
IND-1 statute and climate change, I feel it is important to point out a few areas where FERC could strengthen its analysis in the DEIS.

It is important that FERC ensure full consideration of the reasonably foreseeable consequences of this pipeline construction and pipeline integrity in the case of climate change-induced extreme weather events to protect Oklahoma residents from the consequences of pipeline rupture. The DEIS treats geological hazards (including flooding) in section 4.1.4. However, the DEIS only discusses climate change in very broad terms in the section on cumulative impacts (4.1.3.2.10). Thus, the DEIS is not making sufficient link between climate change and extreme weather events, and does not adequately acknowledge the "reasonably foreseeable" nature of extreme weather events. While the DEIS includes a section addressing risk of terrorism (section 4.12.4), risk of extreme weather events are as (if not more) "reasonably foreseeable" and deserve more attention in the EIS (3). NEPA is inherently forward thinking and requires FERC to consider anticipated environmental impacts (4).

Recent government reports from the Government Accountability Office (GAO) (5) and the 2017 Climate Assessment (6) indicate the extent of potential effects of climate change, outlining frequency and impacts of climate-induced natural disasters. The National Oceanic and Atmospheric Administration ("NOAA") estimated that damages and economic loss from extreme weather events in 2017 alone costs $306 billion (7).

While Oklahoma has less flooding in the past as other parts of the Midwest, extreme weather in 2015 and 2016 demonstrate the "reasonably

IND1-1 Section 4.13.2.10 of the draft EIS describes potential regional impacts associated with climate change, including the potential for more frequent extreme weather events. Sections 4.1.6 and 4.12 of the EIS describe mitigation measures and engineering standards that have been incorporated into the project design to minimize the potential for pipeline integrity concerns during extreme weather events, such as flooding. Additionally, as stated in section 4.3.2.6, all pipeline facilities would be designed and constructed in accordance with Title 49 of the Code of Federal Regulations, Part 192. These regulations include specifications for installing the pipelines at a sufficient depth to avoid possible scour at waterbody crossings. The trench would be sufficiently deep to provide a minimum of 5 feet of cover over the pipeline at waterbodies (or 18 inches in consolidated bedrock). Further, most major flowing waterbodies are proposed to be crossed using the HDD method, which would provide even greater cover over the pipeline.

IND1 – Elena Franco (cont'd)

IND-1 (cont'd) foreseeable" nature of these events in this state. Across the country, there have been multiple incidences of pipeline rupture during flooding events, in which floodwaters scrape dozens of feet of soil and gravel and expose pipelines to damage from debris (8), including the Polecat Creek flood in 1994 in Oklahoma (9). Punctured natural gas pipelines can be expensive and dangerous. Since 2010, reported incidents killed 70 people and injured more than 300, and caused lost gas and property damage of nearly $700 million (10).

The Council on Environmental Quality (CEQ) Section 1502.22 states that "reasonably foreseeable" within the context of this regulation (11), "includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason."(12) These CEQ regulations require disclosure of the effect of low probability/high consequence occurrences, when the analysis of potential impacts is supported by credible scientific evidence and not predicated on conjecture (13). FERC should provide a more detailed assessment that connects geological hazards and climate change, and include assessment of the potential consequences of climate-induced extreme weather events and pipeline safety.

(1) 40 C.F.R. §1508.8(defining "effects" as including direct and reasonably foreseeable indirect effects); 40 C.F.R. §1508.7 (defining "cumulative impacts"); §1508.25(c)(EIS must consider direct, indirect, and cumulative impacts
(2) Natural Gas Act, 15 U.S.C.A §717
(3) 40 C.F.R. §1502.22 (Incomplete or Unavailable Information)
(4) Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n, 481 F.2d 1079, 1092 (D.C. Cir. 1973)(finding that section 102(2)(C) requires agency to describe anticipated environmental effect of proposed action is subject to a rule of reason.); Carolina Envtl. Study Grp. v. United States, 510 F.2d 796, 798 (D.C. Cir. 1975)(finding section 102(2)(C)(i) requires description of reasonably foreseeable effects, and the rule of reason is used to ascertain those effects anticipated.)
(5) U.S. Government Accountability Office. Climate Change: Information on Potential Economic Effects Could Help Guide Federal Efforts to Reduce Fiscal Exposure. GAO-17-720, September 2017.
(6) U.S. Global Change Research Program, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I. [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Steward, and T.K. Maycock (eds.] USGCRP, Washington, DC, USA;
(7) Nat'l Oceanic And Atmospheric Admin, Billion-Dollar Weather and Climate Disasters: Table of Events, avaliable at, https://www.ncdc.noaa.gov/billions/events/US/1980-2017
(8) S,Girgin, E, Krausmann, Historical Analysis of US Onshore Hazardous Liquid Pipeline Accidents Triggered

APPLICANT (A)

A1 – Midship Pipeline Company, LLC

MIDSHIP PIPELINE

March 29, 2018

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

Re: Midship Pipeline Company LLC
Docket No. CP17-458-000
OEP/DG2E/Gas 1
Comments on DEIS and Responses to the Recommended Mitigation Measures

Dear Ms. Bose:

On May 31, 2017, Midship Pipeline Company, LLC ("Midship") submitted its Application for a Certificate of Public Convenience and Necessity and Related Authorizations pursuant to Section 7(c) of the Natural Gas Act, as amended, and the regulations of the Federal Energy Regulatory Commission ("Commission") for the construction and operation of the Midcontinent Supply Header Interstate Pipeline Project ("Midship Project").

On February 9, 2018, the Commission issued the Draft Environmental Impact Statement ("DEIS") for the Midship Project. Midship hereby submits for filing with the Commission comments on the DEIS and responses to the FERC Staff's Recommended Mitigation measures in to support the environmental review of the Midship Project.

Should you have any questions about the instant filing, please feel free to contact the undersigned at (713) 375-5544.

Respectfully Submitted,

/s/ Karri Mahmoud
Karri Mahmoud

Director, Regulatory Project Development
Midship Pipeline Company, LLC

Enclosures

A1 – Midship Pipeline Company, LLC (cont'd)

Certificate of Service

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Houston, Texas this 29th day of March, 2018.

/s/ Karri Mahmoud

Karri Mahmoud
Midship Pipeline Company, LLC

A1 – Midship Pipeline Company, LLC (cont'd)

TABLE 1

Comments of the Draft Environmental Impact Statement

	#	Page	Section	Sentence	Suggested revision/comment
A1-1	1	1-2	1.1 Footnote	Midship Pipeline plans to continue discussions with interested producers, processors, and foundation shippers for future production in the growing SCOOP/STACK plays, which is forecasted to exceed 5,000 MMcf/d by the year 2020.	Midship Pipeline is in active discussions with interested producers, processors, and potential foundation shippers for Firm Transportation from the growing SCOOP/STACK plays, which is forecasted to exceed 5,000 MMcf/d by the year 2020.
A1-2	2	4-66	4.6.1.1	Consultations between Midship Pipeline and the ODWC are ongoing regarding avoidance or mitigation measures to reduce potential impacts on the Texoma/Washita Arm of the Tishomingo WMA. However, because the MIDSHIP Project would not cross the Texoma/Washita Arm of the Tishomingo WMA, we conclude that no direct impacts on the WMA would occur.	Please note that given previous communications with ODWC, Midship considers consultations with ODWC complete until time of construction when the agency indicated that their only concerns with proximity to WMAs was regarding traffic/visitation patterns, and asked for notification when construction was to begin so the rangers could be made aware.
A1-3	3	4-125	4.10.1.2	On October 25, 2016, Midship Pipeline sent a letter to the Bureau of Indian Affairs to introduce the project. In phone calls on October 26 and November 17, 2016, the Bureau of Indian Affairs indicated it would become involved in the project if it crosses Indian trust land and requested digital files of the project facilities, which Midship Pipeline sent in December 2016. The proposed MIDSHIP Project does not cross any Indian trust land.	Note that Midship is now aware the Midship Project does cross 1/9th ownership tribal trust lands. As such, TRC submitted a request for an ARPA permit with the Eastern Oklahoma Division of the BIA on February 5, 2018.
A1-4	4	4-114	4.9.5	Additional impacts on transportation and traffic would result from construction across roadways and railroads.	Impacts will be minimal because all railroads and major roads will be bored.
A1-5	5	4-119	4.9.7	Midship Pipeline estimates that pipeline construction would result in the local purchase of about $19 million in materials (about 10 percent of total project-related materials purchases), and that aboveground facility construction would result in about $2 million in local materials purchases.	Midship Pipeline estimates that pipeline construction would result in the local purchase of about $19 million in materials. Aboveground facility construction, including materials purchases for mainline compressor stations, the booster station, and meter stations, would result in about $8 million in local materials purchases for a project total of $27 million.
A1-6	6	4-121	4.9.8	The area analyzed for environmental justice impacts includes all U.S. Census block groups that contain any project facility and all block groups within 1.0 mile of the proposed aboveground facilities.	The area analyzed for environmental justice impacts includes all U.S. Census block groups that contain any project facility and all block groups within 1.0 mile of the proposed compressor stations and booster station.
A1-7	7	4-132	4.11.1.2	Subpart JJJJ would apply to the natural gas fired emergency generator engines proposed for the Calumet, Tatums, and Bennington Compressor Stations and the two reciprocating compressors proposed for the Sholem Booster Station.	NSPS Subpart JJJJ would apply to the two reciprocating engines that drive the compressors at the Sholem Booster Station, not the compressors themselves.

Midship Pipeline Company, LLC 1 March 2018

A1-1 The footnote in section 1.1 of the EIS has been revised to incorporate this information.

A1-2 Section 4.6.1.1 of the EIS has been revised to incorporate this information.

A1-3 Sections 1.5 and 4.10.1.2 of the EIS have been revised to incorporate this information.

A1-4 Section 4.9.5 of the EIS has been revised to incorporate this information.

A1-5 Section 4.9.7 of the EIS has been revised to incorporate this information.

A1-6 Section 4.9.8 of the EIS has been revised to incorporate this information.

A1-7 Section 4.11.1.2 of the EIS has been updated to reflect this clarification.

A1 – Midship Pipeline Company, LLC (cont'd)

TABLE 1

Comments of the Draft Environmental Impact Statement

	#	Page	Section	Sentence	Suggested revision/comment
A1-8	8	4-133	4.11.1.2	Subpart ZZZZ (*National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*) would be applicable to the emergency generators proposed at the Calumet, Tatums, and Bennington Compressor Stations and at the Sholem Booster Station.	Subpart ZZZZ (*National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*) would be applicable to the emergency generators proposed at the Calumet, Tatums, and Bennington Compressor Stations and the reciprocating engines that drive the compressors at the Sholem Booster Station.
A1-9	9	4-133	4.11.1.2	The EPA established the final Mandatory Greenhouse Gas Reporting Rule, which requires that petroleum and natural gas facilities that emit 25,000 metric tons or more of CO_2e per year report annual emissions of GHGs. Recent additions to the Mandatory Reporting Rule require reporting of GHG emissions generated during operation of natural gas pipeline systems, which would include blowdown emissions, equipment leaks, and vent emissions at compressor stations, as well as blowdown emissions between compressor stations. The applicability of the reporting rule would apply to the entire Midship Pipeline system.	Each compressor station separately, and the pipeline separately would have to emit 25,000 metric tons CO_2e for the reporting requirements to apply.
A1-10	10	4-134	4.11.1.3	Table 4.11.1-1 provides a summary of construction emissions associated with the various project facilities, including on-road and non-road vehicle emissions, fugitive dust emissions, emissions from HDD activities, and open burning emissions. Construction emissions were calculated using EPA calculation tools (EPA Motor Vehicle Emission Simulator 2014 for on-road and non-road equipment) and are an aggregate of emissions for the estimated 9-month duration of project construction.	The MOVES model was used only for on-road and non-road vehicle combustion emissions. Fugitive dust emissions were calculated using the Western Regional Air Partnership (WRAP) Fugitive Dust Handbook, Countless Environmental, September 2006 Table 3-2, level 1, average conditions. Open burning emissions were calculated using EPA guidance document "Volume III: Chapter 16. Open Burning" January 2001, Table 16.4-4 and AP-42, Chapter 2.5 "Open Burning", Table 2.5-5.

A1-8 Section 4.11.1.2 of the EIS has been updated to reflect this clarification.

A1-9 Section 4.11.1.2 of the EIS has been updated to reflect this clarification.

A1-10 Section 4.11.1.3 of the EIS has been updated to reflect this clarification.

A1 – Midship Pipeline Company, LLC (cont'd)

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
1	Midship Pipeline shall follow the construction procedures and mitigation measures described in its application and supplements (including responses to staff data requests) and as identified in the EIS, unless modified by the Order. Midship Pipeline must: a. request any modification to these procedures, measures, or conditions in a filing with the Secretary; b. justify each modification relative to site-specific conditions; c. explain how that modification provides an equal or greater level of environmental protection than the original measure; and d. receive approval in writing from the Director of OEP before using that modification.	-	NA	Midship accepts this recommendation and will comply with its provisions.
2	The Director of OEP, or the Director's designee, has delegated authority to address any requests for approvals or authorizations necessary to carry out the conditions of the Order, and take whatever steps are necessary to ensure the protection of all environmental resources during construction and operation of the project. This authority shall allow: a. the modification of conditions of the Order; b. stop-work authority; and c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from project construction and operation.	-	NA	Midship Pipeline acknowledges this authority.
3	Prior to any construction, Midship Pipeline shall file an affirmative statement with the Secretary, certified by a senior company official, that all company personnel, EIs, and contractor personnel will be informed of the EIs' authority and have been or will be trained on the implementation of the environmental mitigation measures appropriate to their jobs before becoming involved with construction and restoration activities.	Prior to Construction	NA	Midship accepts this recommendation and will comply with its provisions.

A1 – Midship Pipeline Company, LLC (cont'd)

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
4	The authorized facility locations shall be as shown in the EIS, as supplemented by filed alignment sheets. As soon as they are available, and before the start of construction, Midship Pipeline shall file with the Secretary any revised detailed survey alignment maps/sheets at a scale not smaller than 1:6,000 with station positions for all facilities approved by the Order. All requests for modifications of environmental conditions of the Order or site-specific clearances must be written and must reference locations designated on these alignment maps/sheets. Midship Pipeline's exercise of eminent domain authority granted under NGA section 7(h) in any condemnation proceedings related to the Order must be consistent with these authorized facilities and locations. Midship Pipeline's right of eminent domain granted under NGA section 7(h) does not authorize it to increase the size of its natural gas facilities to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.	Prior to Construction, but as soon as available	NA	Midship accepts this recommendation and will comply with its provisions.
5	Midship Pipeline shall file with the Secretary detailed alignment maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all route realignments or facility relocations, and staging areas, pipe storage yards, new access roads, and other areas that would be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species would be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP before construction in or near that area. This requirement does not apply to extra workspace allowed by the Commission's Plan and/or minor field realignments per landowner needs and requirements that do not affect other landowners or sensitive environmental areas such as wetlands. Examples of alterations requiring approval include all route realignments and facility location changes resulting from: a. implementation of cultural resources mitigation measures; b. implementation of endangered, threatened, or special concern species mitigation measures; c. recommendations by state regulatory authorities; and d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.	Prior to Construction	NA	Midship accepts this recommendation and will comply with its provisions.

A1 – Midship Pipeline Company, LLC (cont'd)

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
6	Within 60 days of the acceptance of the authorization and before construction begins, Midship Pipeline shall file an Implementation Plan with the Secretary for review and written approval by the Director of OEP. Midship Pipeline must file revisions to the plan as schedules change. The plan shall identify: a. how Midship Pipeline will implement the construction procedures and mitigation measures described in its application and supplements (including responses to staff data requests), identified in the EIS, and required by the Order; b. how Midship Pipeline will incorporate these requirements into the contract bid documents, construction contracts (especially penalty clauses and specifications), and construction drawings so that the mitigation required at each site is clear to on-site construction and inspection personnel; c. the number of EIs assigned per spread, and how the company will ensure that sufficient personnel are available to implement the environmental mitigation; d. company personnel, including EIs and contractors, who will receive copies of the appropriate material; e. the location and dates of the environmental compliance training and instructions Midship Pipeline will give to all personnel involved with construction and restoration (initial and refresher training as the project progresses and personnel change), with the opportunity for OEP staff to participate in the training session(s); f. the company personnel (if known) and specific portion of Midship Pipeline's organization having responsibility for compliance; g. the procedures (including use of contract penalties) Midship Pipeline will follow if noncompliance occurs; and h. for each discrete facility, a Gantt or PERT chart (or similar project scheduling diagram), and dates for: i. the completion of all required surveys and reports; ii. the environmental compliance training of on-site personnel; iii. the start of construction; and iv. the start and completion of restoration.	Within 60 days of the acceptance of the authorization and before construction begins	NA	Midship accepts this recommendation and will comply with its provisions.

A1 – Midship Pipeline Company, LLC (cont'd)

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
7	Midship Pipeline shall employ a team of EIs (i.e., three or more or as may be established by the Director of OEP) per construction spread. The EI(s) shall be: a. responsible for monitoring and ensuring compliance with all mitigation measures required by the Order and other grants, permits, certificates, or other authorizing documents; b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 6 above) and any other authorizing document; c. empowered to order correction of acts that violate the environmental conditions of the Order, and any other authorizing document; d. a full-time position, separate from all other activity inspectors; e. responsible for documenting compliance with the environmental conditions of the Order, as well as any environmental conditions/permit requirements imposed by other federal, state, or local agencies; and f. responsible for maintaining status reports.	For Construction	NA	Midship accepts this recommendation and will comply with its provisions.

A1 – Midship Pipeline Company, LLC (cont'd)

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
8	Beginning with the filing of its Implementation Plan, Midship Pipeline shall file updated status reports with the Secretary on a weekly basis until all construction and restoration activities are complete. On request, these status reports will also be provided to other federal and state agencies with permitting responsibilities. Status reports shall include: a. an update on Midship Pipeline's efforts to obtain the necessary federal authorizations; b. the construction status of each spread, work planned for the following reporting period, and any schedule changes for stream crossings or work in other environmentally sensitive areas; c. a listing of all problems encountered and each instance of noncompliance observed by the EIs during the reporting period (both for the conditions imposed by the Commission and any environmental conditions/permit requirements imposed by other federal, state, or local agencies); d. a description of the corrective actions implemented in response to all instances of noncompliance, and their cost; e. the effectiveness of all corrective actions implemented; f. a description of any landowner/resident complaints that may relate to compliance with the requirements of the Order, and the measures taken to satisfy their concerns; and g. copies of any correspondence received by Midship Pipeline from other federal, state, or local permitting agencies concerning instances of noncompliance, and Midship Pipeline's response.	Beginning with the filing of its Implementation Plan; and weekly thereafter	NA	Midship accepts this recommendation and will comply with its provisions.
9	Midship Pipeline must receive written authorization from the Director of OEP before commencing construction of any project facilities. To obtain such authorization, Midship Pipeline must file with the Secretary documentation that it has received all applicable authorizations required under federal law (or evidence of waiver thereof).	Prior to Construction	NA	Midship accepts this recommendation and will comply with its provisions.
10	Midship Pipeline must receive written authorization from the Director of OEP before placing the project into service. Such authorization will only be granted following a determination that rehabilitation and restoration of the right-of-way and other areas affected by the project are proceeding satisfactorily.	Before in service	NA	Midship accepts this recommendation and will comply with its provisions

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
11	Within 30 days of placing the authorized facilities in service, Midship Pipeline shall file an affirmative statement with the Secretary, certified by a senior company official: a. that the facilities have been constructed in compliance with all applicable conditions, and that continuing activities will be consistent with all applicable conditions; or b. identifying which of the conditions in the Order Midship Pipeline has complied with or will comply with. This statement shall also identify any areas affected by the project where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.	Within 30 days of in-service	NA	Midship accepts this recommendation and will comply with its provisions.
12	A1-11 Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary the results of its feasibility assessment to extend the North Canadian River HDD to span the dike near Mainline MP 7.3 on Mark Schweitzer's property. If the feasibility study indicates that the HDD cannot be extended to encompass the dike, Midship Pipeline should provide detailed information on any route adjustments and/or construction techniques developed in consultation with Mr. Schweitzer to minimize impacts on the dike.	Prior to 4/2/2018	Section 3.3	The concerns of Mark and Annette Schweitzer regarding this crossing have been resolved with a route adjustment. The revised route, which avoids the earthen dike on Mr. Schweitzer's property, is shown in MS-A1-008. In November of 2017, Midship met with Mr. Schweitzer on his property to discuss his concerns related to the earthen dike constructed to protect his property from potential flooding of the North Canadian River. Mr. Schweitzer agreed to allow surveys to collect data for an alternate route. In December of 2017, the necessary surveys were completed. Mr. Schweitzer confirmed his acceptance of the alternate route during the surveys. In an email dated December 7, 2017, Annette Schweitzer confirmed her acceptance of the route adjustment. A record of this email correspondence is provided as supporting documentation in ***Attachment 12***. Midship currently is working with Mr. and Mrs. Schweitzer to acquire an easement along the revised route.
13	A1-12 Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary a plan that includes the proposed measures it would implement in the event that unanticipated contamination is encountered during construction.	Prior to 4/2/2018	Section 4.2.2.6	Midship's Procedure for Addressing Discovery of Unanticipated Contamination during Construction is provided as ***Attachment 13***.

Midship Pipeline Company, LLC 6 March 2018

A1-11 Section 3.3 of the EIS has been revised to incorporate this information.

A1-12 Section 4.2.2.6 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

	#	Description	Timing	Section Reference	Response
	14	Prior to construction, Midship Pipeline shall conduct spring and private well surveys, contingent upon approval by landowners, and file with the Secretary a revised table 4.3.1-2 that includes an updated list of water wells and springs within 150 feet of construction workspaces based on completed surveys. Midship Pipeline shall conduct, with the well owner's permission, pre- and post-construction sampling of well yield and water quality for all wells and springs within 150 feet of project workspace (regardless of blasting activities) and repair or replace wells and springs as necessary to serve the preconstruction purpose of the well or spring.	Prior to Construction	Section 4.3.1.7	Midship accepts this recommendation and will comply with its provisions.
A1-13	15	Prior to construction, Midship Pipeline shall confirm that it will not store hazardous materials, refuel equipment or vehicles, or park equipment or vehicles overnight within 100 feet of wells and springs unless the EI cannot identify a reasonable alternate location and additional spill prevention measures are implemented.	Prior to Construction	Section 4.3.1.7	Midship confirms that it will not store hazardous materials, refuel equipment or vehicles, or park equipment or vehicles overnight within 100 feet of wells and springs unless the EI cannot identify a reasonable alternate location. If parked within 100 feet, additional spill prevention measure will be implemented.
A1-14	16	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary any surface water and wetland field survey results and/or desktop data not previously filed with FERC, including any revised resource impact tables and/or maps, as applicable.	Prior to 4/2/2018	Section 4.3.2.1	With this filing, Midship is submitting an updated wetland delineation report and revised resource report impacts tables and maps.
A1-15	17	Prior to the end of the draft EIS comment period, Midship Pipeline should assess the feasibility of using a dry crossing method at each of the perennial waterbodies that are intermediate in width see appendix J), and the impaired waterbodies in table 4.3.2-3 that Midship Pipeline currently propose to cross using the wet open-cut method. Midship Pipeline should file the results of the assessment with the Secretary including any revised tables and maps, as appropriate.	Prior to 4/2/2018	Section 4.3.2.6	Midship has determined that dry crossings are feasible at the perennial waterbodies of intermediate width as listed in Appendix J and the impaired waterbodies in table 4.3.2-3. Revised resource report tables and figures are provided as part of this filing.
A1-16	18	Prior to the end of the draft EIS comment period, Midship Pipeline should assess the feasibility of shifting the pipeline route to avoid unnamed pond S-IO-RFI- 17/02/03-02 at Mainline MP 149.2 and file with the Secretary the results of the assessment and any revised tables and maps, as appropriate.	Prior to 4/2/2018	Section 4.3.2.6	Midship is negotiating an easement with the landowner who owns the pond, and the landowner has not indicated that crossing the pond will be unacceptable to him. For this reason Midship prefers not to shift the Mainline route out of the pond. The pond will be restored to its original condition after construction.

Midship Pipeline Company, LLC 7 March 2018

A1-13 Section 4.3.1.7 of the EIS has been revised to incorporate this information.

A1-14 Sections 4.3.2 and 4.4.1 of the EIS have been revised to incorporate this information.

A1-15 Section 4.3.2.5 and appendix J to the EIS has been revised to incorporate this information.

A1-16 Section 4.3.2.6 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

	#	Description	Timing	Section Reference	Response
A1-17	19	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary a complete set of revised HDD profile and plan drawings, including detailed mapping of cleared areas, mud pits, and/or pipe assembly areas as required in the Commission's Procedures section V.B.6.d.	Prior to 4/2/2018	Section 4.3.2.6	Site-specific HDD profiles and a Typical Horizontal Directional Drill Site Plan & Profile that shows typical entry and exit side layouts of HDD equipment are provided as ***Attachment 19***. Site-specific detailed HDD layouts will not be available until the drilling contractor has evaluated each drill site upon arriving for the drilling operation. All of the HDD layouts will be restricted to workspace approved by OEP.
A1-18	20	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary additional justification for the ATWS associated with the waterbodies identified in bold in table 4.3.2-8.	Prior to 4/2/2018	Section 4.3.2.6	Midship has reviewed the ATWS in bold in Table 4.3.2-8 and an updated Appendix 1F (Exceptions to the Plan and Procedures) in this filing. Review resulted either in additional justification for ATWS or moved/removed ATWS.
A1-19	21	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary the results of a feasibility assessment to utilize alternate construction and restoration techniques (e.g., reduced right-of-way width, HDD, site-specific wetland restoration plan) to reduce impacts on the PFO/PEM wetland complex associated with Oil Creek between Mainline MPs 141.5 and 142.2. Midship Pipeline should include any revised resource impact tables and/or maps, as applicable.	Prior to 4/2/2018	Section 4.4.4	Midship has surveyed and designed a reroute of the pipeline through this area that avoids the PFO/PEM wetland complex. The route has been incorporated into the proposed project and updated tables and figures are provided in this filing
A1-20	22	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary additional justification for the ATWS associated with wetland W-JOEHK-17/01/21-04 at Mainline MP 141.5.	Prior to 4/2/2018	Section 4.4.5	Midship has surveyed and designed a reroute of the pipeline through this area that avoids this wetland. The route has been incorporated into the proposed project and updated tables and figures are provided in this filing.

Midship Pipeline Company, LLC 8 March 2018

A1-17 Section 4.3.2.6 of the EIS has been revised to incorporate this information. Because the Henry House Creek HDD crossing lacks survey permission and geotechnical data, we are recommending Midship Pipeline file this information prior to construction.

A1-18 Section 4.3.2.6 of the EIS has been revised to incorporate this information. However, several additional temporary workspaces within 50 feet of waterbodies require additional site-specific justification. We are recommending Midship Pipeline file this information prior to construction.

A1-19 Section 4.4.4 of the EIS has been revised to incorporate this information.

A1-20 Section 4.4.5 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
A1-21 23	If HDD operations for the Canadian River crossing will occur between April 1 and July 31, Midship Pipeline shall conduct surveys for active black-capped vireo nests within riparian habitat adjacent to the Canadian River. Before the initiation of surveys, Midship Pipeline shall coordinate with the FWS regarding appropriate survey methods for the black-capped vireo. If an active black-capped vireo nest(s) is documented, Midship Pipeline shall consult with the FWS to determine appropriate avoidance and mitigation measures. The survey report, any FWS comments on the survey, and its conclusions shall be filed with the Secretary. The survey report shall include the following information: a. name(s) and qualifications of the person(s) conducting the survey; b. method(s) used to conduct the survey; c. date(s) of the survey; d. area surveyed (include the mileposts surveyed); e. survey results; and f. proposed mitigation to minimize or avoid the potential impacts. Midship Pipeline must receive written approval from the Director of OEP before construction activities associated with the Canadian River crossing between April 1 and July 31.	TBD	Section 4.7.1.1	Midship accepts this recommendation and will comply with its provisions, although Midship anticipates that the HDD operations for the Canadian River crossing will not occur between April 1 and July 31.
A1-22 24	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary an updated HDD Plan that revises section 13.3 to confirm that, in the event of an inadvertent release of drilling mud within the Canadian River or the 300 feet of adjacent riparian habitat, Midship Pipeline would: a. immediately notify FERC and the FWS; b. contain the released drilling mud; and c. receive written approval from the Director of OEP prior to commencing any cleanup operations within or adjacent to the Canadian River and prior to resuming drilling operations.	Prior to 4/2/2018	Section 4.7.1.6	Midship has revised section 13.3 of the Project HDD Plan (***Attachment 24***) to confirm that in the event of an inadvertent release of drilling mud within the Canadian River or the 300 feet of adjacent riparian habitat, Midship will a) immediately notify FERC and the USFWS and b) contain the released drilling mud. However, with regard to written approval from the Director of OEP for commencing cleanup and resuming drilling operations, Midship proposes the following, instead: Midship proposes that for the Canadian River, in the interest of implementation of a rapid response to a drilling mud release, authorization to contain and clean up a drilling mud release within the river or the adjacent riparian area should be at the discretion of the third-party EI in direct verbal consultation with the Director

Midship Pipeline Company, LLC 9 March 2018

A1-21 Section 4.7.1.1 of the EIS has been revised to incorporate this information.

A1-22 Section 4.7.1.6 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

	#	Description	Timing	Section Reference	Response
A1-22 (cont'd)					of OEP (or delegate) and the USFWS. The third-party EI, in direct verbal consultation with these agencies, also would authorize re-commencement of drilling operations.
A1-23	25	Prior to construction between Mainline MPs 124 and 199, Midship Pipeline shall conduct additional surveys for the ABB during the species' 2018 active season. Before the initiation of surveys, Midship Pipeline shall coordinate with the FWS regarding the current range for the ABB, appropriate survey methods, and seasonal timing. The survey reports and any FWS comments on the survey and its conclusions shall be filed with the Secretary. The survey reports shall include the following information: a. name(s) and qualifications of the person(s) conducting the survey; b. method(s) used to conduct the survey; c. date(s) of the survey; d. area surveyed (include the mileposts surveyed); e. survey results; and f. proposed mitigation to minimize or avoid the potential impacts. Midship Pipeline must receive written approval from the Director of OEP before commencing construction activities between Mainline MPs 124 and 199.	Prior to Construction	Section 4.7.1.7	Midship has scheduled American burying beetle surveys during the species' 2018 active season. Midship will conduct the survey in accordance with the accepted ABB survey protocol. The survey report, including the information as listed by FERC, and any FWS comments on the survey and its conclusions will be filed with the Secretary. Midship will not commence construction between MPs 124 and 199 until written approval from the Director of OEP is received.
	26	Midship Pipeline shall not begin construction of the MIDSHIP Project until: a. the FERC staff receives comments from the FWS regarding the MIDSHIP Project; b. the FERC staff completes consultation with the FWS; and c. Midship Pipeline has received written notification from the Director of OEP that construction or use of mitigation may begin.	Prior to Construction	Section 4.7.1.8	Midship accepts this recommendation and will comply with its provisions.
A1-24	27	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary confirmation that preconstruction migratory bird nesting surveys would occur within 1 week prior to vegetation clearing during the March 1 to July 31 peak nesting season or provide documentation of consultation with the Oklahoma Ecological Services Field Office that it concurs with Midship Pipeline's proposed survey timing.	Prior to 4/2/2018	Section 4.7.2	Midship has revised its Migratory Bird Conservation Plan to specify that if construction will occur during migratory bird nesting season (March 1 – July 31), Midship will conduct preconstruction migratory bird nesting surveys

Midship Pipeline Company, LLC 10 March 2018

A1-23 Section 4.7.1.7 of the EIS has been revised to incorporate this information.

A1-24 Section 4.7.2 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
				within 1 week prior to vegetation clearing.
A1-25 28	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary the results of its feasibility assessment for using a 75-foot-wide construction right-of-way in both uplands and wetlands along the entire length of the 16-inch-diameter Velma Lateral, including any revised resource impact tables and/or maps, as applicable.	Prior to 4/2/2018	Section 4.8.1.2	Midship has determined that a 75-foot-wide ROW for the Velma lateral is feasible, and updated tables and figures are provided as part of this filing.
A1-26 29	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary a description of the specific mitigation measures it would implement on each property to address the concerns of John Ford, Don Michael Haggerty, the Cavners, and OklahomaRanch.com (attorney Donald J. Chaffin), including copies of correspondence if applicable	Prior to 4/2/2018	Section 4.8.4	Specific mitigation measures that will be implemented to address the specific concerns of the listed landowners are as follows: *a. John Ford* The concerns of Mr. John Ford have been resolved with a route adjustment which avoids a pond on his property. In the June 5, 2017 response to public comments document, Midship indicated that it had agreed to a route adjustment on Mr. John Ford's property to avoid his pond, and that the details would be provided in a supplemental filing. On September 5, 2017, Midship filed a response to the FERC Environmental Data Request No. 1. In this filing, in response to Resource Report 2 Question 19, Midship provided the alignment sheets that showed the details of this route adjustment. Mr. John Ford is agreeable to this route and an easement has been acquired *b. Don Michael Haggerty* On October 4, 2017, Midship filed a response to the FERC Environmental Data Request No. 2. In this filing, in response to Resource Report 8

Midship Pipeline Company, LLC 11 March 2018

A1-25 Sections 2.2.2 and 4.8.1.2 of the EIS have been revised to incorporate this information.

A1-26 Section 4.8.4 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

A1-26 (cont'd)

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
				Question 3. Midship provided specific mitigation measures that will be implemented to address each of Mr. Haggerty's specific concerns. Mr. Haggerty expressed concerns related to the following topics: disturbance of calving, fire danger from ruptured or leaking pipe, potential effects on a lake and conservation area, damage to a historic natural spring, potential impacts on Simon Creek, damage to a rural water line and disruption of the rural water system, impacts on archeological and paleontological resources, and impacts on development. Mr. Haggerty denied surveys via U.S. mail on November 29, 2016. Since then, Midship has attempted multiple times and using multiple communication forms to address Mr. Haggerty's concerns and answer any questions he may have. Mr. Haggerty has denied all forms of communication including responding to mailed information (which is his requested form of communication). The most recent attempted contact with Mr. Haggerty occurred on January 9, 2018. Midship will continue to attempt to communicate with Mr. Haggerty to answer questions and address any additional concerns. *c. The Cavners* The concerns of Deon and Nancy Cavner have been addressed. The Cavners are not directly affected landowners or abutters to the Project. Mr. Cavner attended the open house meeting on December 14, 2016 in Ardmore, OK, at which Midship was able to answer Mr. Cavner's questions and address his concerns. On October 4, 2017, Midship filed a response to the FERC Environmental Data Request No. 2. In this filing, in response to Resource Report 8

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

	#	Description	Timing	Section Reference	Response
A1-26 (cont'd)					Question 3, Midship provided specific mitigation measures that will be implemented to address each of the Cavners' specific concerns. One of the concerns was related to noise associated with the compressor station. As described in the October 4, 2017 response, the noise attributable to the compressor station will be controlled to limit noise at the nearest noise sensitive area (e.g., residence) to 55 dBA Ldn or less. *d. OklahomaRanch.com (attorney Donald J. Chaffin)* On October 4, 2017, Midship filed a response to the FERC Environmental Data Request No. 2. In this filing, in response to Resource Report 8 Question 3, Midship provided specific mitigation measures that will be implemented to address each of the specific concerns raised by attorney Donald J. Chaffin on behalf of Oklahomaranch.com LLC (Ms. Laurie Williams). Henry House Creek and the adjacent area is proposed to be crossed by horizontal directional drill (HDD), which will avoid impacts to this creek and any adjacent wetlands. Midship has communicated this to attorney Donald J. Challin, to which Mr. Chaffin responded on August 3, 2017 that this would be acceptable to Ms. Williams. Documentation of this correspondence is provided in ***Attachment 29***. Midship is working with Oklahomaranch.com LLC on an agreement to secure an easement.

Midship Pipeline Company, LLC 13 March 2018

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
30	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary updated information regarding properties crossed by the MIDSHIP Project that are enrolled in NRCS or PSA conservation programs, and describe any proposed mitigation measures Midship Pipeline would implement to maintain the status of properties enrolled in these programs based on its consultation with the landowner(s) and the administering agency(ies).	Prior to 4/2/2018	Section 4.8.4	Midship located nine conservation easements or reservations when Marketable Title was performed: BR-0860.000 • Easement to The Bryan Soil and Water Conservation District (421/335) • Easement to The Bryan Soil and Water Conservation District (421/230) JO-0857.000 • Quit Claim Deed from USDA to James M. Pratt (111/498) o Conservation easement reserved JO-0858.000 • Quit Claim Deed from USDA to James M. Pratt (111/498) o Conservation easement reserved CR-0472.000 • Easement to Arbuckle Soil & Water Soil Conservation District (505/324) CR-0476.010 • Easement to Arbuckle Soil & Water Conservation District (505/321) CR-0568.000 • Easement to Arbuckle Soil Conservation District (502/460)

A1-27

Midship Pipeline Company, LLC 14 March 2018

A1-27 Section 4.8.4 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

A1-27 (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
				CR-0570.000 • Easement to Arbuckle Soil Conservation District (484/476) GR-0289.010 • Easement to Grady County Soil and Water Conservation District (761/120) Midship did not find any recorded documents for the Wetlands Reserve Program (WRP), Conservation Reserve Program (CRP) or Conservation Reserve Enhancement Program (CREP). However, it is possible land could be enrolled in the Wetlands Reserve Program (WRP), Conservation Reserve Program (CRP) or Conservation Reserve Enhancement Program (CREP) and the title search not find any related document. The title scope is limited to only records found in the Office of the Recorder, Probate Court and District Court of the county we are searching. In the Recorder's office, documents would need to be recorded in the land records - given a Book/Page or Document Number. If a WRP, CRP or CREP document was not recorded at the Recorder's office, the document would not be included in the title search. In the absence of these recorded documents, Midship would know a given parcel is enrolled in a wetland/conservation program only if the information is offered by the landowner. **Additional Tracts Identified:** The following 12 tracts have been identified as

Midship Pipeline Company, LLC 15 March 2018

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

	#	Description	Timing	Section Reference	Response
A1-27 (cont'd)					tracts which may be enrolled in a conservation or wetlands program. This information was provided verbally by the landowner or found on the executed Construction Questionnaire form: CL-KI-0023.000 GR-0208.010 GR-0365.000 CR-0617.000 CR-0631.000 CR-0669.000 JO-0841.000 BR-0961.000 BR-0963.000 BR-0968.000 BR-1006.000 BR-1007.000 It is possible this list does not include all tracts enrolled in a conservation or wetlands program because the landowners may be unaware their property is enrolled or they may be unwilling to provide this information. Wherever easements or reservations have been identified, Midship will work with the landowner and/or easement holder or administrative agency to ensure construction and restoration methods and other impact mitigation are consistent with the goals of the respective conservation easement program.
A1-28	31	Prior to the end of the draft EIS comment period, Midship Pipeline should file with the Secretary a visual screening plan for the Bennington Compressor Station that includes specific mitigation measures it would implement to reduce the visibility of the compressor station from nearby residences.	Prior to 4/2/2018	Section 4.8.8.2	Midship has performed a visual assessment for Bennington Compressor Station to determine its visual impacts on surrounding residences (***Attachment 31a***). Only one residence, across Pipeline Road to the southwest, will be affected visually by the compressor Station. To mitigate for this impact, Midship has developed a

Midship Pipeline Company, LLC 16 March 2018

A1-28 Section 4.8.8.2 of the EIS has been revised to incorporate this information.

A1 – Midship Pipeline Company, LLC (cont'd)

A1-28 (cont'd)

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
				Bennington Landscape Mitigation Plan (***Attachment 31b***) to provide visual shielding between the residence and the compressor station. The effectiveness of the visual mitigation can be seen in ***Attachment 31c***.
32	Prior to construction, Midship Pipeline shall file with the Secretary, for review and written approval by the Director of OEP, a traffic management plan that details specific measures that it will implement to minimize impacts on traffic. As applicable, the traffic management plan shall identify traffic control measures and personnel, emergency access management procedures, offsite vehicle parking areas, alternative worker transportation methods (e.g., bussing to construction worksites), and a communication plan for notifying emergency services personnel, school systems, and the public about the location and duration of road closures.	Prior to Construction	Section 4.9.5	Midship accepts this recommendation and will comply with its provisions.
33	Midship Pipeline shall not begin construction of facilities and/or use of staging, storage, or temporary work areas and new or to-be-improved access roads until: a. Midship Pipeline files with the Secretary: i. the remaining cultural resources survey report(s); ii. site evaluation report(s) and avoidance/treatment plan(s), as required; and iii. comments on the cultural resources reports and plans from the Oklahoma State Historic Preservation Office and interested Indian tribes; b. the ACHP is afforded an opportunity to comment if historic properties would be adversely affected; and c. the FERC staff reviews and the Director of OEP approves the cultural resources reports and plans, and notifies Midship Pipeline in writing that treatment plans/mitigation measures (including archaeological data recovery) may be implemented and/or construction may proceed. All materials filed with the Commission containing location, character, and ownership information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering "CUI/PRIV – DO NOT RELEASE."	Prior to Construction	Section 4.10.5	Midship accepts this recommendation and will comply with its provisions.

A1 – Midship Pipeline Company, LLC (cont'd)

MIDSHIP PROJECT – DEIS
RESPONSES TO RECOMMENDATIONS

TABLE 1

FERC Staff's Recommended Mitigation

#	Description	Timing	Section Reference	Response
34	With its Implementation Plan, Midship Pipeline shall file with the Secretary, for review and written approval by the Director of OEP, an HDD noise assessment for the North Canadian River; Oklahoma, Kansas and Texas Railroad; Blue River; and Rock Creek HDDs. The HDD noise assessments shall include: a. a detailed list of the noise mitigation measures Midship Pipeline will implement at each HDD entry/exit site; and b. the predicted noise attributable to HDD activities at each entry/exit site with implementation of the proposed noise mitigation measures that demonstrates that noise levels associated with HDD activities will be reduced to less than 55 dBA Ldn at the nearest NSA.	With its Implementation Plan	Section 4.11.2.2	Midship accepts this recommendation and will comply with its provisions.
35	Midship Pipeline shall file noise surveys with the Secretary no later than 60 days after placing the Calumet, Tatums, and Bennington Compressor Stations and the Sholem Booster Station in service. If a full load condition noise survey is not possible, Midship Pipeline shall provide an interim survey at the maximum possible horsepower load and provide the full load survey within 6 months. If the noise attributable to the operation of any of the compressor or booster stations under interim or full horsepower load conditions exceeds an Ldn of 55 dBA at any nearby NSAs, Midship Pipeline shall file a report on what changes are needed and shall install the additional noise controls to meet the level within 1 year of the in-service date. Midship Pipeline shall confirm compliance with the above requirement by filing a second noise survey with the Secretary no later than 60 days after it installs the additional noise controls.	no later than 60 after in service	Section 4.11.2.2	Midship accepts this recommendation and will comply with its provisions.

Midship Pipeline Company, LLC 18 March 2018

A1 – Midship Pipeline Company, LLC (cont'd)

The attachments to this letter have been removed from this environmental impact statement. They are available for viewing on the Federal Energy Regulatory Commission's (FERC) website at http://www.ferc.gov. Using the "eLibrary" link, select "General Search" from the eLibrary menu, enter the selected date range and "Docket No." excluding the last three digits (i.e., CP17-458, PF17-3), and follow the instructions. For assistance please contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll free at 1-866-208-3676 or, for TTY, contact 202-502-8659. The category/accession number for this submittal is 20180329-5230.

APPENDIX P

INDEX