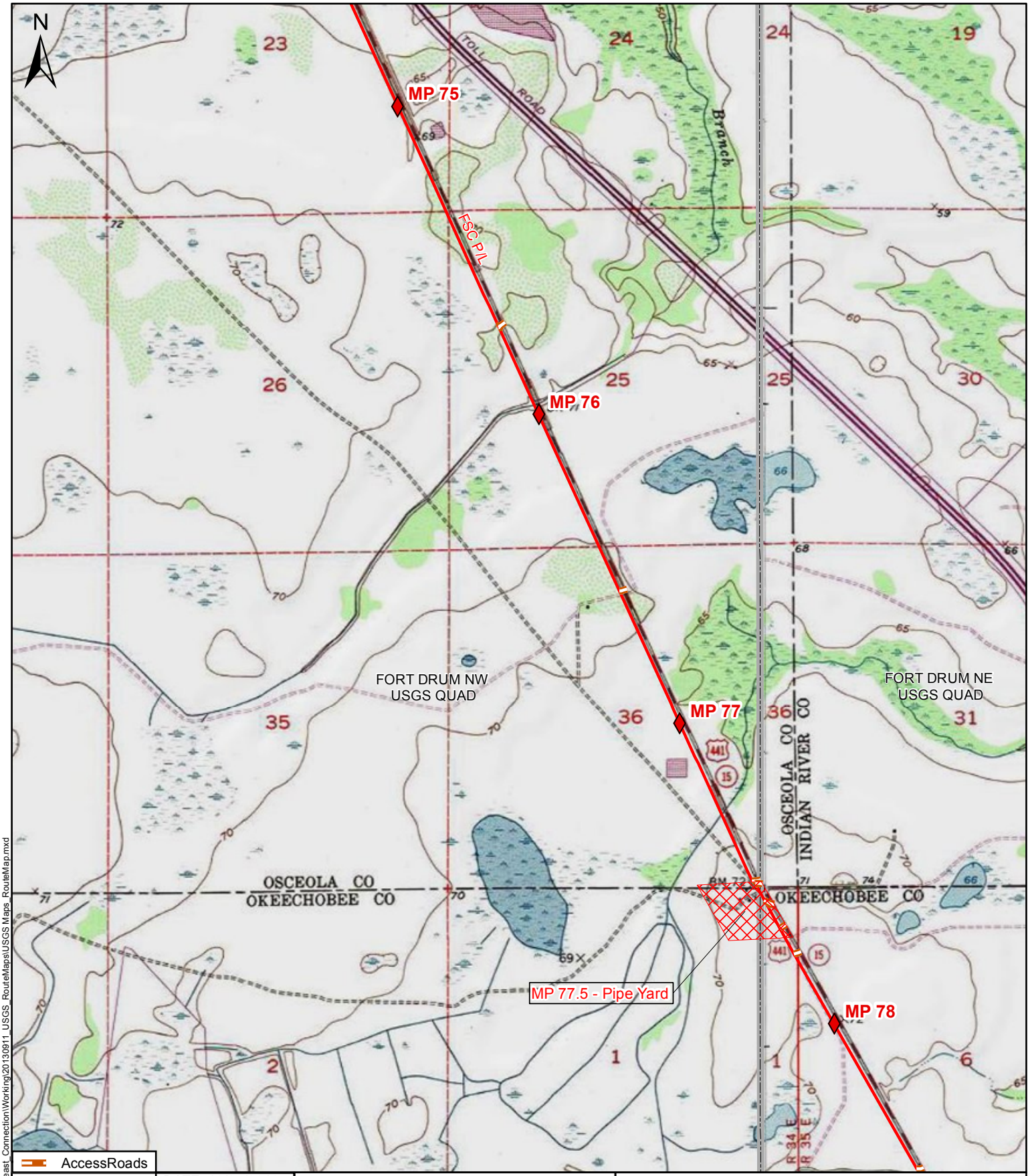

DRAWN BY: C.R.	DATE: 10/24/2013
REVIEWED BY: M.B.	DATE: 10/24/2013
APPROVED BY:R.G.	DATE: 10/24/2013
SCALE: 1 ' = 2,000 "	SHEET: 24 OF 38

0 1,000 2,000 4,000
Feet

A	09/11/2013	ISSUED FOR REVIEW
B	10/24/2013	ISSUED FOR 30% DESIGN

FLORIDA SOUTHEAST CONNECTION

UniversalPegasus INTERNATIONAL

USGS TOPOGRAPHIC MAPS

FLORIDA SOUTHEAST CONNECTION LLC
FLORIDA SOUTHEAST CONNECTION
PIPELINE PROJECT
PROPOSED PIPELINE AND FACILITIES
Osceola, Indian River & Okeechobee County, Florida

DRAWING NO: 21040-510-GNW-21533 REV. B

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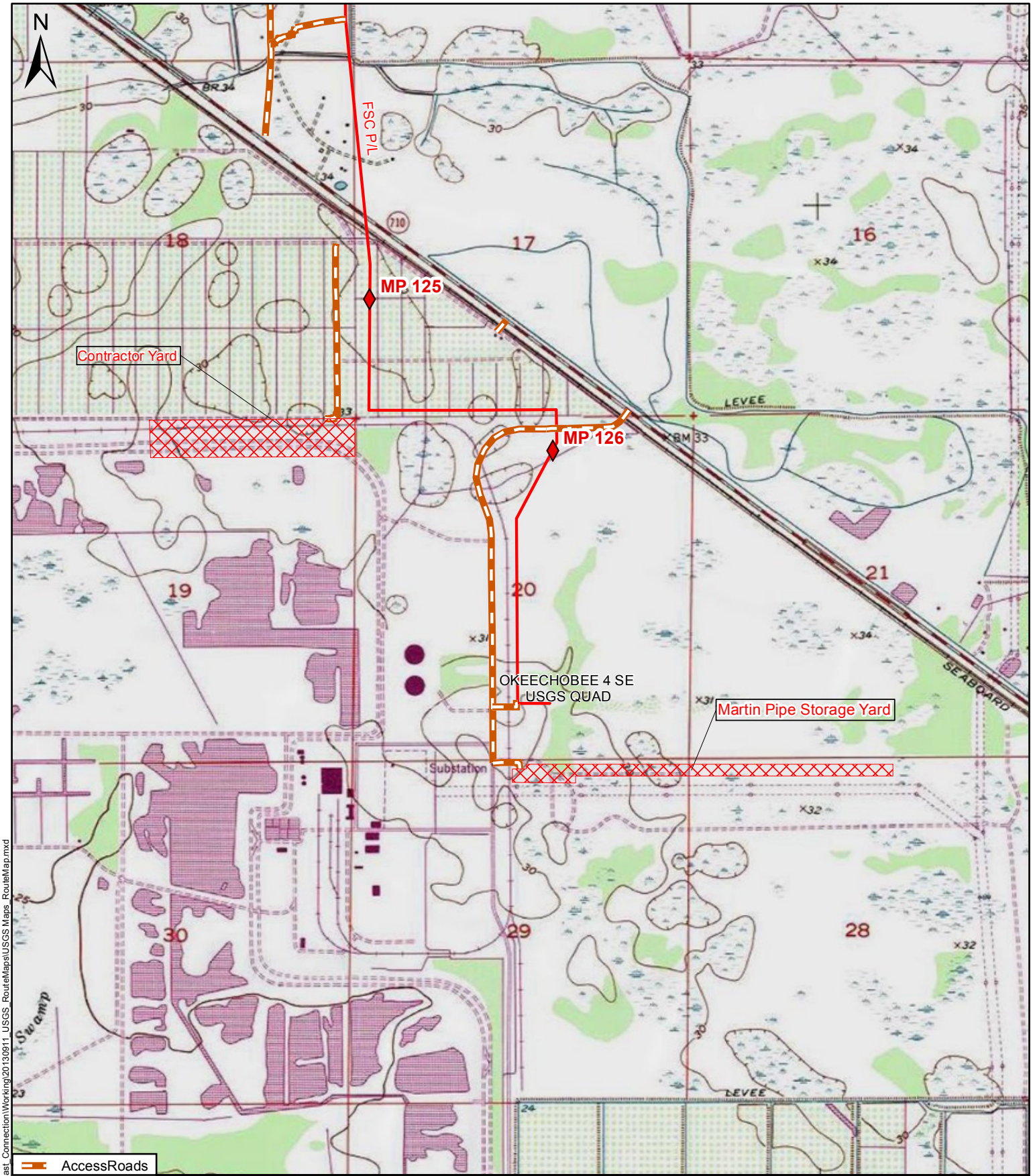
Figure 1.5-3D



DRAWN BY: C.R.	DATE: 10/24/2013	
REVIEWED BY: M.B.	DATE: 10/24/2013	
APPROVED BY:R.G.	DATE: 10/24/2013	
SCALE: 1 ' = 2,000 "	SHEET: 38 OF 38	

0 1,000 2,000 4,000
Feet

A	09/11/2013	ISSUED FOR REVIEW
B	10/24/2013	ISSUED FOR 30% DESIGN

FLORIDA SOUTHEAST CONNECTION

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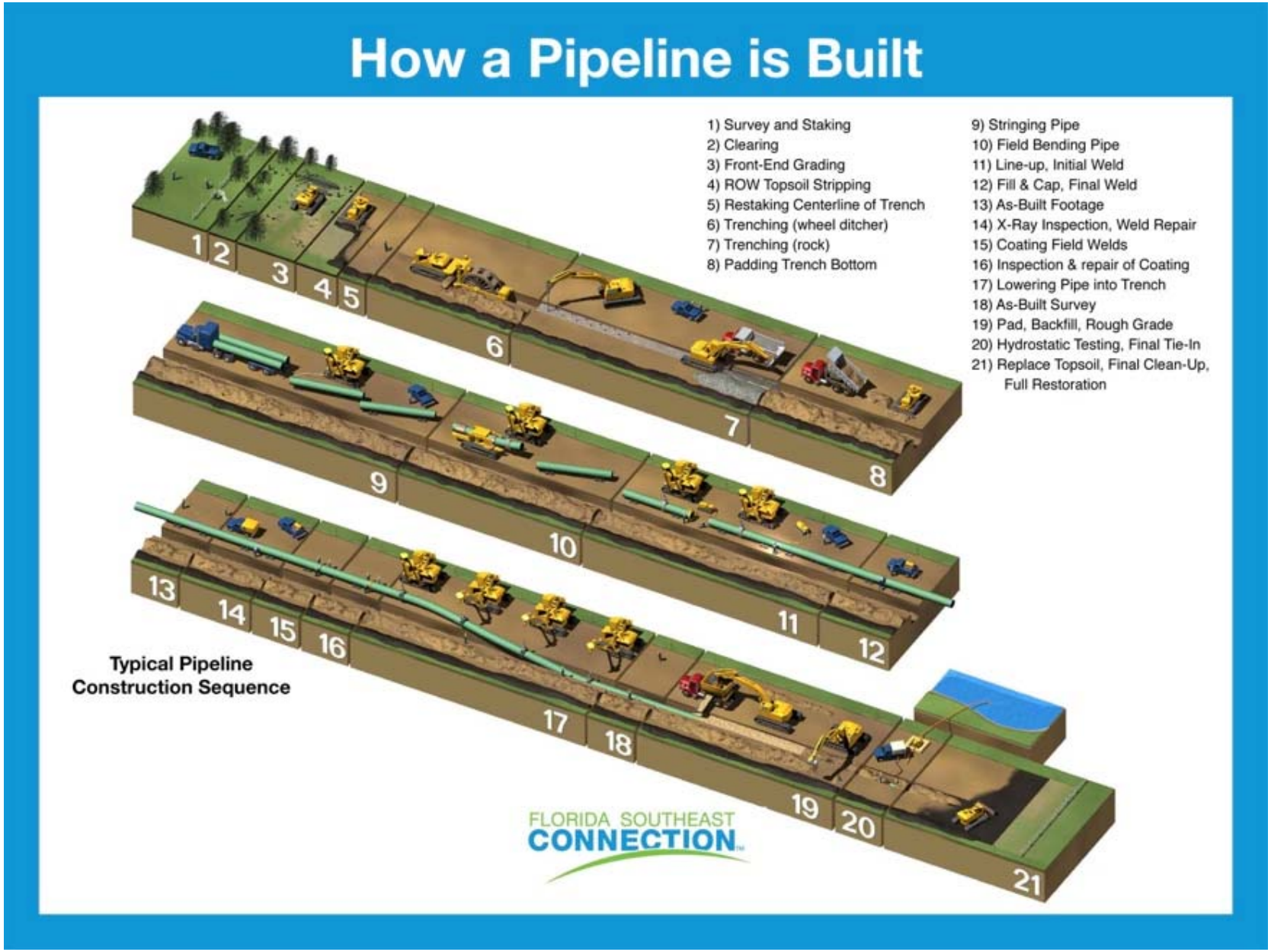
USGS TOPOGRAPHIC MAPS

FLORIDA SOUTHEAST CONNECTION LLC
FLORIDA SOUTHEAST CONNECTION
PIPELINE PROJECT
PROPOSED PIPELINE AND FACILITIES
Martin County, Florida

DRAWING NO: 21040-510-GNW-21554 REV. B

Path: Y:\Projects\21040_FPL_Florida_Southeast_Connection\Working\20130911_USGS_RouteMaps\USGS Maps_RouteMap.mxd

Figure 1.5-3E


How a Pipeline is Built
1) Survey and Staking
2) Clearing
3) Front-End Grading
4) ROW Topsoil Stripping
5) Restaking Centerline of Trench
6) Trenching (wheel ditcher)
7) Trenching (rock)
8) Padding Trench Bottom
9) Stringing Pipe
10) Field Bending Pipe
11) Line-up, Initial Weld
12) Fill & Cap, Final Weld
13) As-Built Footage
14) X-Ray Inspection, Weld Repair
15) Coating Field Welds
16) Inspection & repair of Coating
17) Lowering Pipe into Trench
18) As-Built Survey
19) Pad, Backfill, Rough Grade
20) Hydrostatic Testing, Final Tie-In
21) Replace Topsoil, Final Clean-Up, Full Restoration
1
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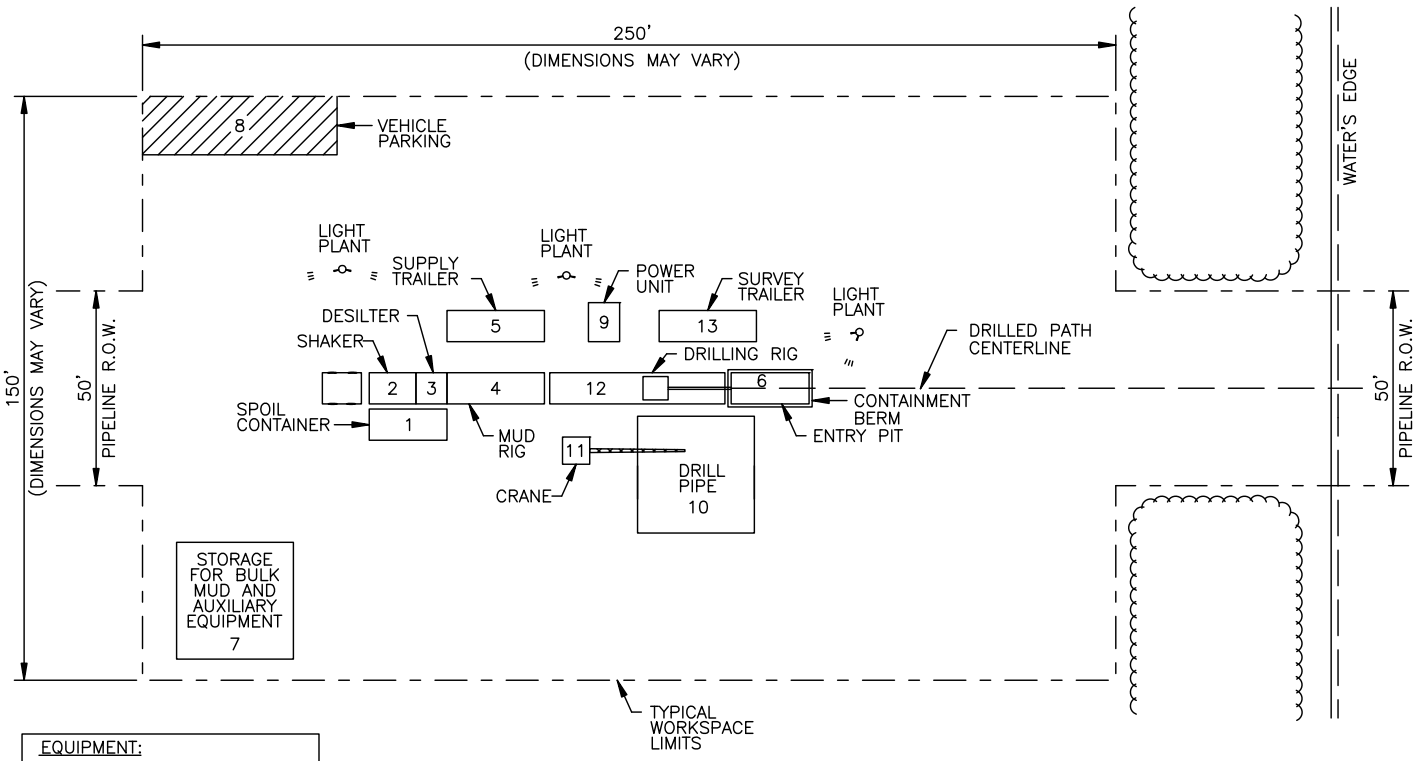
Typical Pipeline Construction Sequence
FLORIDA SOUTHEAST CONNECTION

Figure 1.7-1



EQUIPMENT:

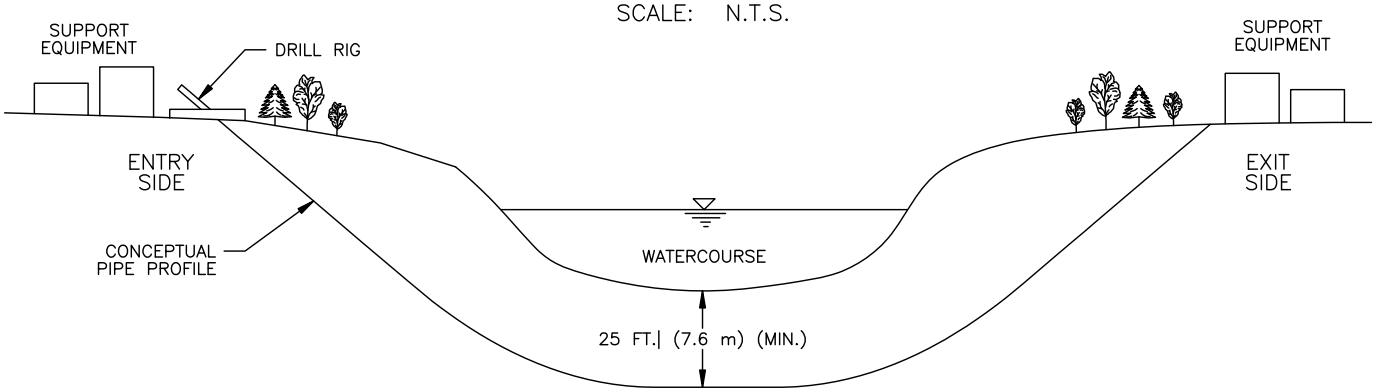
1. SPOIL CONTAINER: 8' x 20'
2. SHAKER: 8' x 12'
3. DESILTER: 8' x 8'
4. MUD RIG: 8' x 25'
5. SUPPLY TRAILER: 8' x 25'
6. ENTRY PIT: 8' x 20'
7. STORAGE: 30' x 30'
8. VEHICLE PARKING: 15' x 50'
9. POWER UNIT: 8' x 10'
10. DRILL PIPE: 30' x 30'
11. CRANE: 8' x 8'
12. DRILLING RIG: 8' x 45'
13. SURVEY TRAILER: 8' x 25'

NOTES:

1. EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.
2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.
4. ACCESS ROADS WILL BE USED TO OBTAIN WATER FROM SOURCE WHERE PERMITTED.

ENTRY SITE PLAN

SCALE: N.T.S.



NOTES:

1. PIPE DEPTHS MAY VARY.

PROFILE

SCALE: N.T.S.

FLORIDA SOUTHEAST CONNECTION PROJECT

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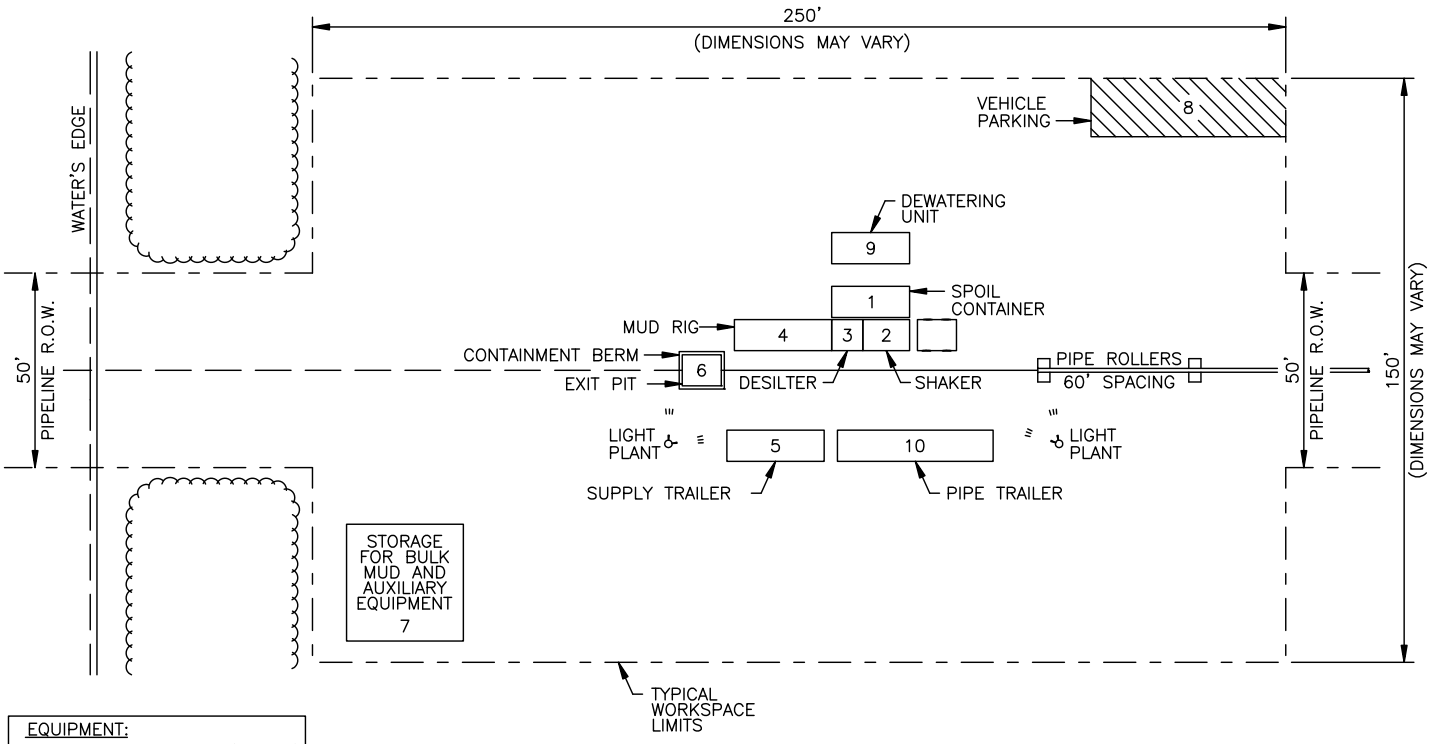
FLORIDA SOUTHEAST CONNECTION

NO.	REVISION	DATE	APPR.
C	ISSUE FOR FINAL PRE-FERC FILING	12/20/13	LD
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

Figure 1.7-2A
Typical Directional Drill Entry Site Plan & Profile

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040-510-TYP-20024	1 OF 1



EQUIPMENT:

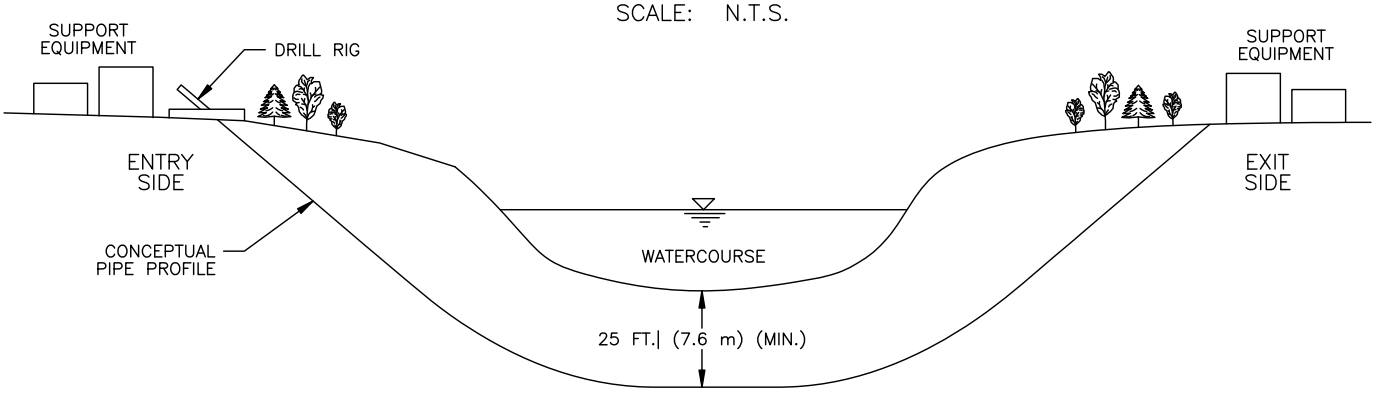
1. SPOIL CONTAINER: 8' x 20'
2. SHAKER: 8' x 12'
3. DESILTER: 8' x 8'
4. MUD RIG: 8' x 25'
5. SUPPLY TRAILER: 8' x 25'
6. EXIT PIT: 8' x 10'
7. STORAGE: 30' x 30'
8. VEHICLE PARKING: 15' x 50'
9. DEWATERING UNIT: 8' x 20'
10. PIPE TRAILER: 8' x 40'

NOTES:

1. EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.
2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.
4. ACCESS ROADS WILL BE USED TO OBTAIN WATER FROM SOURCE WHERE PERMITTED.

EXIT SITE PLAN

SCALE: N.T.S.



NOTES:

1. PIPE DEPTHS MAY VARY.

PROFILE

SCALE: N.T.S.

FLORIDA SOUTHEAST CONNECTION PROJECT

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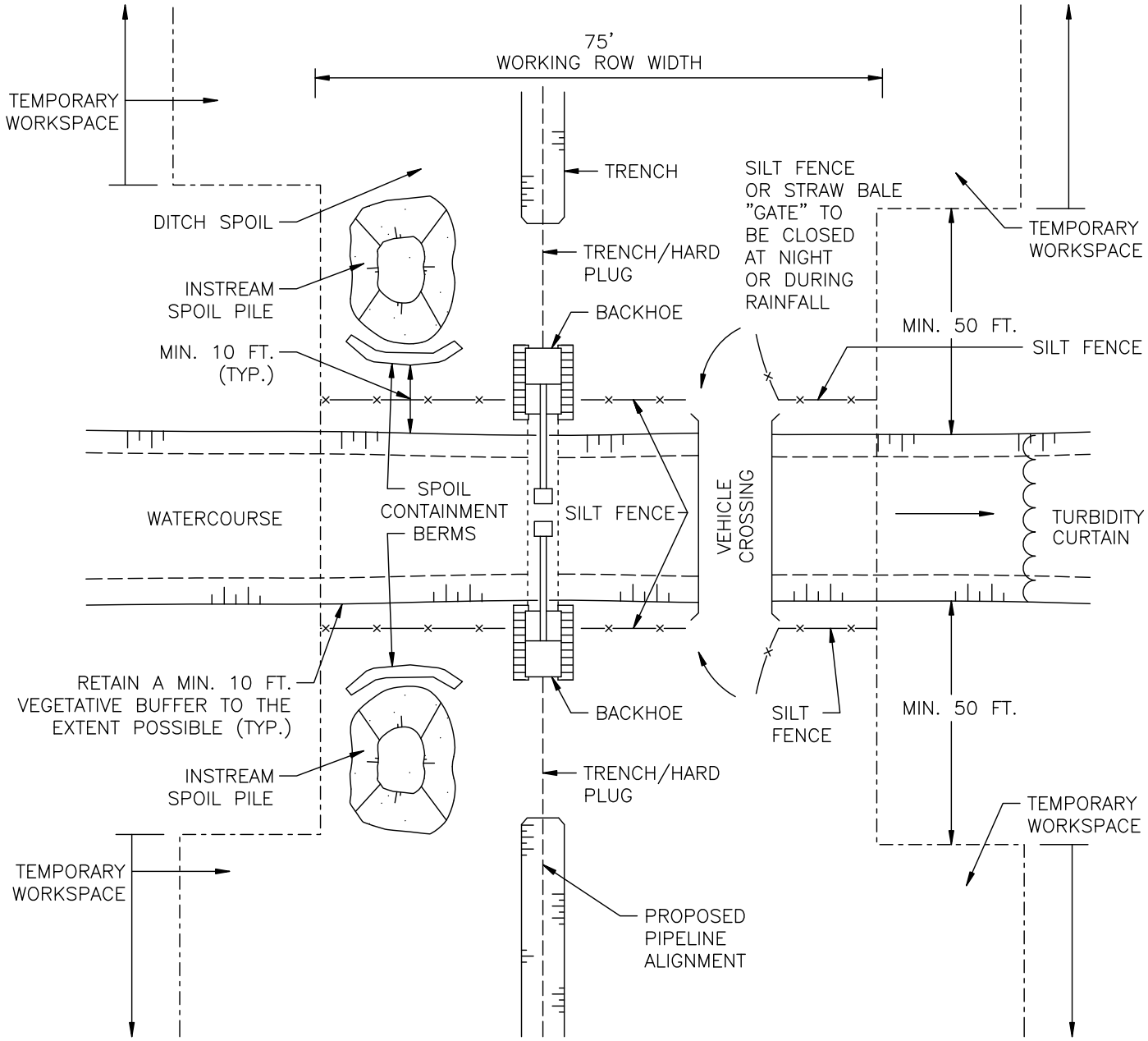
FLORIDA SOUTHEAST CONNECTION

NO.	REVISION	DATE	APPR.
C	ISSUE FOR FINAL PRE-FERC FILING	12/20/13	LD
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

Figure 1.7-2B
Typical Directional Drill
Exit Site Plan & Profile

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040-510-TYP-20025	1 OF 1



PLAN VIEW

SCALE: N.T.S.

SEQUENCE OF ACTIVITIES

STEP 1. CLEAR AND GRADE.

STEP 2. IMPLEMENT THE TEMPORARY EROSION AND SEDIMENT CONTROLS.

STEP 3. FABRICATE PIPE.

STEP 4. EXCAVATE TRENCH AND INSTALL PIPE.

STEP 5. BACKFILL AND RESTORE STREAM BANKS.

STEP 6. IMPLEMENT THE PERMANENT EROSION AND SEDIMENT CONTROLS.

SEE SHEET 2 FOR NOTES.

FLORIDA SOUTHEAST CONNECTION PROJECT

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FLORIDA SOUTHEAST CONNECTION

NO.	REVISION	DATE	APPR.
C	ISSUE FOR FINAL PRE-FERC FILING	12/20/13	LD
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

Figure 1.7-3
Typical Open Cut Wet Crossing

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LD	RG	LD	21040	21040-510-TYP-20053	1 OF 2

NOTES:

1– WORK SPACE — MAXIMUM LIMITS ARE DEPICTED. STAGING FOR MAKEUP LOCATED A MINIMUM OF 50 FEET FROM WATERBODY.

2– CLEARING — MARK CLEARING LIMITS AND MINIMIZE CLEARING OF RIPARIAN VEGETATION. WOODY VEGETATION SHALL BE CUT AT GROUND LEVEL AND THE STUMPS/ROOTS LEFT IN PLACE TO THE EXTENT POSSIBLE.

3– TOPSOIL STRIPPING — TOPSOIL SHALL BE STRIPPED FROM ALL WETLAND AREAS OVER THE DITCH LINE AND SPOIL AREAS.

4– SPILL PREVENTION — CONTRACTOR SHALL INSTALL SIGNS 100 FEET MINIMUM FROM EACH STREAM BANK AND WETLAND TO IDENTIFY THE HAZARDOUS MATERIALS EXCLUSION AREA.

5– EROSION & SEDIMENT CONTROL

A. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED OR ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS STREAM OR WETLAND.

B. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY OR INDIRECTLY INTO THE STREAM. ALL EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO SUIT ACTUAL SITE CONDITIONS. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION.

C. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA, INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED CONSTRUCTION RIGHT OF WAY EXCEPT DURING EXCAVATION /INSTALLATION OF THE CROSSING PIPE.

D. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE RIVER CROSSING UNTIL THE RIVER CROSSING IS INSTALLED AND BACKFILLED.

E. TRENCH BREAKERS ARE TO BE INSTALLED AT THE SAME SPACING AND IMMEDIATELY UPSLOPE OF PERMANENT SLOPE BREAKERS, OR AS DIRECTED BY THE COMPANY.

6– INSTALLATION — CONTRACTOR SHALL MAINTAIN HARD PLUGS IN THE DITCH AT THE RIVER EDGE UNTIL JUST PRIOR TO PIPE INSTALLATION. CONTRACTOR SHALL EXCAVATE TRENCH AND INSTALL PIPE AS EXPEDIENTLY AS PRACTICAL TO REDUCE THE DURATION OF WORK ACTIVITIES IN THE STREAM BED.

7– SPOIL PLACEMENT — CONTRACTOR SHALL PLACE TRENCH SPOIL ONLY IN CERTIFICATED WORK SPACE AND A MINIMUM OF 10 FEET FROM THE STREAM BANKS TO PREVENT ENTRY OF SPOIL INTO THE STREAM FLOW. SPOIL SHALL BE CONTAINED AS NECESSARY USING EITHER A STRAW BALE BARRIER OR AN EARTH/ROCK BERM.

8– CLEANUP BANK STABLIZATION RESTORATION — CONTRACTOR SHALL RESTORE THE STREAM BED AND BANKS TO APPROXIMATE PRECONSTRUCTION CONTOURS, UNLESS OTHERWISE APPROVED BY THE COMPANY. CONTRACTOR SHALL INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED. ANY MATERIALS PLACED IN THE STREAM TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATER COURSE AND WETLAND BOUNDARIES UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.

9– TEMPORARY VEHICLE CROSSING — VEHICLE CROSSING CAN BE CONSTRUCTED USING EITHER A FLUME CROSSING OR A TEMPORARY BRIDGE.

10– REFERENCE — REFER TO WATER BODY AND WETLAND CROSSING PROCEDURES FOR REQUIREMENTS.

REFER TO SHEET 1

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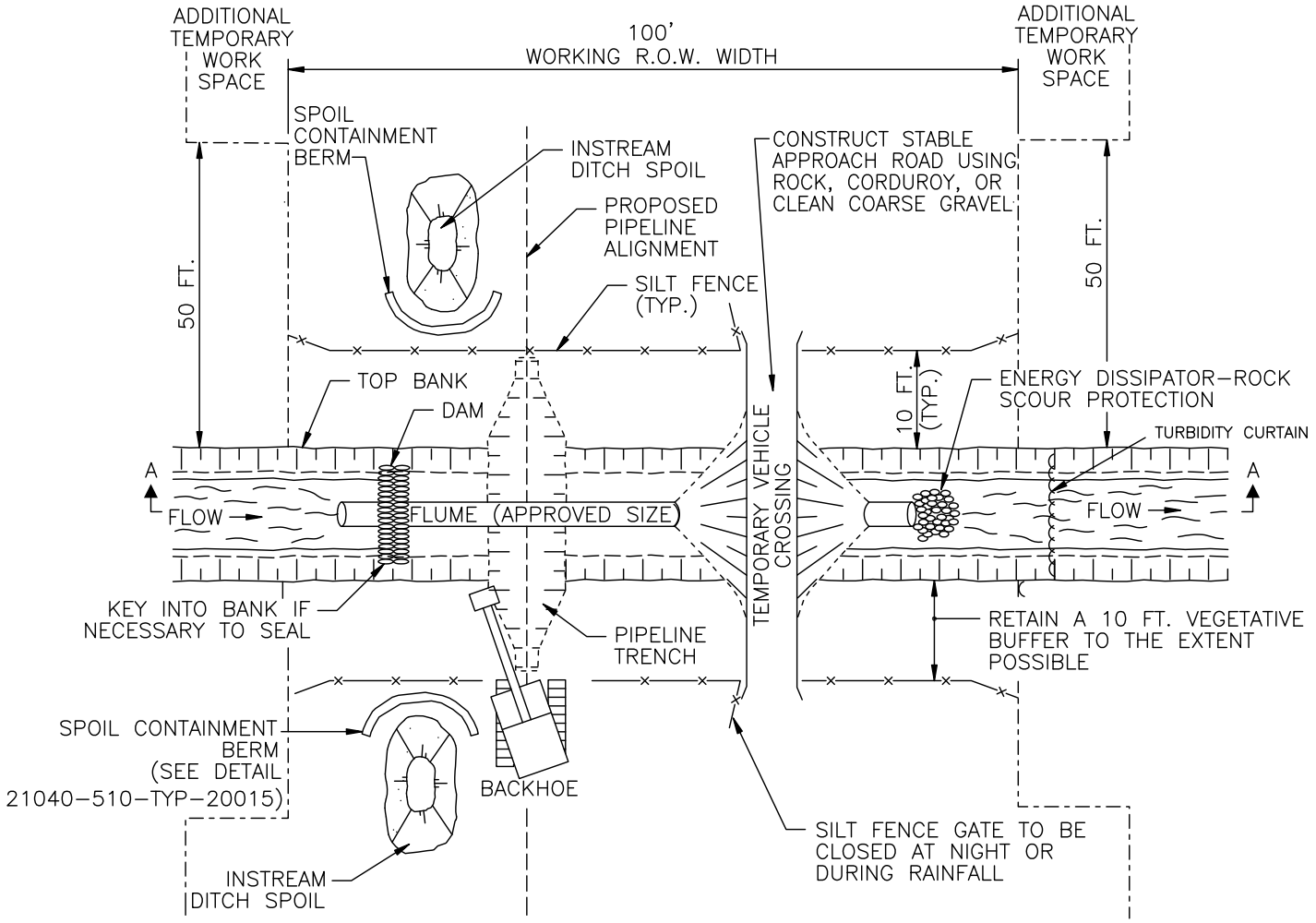
NO.	REVISION	DATE	APPR.
C	ISSUE FOR FINAL PRE–FERC FILING	12/20/13	LD
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

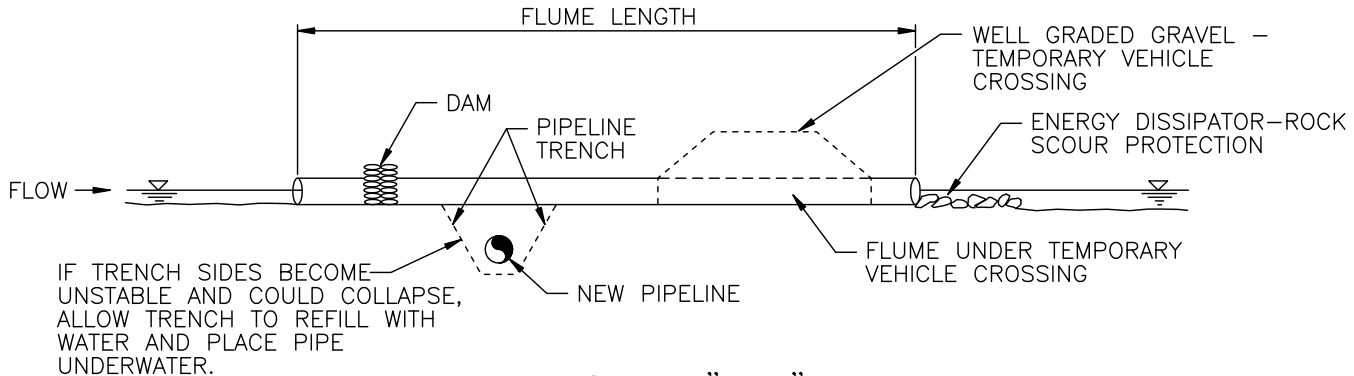
Figure 1.7-3
Typical Open Cut Wet Crossing

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040–510–TYP–20053	2 OF 2



PLAN VIEW

SCALE: N.T.S.



SECTION "A-A"

SCALE: N.T.S.

SEE SHEET 2 FOR NOTES.

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NO.	REVISION	DATE	APPR.
C	ISSUE FOR FINAL PRE-FERC FILING	12/20/13	LD
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

Figure 1.7-4
Typical Dry Flume Crossing

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040-510-TYP-20057	1 OF 2

DRY FLUME CROSSINGS

THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES TO BE FOLLOWED AT ALL "DRY FLUME" TYPE CROSSINGS.

SEQUENCE OF ACTIVITIES

STEP 1. CLEAR AND GRADE CERTIFICATED RIGHT-OF-WAY AS NECESSARY.
STEP 2. IMPLEMENT THE TEMPORARY EROSION AND SEDIMENT CONTROLS.
STEP 3. FABRICATE PIPE.
STEP 4. INSTALL DRY STREAM CROSSING MATERIALS.
STEP 5. EXCAVATE TRENCH AND INSTALL PIPE.
STEP 6. BACKFILL AND RESTORE STREAM BANKS.
STEP 7. REMOVE FLUME CROSSING.
STEP 8. IMPLEMENT THE PERMANENT EROSION AND SEDIMENTATION CONTROLS.

NOTES:

1. MARK OUT AND MAINTAIN LIMITS OF AUTHORIZED WORK AREAS WITH FENCING OR FLAGGING TAPE TO AVOID UNNECESSARY DISTURBANCE OF VEGETATION. ENSURE EQUIPMENT OPERATORS WORKING ON THE CROSSING HAVE BEEN BRIEFED ABOUT THIS PLAN AND THE MEASURES NEEDED TO PROTECT WATER QUALITY.

2. ALL NECESSARY EQUIPMENT AND MATERIALS TO BUILD THE FLUME MUST BE ON SITE OR READILY AVAILABLE PRIOR TO COMMENCING IN-WATER WORK.

3. TO THE EXTENT POSSIBLE, MAINTAIN A MINIMUM 10 FT. VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREAS AND THE WATERCOURSE. INSTALL AND MAINTAIN A SILT FENCE OR STRAW BALE BARRIER UPSLOPE OF THE BUFFER STRIP ON EACH SIDE OF THE WATERCOURSE.

4. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED OR ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS STREAM.
   a. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY OR INDIRECTLY INTO THE STREAM.
   b. EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO ACTUAL SITE CONDITIONS.
   c. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION. UTILIZE STRAW BALE BARRIERS ONLY IN LIEU OF A SILT FENCE WHERE FREQUENT ACCESS IS REQUIRED.
   d. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG.
   e. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED PORTIONS OF THE RIGHT-OF-WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.
   f. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE RIVER CROSSING UNTIL THE RIVER CROSSING IS INSTALLED AND BACKFILLED.

5. PIPE SHALL BE STRUNG AND WELDED FOR READY INSTALLATION PRIOR TO WATERCOURSE TRENCHING.

6. FLUME CAPACITY DURING DRY CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE 1.5 TIMES THE FLOW MEASURED AT THE TIME OF CONSTRUCTION PROVIDED THAT THE FLUMES WILL BE IN PLACE NOT MORE THAN 96 HOURS AND NO PRECIPITATION IS FORECAST. FLUME CAPACITY FOR VEHICLE ACCESS SHALL BE SUFFICIENT TO PASS THE 2 YEAR DESIGN FLOW OR THE FLOW REASONABLY EXPECTED TO OCCUR DURING THE INSTALLATION. EXCESS FLUMES REQUIRED FOR LONGER TERM ACCESS SHALL BE CAPPED DURING DRY CROSSING PROCEDURES.

7. ENSURE THAT THE DAMS AND VEHICLE-CROSSING ARE LOCATED FAR ENOUGH APART TO ALLOW FOR A WIDE EXCAVATION. FLUMES ARE TO BE SET WITH 10 PERCENT OF THEIR DIAMETER BELOW STREAMBED LEVEL WHERE SOIL CONDITIONS PERMIT (OTHERWISE INSTALLED AT STREAM GRADE AND SLOPE).

8. PLACE IMPERVIOUS DAMS AT EACH END OF THE FLUME, UPSTREAM FIRST, THEN DOWNSTREAM. ACCEPTABLE ALTERNATIVES INCLUDE GRAVEL WITH RIP-RAP PROTECTION, SAND BAGS, STEEL PLATE AND ROCKFILL. DURING INSTALLATION, INSTALL AN IMPERVIOUS MEMBRANE, IF NECESSARY, TO LIMIT LEAKAGE, DAMS MAY NEED KEYING INTO THE BANK AND STREAMBED.

9. EXCAVATE TRENCH THROUGH PLUGS AND UNDER FLUME FROM BOTH SIDES. WORK IS TO BE COMPLETED AS QUICKLY AS POSSIBLE.
   a. LOWER IN PIPE BY PASSING UNDER FLUME AND BACKFILL IMMEDIATELY WITH SPOIL MATERIAL.
   b. IT IS NOT NECESSARY TO DEWATER THE IN-STREAM TRENCH, HOWEVER, DISPLACED WATER SHALL BE PUMPED TO A STABLE UPLAND AREA TO AVOID OVERTOPPING OF DAMS DURING PIPE PLACEMENT.
   c. IF THE SPOIL MATERIAL IS NOT SUITABLE, USE IMPORTED CLEAN GRANULAR MATERIAL.
   d. IF BLASTING IS REQUIRED, USE CONTROLLED BLASTING TECHNIQUES TO PREVENT DAMAGE TO THE FLOW CONVEYANCE SYSTEM. ALTERNATIVELY, BLASTING MAY BE ACCOMPLISHED PRIOR TO FLUME INSTALLATION BY DRILLING THROUGH THE OVERBURDEN.

10. EXCAVATED MATERIAL MUST NOT BE STOCKPILED WITHIN 10 FT. OF THE WATERCOURSE. THIS MATERIAL MUST BE CONTAINED WITHIN BERM CONTAINMENT, WITH SECONDARY SILT FENCE PROTECTION TO PREVENT SATURATED SOIL FROM FLOWING BACK INTO THE WATERCOURSE.

11. PER AGENCY'S APPROVAL; DEWATERING OF THE ONLAND TRENCH SHOULD OCCUR IN ASTABLE VEGETATED AREA A MINIMUM OF 50 FT. FROM ANY WATERBODY. THE PUMP DISCHARGE SHOULD BE DIRECTED ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL OR TIMBERS TO PREVENT LOCALIZED EROSION. THE DISCHARGE WATER SHOULD ALSO BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD BY BY USING STRAW BALES AND THE NATURAL TOPOGRAPHY.

12. FLUMES SHOULD BE REMOVED AS SOON AS POSSIBLE, WHEN NO LONGER REQUIRED FOR PIPE LAYING OR FOR ROAD ACCESS, IN THE FOLLOWING MANNER:
   a. REMOVE THE VEHICLE CROSSING RAMP. BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH THE FLOW CONDITIONS (E.G., EROSION CONTROL BLANKETS, CRIBBING, ROCK RIP-RAP, ETC.) TO THE MAXIMUM EXTENT POSSIBLE BEFORE REMOVING THE DAMS.
   b. REMOVE DOWNSTREAM DAM.
   c. REMOVE UPSTREAM DAM.
   d. REMOVE FLUME.
   e. COMPLETE BANK TRIMMING AND EROSION PROTECTION. IF SANDBAGS ARE USED FOR THE DAMS, PLACE AND REMOVE BY HAND TO AVOID EQUIPMENT BREAKING BAGS.

13. CONTRACTOR SHALL RESTORE THE STREAM BED AND BANKS TO APPROXIMATE PRE-CONSTRUCTION CONTOURS, BUT NOT TO EXCEED 2 HORIZONTAL TO 1 VERTICAL.
   a. CONTRACTOR SHALL INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED ON A SITE SPECIFIC BASIS. IN THE ABSENCE OF SITE SPECIFIC INFORMATION, A FLEXIBLE CHANNEL LINER SUCH AS NAG C125 OR C350 WHICH IS CAPABLE OF WITHSTANDING ANTICIPATED FLOW SHALL BE INSTALLED. ALTERNATIVELY, ROCK RIP-RAP SHALL BE INSTALLED.
   b. ANY MATERIALS PLACED IN THE STREAM TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING.
   c. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATER COURSE UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.

REFER TO SHEET 1

FLORIDA SOUTHEAST CONNECTION PROJECT

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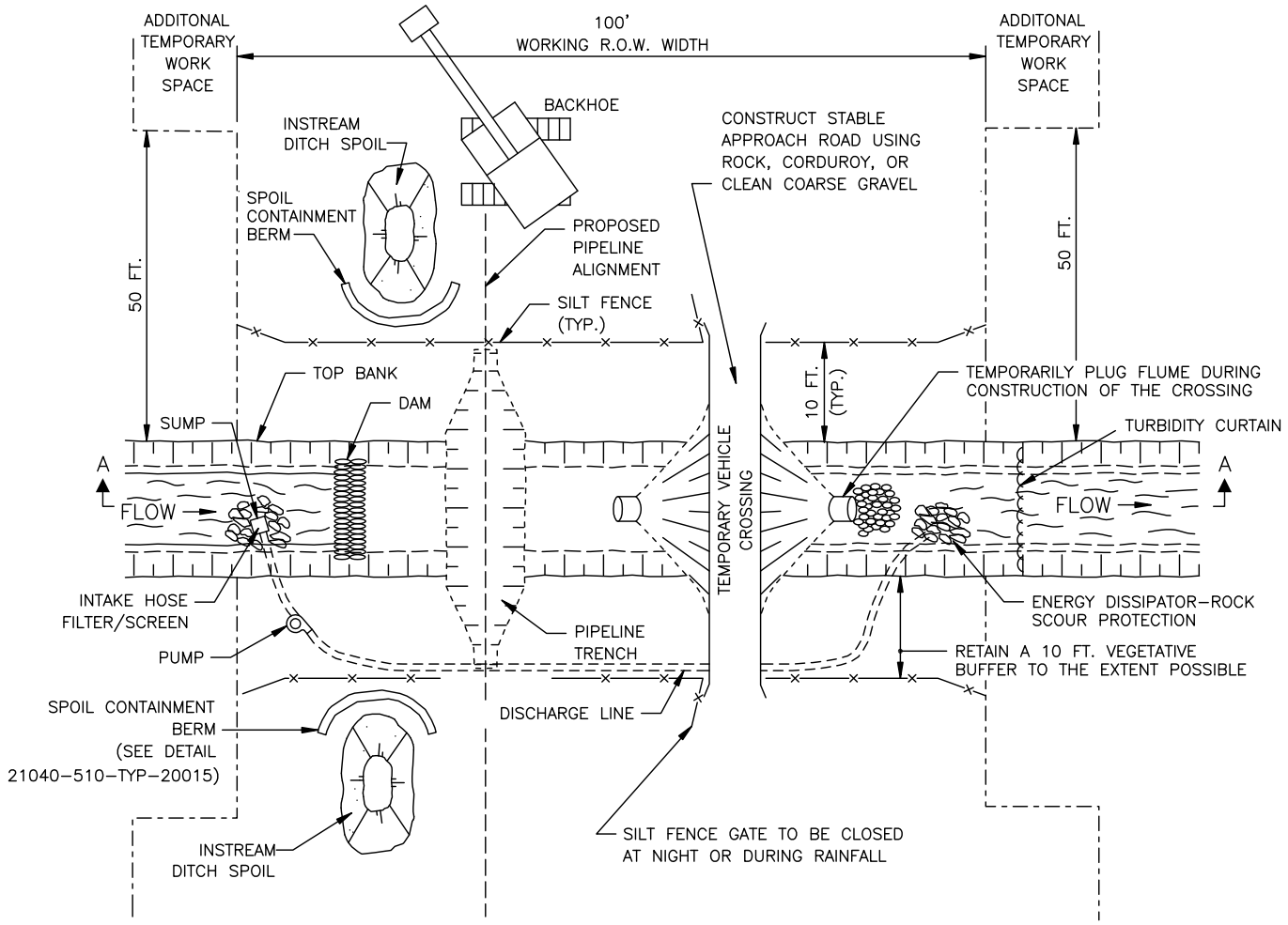
FLORIDA SOUTHEAST CONNECTION

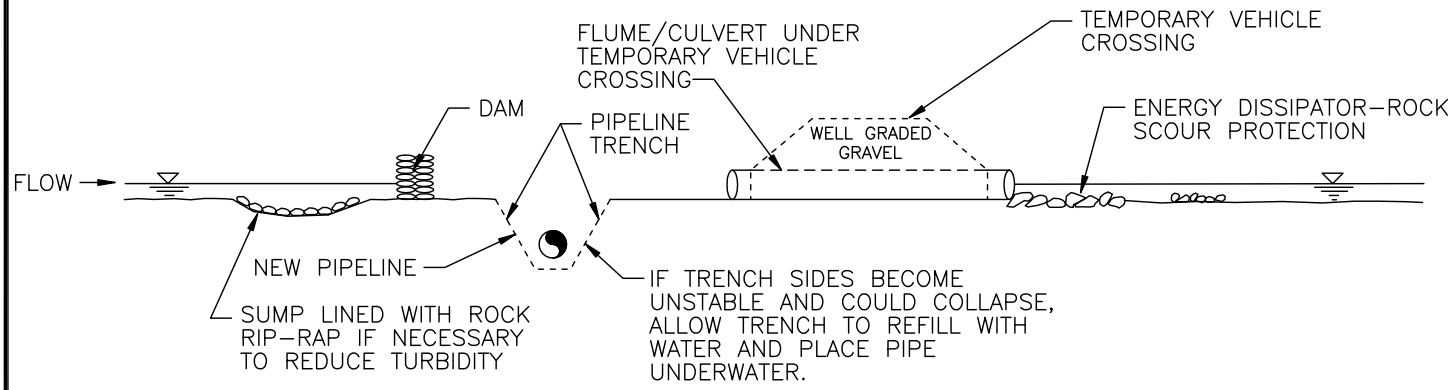
NO.	REVISION	DATE	APPR.
C	ISSUE FOR FINAL PRE-FERC FILING	12/20/13	LD
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

Figure 1.7-4
Typical Dry Flume Crossing

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040-510-TYP-20057	2 OF 2



PLAN VIEW
SCALE: N.T.S.



SECTION "A-A"
SCALE: N.T.S.

SEE SHEET 2 FOR NOTES.

FLORIDA SOUTHEAST CONNECTION PROJECT

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B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

Figure 1.7-5
Typical Dam and Pump Crossing

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040-510-TYP-20055	1 OF 2

DAM AND PUMP CROSSING

THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES TO BE FOLLOWED AT ALL "DAM AND PUMP" TYPE CROSSINGS.

SEQUENCE OF ACTIVITIES

STEP 1. CLEAR AND GRADE CERTIFICATED RIGHT-OF-WAY AS NECESSARY.
STEP 2. IMPLEMENT THE TEMPORARY EROSION AND SEDIMENT CONTROLS.
STEP 3. FABRICATE PIPE.
STEP 4. INSTALL DRY STREAM CROSSING MATERIALS.
STEP 5. EXCAVATE TRENCH AND INSTALL PIPE.
STEP 6. BACKFILL AND RESTORE STREAM BANKS.
STEP 7. REMOVE DAMS.
STEP 8. IMPLEMENT THE PERMANENT EROSION AND SEDIMENTATION CONTROLS.

MAINTENANCE OF STREAMFLOW

IF THERE IS ANY FLOW IN THE WATERCOURSE, INSTALL PUMPS TO MAINTAIN STREAMFLOW AROUND THE BLOCKED OFF SECTIONS OF CHANNEL. THE PUMP IS TO HAVE 1.5 TO 2 TIMES THE PUMPING CAPACITY OF ANTICIPATED FLOW. A SECOND STANDBY PUMP OF EQUAL CAPACITY IS TO BE READILY AVAILABLE AT ALL TIMES. AN ENERGY DISSIPATOR IS TO BE BUILT TO ACCEPT PUMP DISCHARGE WITHOUT STREAMBED OR STREAMBANK EROSION. IF THE CROSSING IS PROLONGED BEYOND ONE DAY THE OPERATION NEEDS TO BE MONITORED OVERNIGHT.

NOTES:

1. WHERE NECESSARY, OBTAIN PRIOR APPROVAL BEFORE USING THE DAM AND PUMP METHOD.
2. SCHEDULE INSTREAM ACTIVITY FOR LOW FLOW PERIODS AND FOR THE APPROPRIATE TIMING WINDOW.
3. MARK OUT AND MAINTAIN LIMITS OF AUTHORIZED WORK AREAS WITH FENCING OR FLAGGING TAPE TO AVOID UNNECESSARY DISTURBANCE OF VEGETATION. ENSURE EQUIPMENT OPERATORS WORKING ON THE CROSSING HAVE BEEN BRIEFED ABOUT THIS PLAN AND THE MEASURES NEEDED TO PROTECT WATER QUALITY. INSTALL PRE-WORK SEDIMENT CONTROL MEASURES AS SPECIFIED IN THE PLAN. ALL NECESSARY EQUIPMENT AND MATERIALS TO BUILD THE DAMS AND TO PUMP WATER MUST BE ON SITE OR READILY AVAILABLE PRIOR TO COMMENCING IN-WATER CONSTRUCTION. PIPE SHOULD BE STRUNG, WELDED AND COATED AND READY FOR INSTALLATION PRIOR TO WATERCOURSE TRENCHING.
4. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED OR ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS STREAM.
   a. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY OR INDIRECTLY INTO THE STREAM.
   b. EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO ACTUAL SITE CONDITIONS.
   c. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION. UTILIZE STRAW BALE BARRIERS ONLY IN LIEU OF A SILT FENCE WHERE FREQUENT ACCESS IS REQUIRED.
   d. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA, INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG.
   e. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED PORTIONS OF THE RIGHT-OF-WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.
   f. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE RIVER CROSSING UNTIL THE RIVER CROSSING IS INSTALLED AND BACKFILLED.
5. TO THE EXTENT POSSIBLE, MAINTAIN A MINIMUM 10 FEET VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREAS AND THE WATERCOURSE. INSTALL AND MAINTAIN A SILT FENCE UPSLOPE OF THE BUFFER STRIP ON EACH SIDE OF THE WATERCOURSE. THE SILT FENCE SHOULD INCORPORATE REMOVABLE "GATES" AS REQUIRED TO ALLOW ACCESS WHILE MAINTAINING EASE OF REPLACEMENT FOR OVERNIGHT OR DURING PERIODS OF RAINFALL.
6. CONSTRUCT A TEMPORARY SUMP UPSTREAM OF THE DAM AND LINE WITH ROCKFILL IF A NATURAL POOL DOES NOT EXIST. INSTALL THE PUMP OR PUMP INTAKE IN THE POOL OR SUMP. DISCHARGE WATER ONTO AN ENERGY DISSIPATOR DOWNSTREAM OF THE WORK AREA.
7. EXCAVATED MATERIAL MUST NOT BE STOCKPILED WITHIN 10 FT. OF THE WATERCOURSE. THIS MATERIAL MUST BE CONTAINED WITHIN BERM CONTAINMENT, WITH SECONDARY SILT FENCE PROTECTION TO PREVENT SATURATED SOIL FROM FLOWING BACK INTO THE WATERCOURSE.
8. CHEMICALS, FUELS, LUBRICATING OILS SHALL NOT BE STORED AND EQUIPMENT REFUELED WITHIN 100 FT. OF THE WATERBODY. PUMPS ARE TO BE REFUELED AS PER THE SPCC PLANS.
9. STAGING AREAS ARE TO BE LOCATED AT LEAST 50 FT. FROM THE WATER'S EDGE (WHERE TOPOGRAPHIC CONDITIONS PERMIT) AND SHALL BE THE MINIMUM SIZE NEEDED.
10. DAMS ARE TO BE MADE OF STEEL PLATE, INFLATABLE PLASTIC DAM, SAND BAGS, COBBLES, WELL GRADED COARSE GRAVEL FILL, OR ROCK FILL. DAMS MAY NEED KEYING INTO THE BANKS AND STREAMBED. ENSURE THAT THE DAM AND VEHICLE CROSSING ARE LOCATED FAR ENOUGH APART TO ALLOW FOR A WIDE EXCAVATION. CAP FLUMES USED UNDER VEHICLE CROSSING DURING DRY CROSSING.
11. AFTER RECEIVING APPROVAL FROM AGENCY; DEWATER AREA BETWEEN DAMS IF POSSIBLE, DEWATERING SHOULD OCCUR IN A STABLE VEGETATIVE AREA A MINIMUM OF 50 FT. FROM ANY WATERBODY. THE PUMP DISCHARGE SHOULD BE DISCHARGED ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL SANDBAGS, OR TIMBERS TO PREVENT LOCALIZED EROSION. THE DISCHARGE WATER SHOULD ALSO BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD BY USING STRAW BALES AND THE NATURAL TOPOGRAPHY. IF IT IS NOT POSSIBLE TO DEWATER THE EXCAVATION DUE TO SOILS WITH A HIGH HYDRAULIC CONDUCTIVITY, THE EXCAVATION AND PIPE PLACEMENT IS TO BE CARRIED OUT IN THE STANDING WATER. PUMP ANY DISPLACED WATER AS DESCRIBED ABOVE TO PREVENT OVERTOPPING OF DAMS.
12. EXCAVATE TRENCH THROUGH PLUGS AND STREAMBED FROM BOTH SIDES, RE-POSITIONING DISCHARGE HOSE AS NECESSARY. LOWER THE PIPE IN THE TRENCH AND BACKFILL IMMEDIATELY. DURING THIS OPERATION WORK IS TO BE COMPLETED AS QUICKLY AS POSSIBLE.
13. CONTRACTOR SHALL RESTORE THE STREAM BED AND BANKS TO APPROXIMATE PRE-CONSTRUCTION CONTOURS, BUT NOT TO EXCEED 2 HORIZONTAL TO 1 VERTICAL.
   a. CONTRACTOR SHALL INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED ON A SITE SPECIFIC BASIS. IN THE ABSENCE OF SITE SPECIFIC INFOR-MATION, A FLEXIBLE CHANNEL LINER SUCH AS NAG C125 OR C350 WHICH IS CAPABLE OF WITHSTANDING ANTICIPATED FLOW SHALL BE INSTALLED. ALTERNATIVELY, ROCK RIP-RAP SHALL BE INSTALLED.
   b. ANY MATERIALS PLACED IN THE STREAM TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING.
   c. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATER COURSE UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.
14. WHEN THE STREAMBED HAS BEEN RESTORED, THE CREEK BANKS ARE TO BE CONTOURED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH FLOW VELOCITY BETWEEN DAMS (E.G., EROSION CONTROL BLANKETS, CRIBBING, ROCK RIP-RAP, ETC.). THE DAMS ARE TO BE REMOVED DOWNSTREAM FIRST. KEEP PUMP RUNNING UNTIL NORMAL FLOW IS RESUMED. COMPLETE BANK TRIMMING AND EROSION PROTECTION. IF SANDBAGS ARE USED FOR THE DAMS, PLACE AND REMOVE BY HAND TO AVOID EQUIPMENT BREAKING BAGS.

REFER TO SHEET 1

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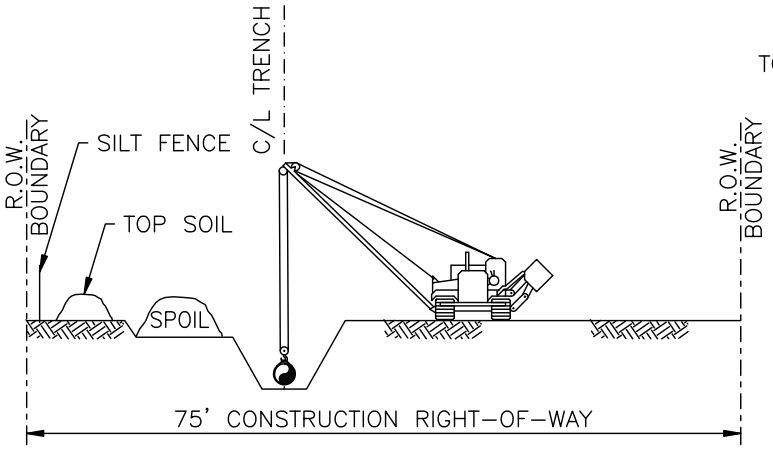
C	ISSUE FOR FINAL PRE-FERC FILING	12/20/13	LD
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

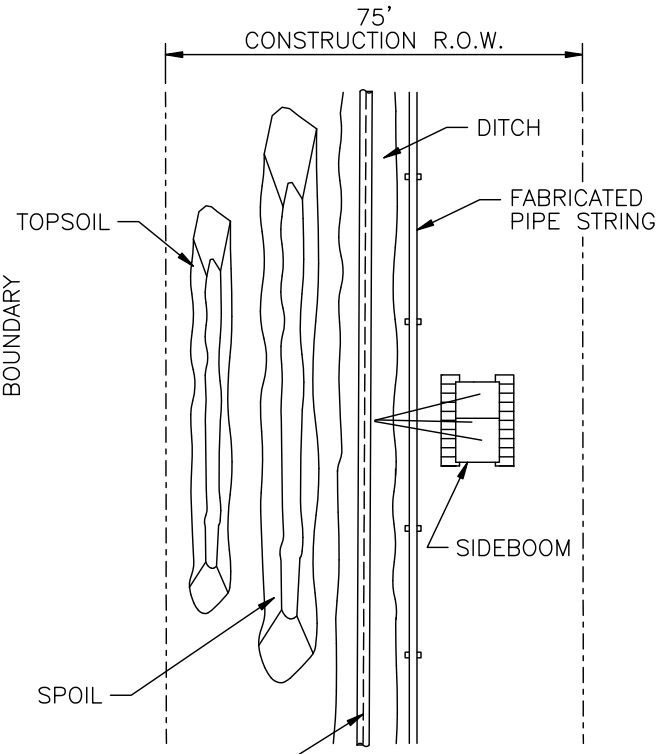
Figure 1.7-5
Typical Dam and Pump Crossing

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040-510-TYP-20055	2 OF 2



CROSS SECTION

SCALE: N.T.S.



PLAN VIEW

SCALE: N.T.S.

CONSTRUCTION PROCEDURE NOTES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER SPCC PLAN.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
4. CONSTRUCT WHEN DRY, IF POSSIBLE. IF SITE BECOMES WET AT TIME OF TRENCHING, AVOID SOIL COMPACTION BY UTILIZING TIMBER RIP-RAP OR PREFABRICATED EQUIPMENT MATS.
5. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT DOWN SLOPE EDGE OF RIGHT-OF-WAY ALONG WETLAND EDGE IF EVIDENT, OTHERWISE INSTALL BARRIER ON BOTH EDGES.
6. RESTRICT ROOT GRUBBING TO ONLY THAT AREA OVER THE DITCHLINE AND DITCH SPOIL AREAS. GRIND STUMPS IF NECESSARY IN OTHER AREAS TO FACILITATE CONSTRUCTION.
7. CONDUCT TRENCH LINE TOPSOIL STRIPPING (IF TOPSOIL IS NOT SATURATED). SALVAGE TOPSOIL TO ACTUAL DEPTH OR A MAXIMUM DEPTH OF 12 INCHES, AS DETERMINED BY THE ENVIRONMENTAL INSPECTOR. SEGREGATED TOPSOIL PILE MAY BE LOCATED ON SPOIL SIDE, AS REQUIRED.
8. TRENCH THROUGH WETLANDS.
9. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN.
10. LOWER-IN PIPE. PRIOR TO BACKFILLING TRENCH, TRENCH PLUG REQUIREMENTS SHALL BE DETERMINED BY THE ENVIRONMENTAL INSPECTOR. BACKFILL TRENCH.
11. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.
12. REMOVE ANY TIMBER MATS OR PREFABRICATED MATS FROM WETLANDS UPON COMPLETION.

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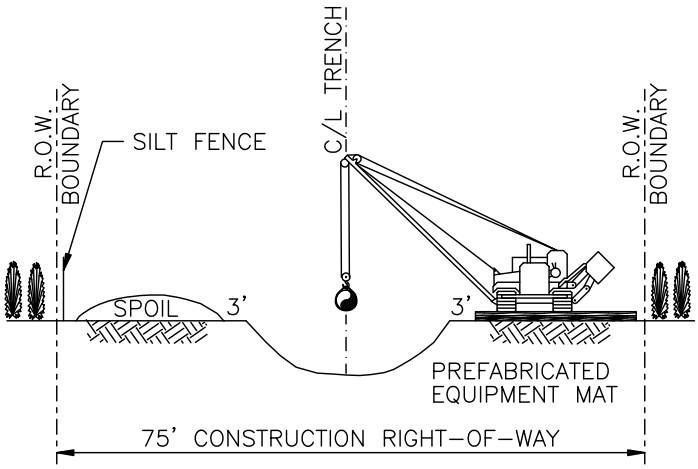
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

Figure 1.7-6
Type I "Dry"
Wetland Crossing

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/14/13	LB	RG	LD	21040	21040-510-TYP-20062	1 OF 1



CROSS SECTION

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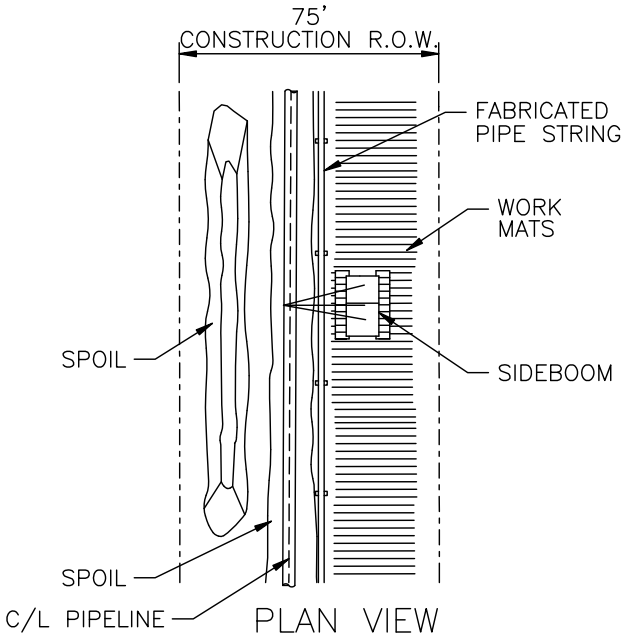

PLAN VIEW

SCALE: N.T.S.

CONSTRUCTION PROCEDURE NOTES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER SPCC PLAN.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
4. MINIMIZE SOIL COMPACTION BY UTILIZING PREFABRICATED EQUIPMENT MATS.
5. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT DOWN SLOPE EDGE OF RIGHT-OF-WAY AND ALONG WETLAND EDGE AS REQUIRED.
6. RESTRICT ROOT GRUBBING TO ONLY THAT AREA OVER THE DITCHLINE AND DITCH SPOIL AREAS. GRIND STUMPS IF NECESSARY IN OTHER AREAS TO FACILITATE CONSTRUCTION.
7. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
8. LEAVE HARD PLUGS AT THE EDGE OF WETLAND UNTIL JUST PRIOR TO TRENCHING.
9. INSTALL TIMBER MATS/RIP-RAP THROUGH ENTIRE WETLAND AREA. EQUIPMENT NECESSARY FOR RIGHT-OF-WAY CLEARING MAY MAKE ONE (1) PASS THROUGH THE WETLAND BEFORE MATS ARE INSTALLED.
10. TRENCH THROUGH WETLANDS.
11. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN.
12. LOWER-IN PIPE, INSTALL TRENCH PLUGS AT WETLAND EDGES IF DIRECTED BY THE ENVIRONMENTAL INSPECTOR AND BACKFILL IMMEDIATELY.
13. REMOVE ANY TIMBER MATS OR PREFABRICATED MATS FROM WETLANDS UPON COMPLETION.
14. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.
15. GENERALLY, SEEDING IN WETLANDS WILL NOT BE NECESSARY SINCE WETLANDS REVEGETATE QUICKLY AND SOD WILL REMAIN INTACT EXCEPT OVER TRENCH. THE CONTRACTOR SHALL SEED ANY WETLANDS THAT MAY REQUIRE SEEDING AS DETERMINED BY THE ENVIRONMENTAL INSPECTOR.

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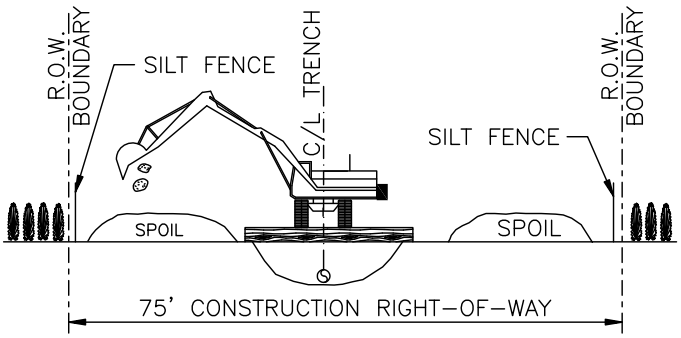
C	ISSUED FOR 30% DESIGN	10/25/13	LD
B	ISSUED FOR REVIEW	09/25/13	LD
A	ISSUED FOR REVIEW	08/21/13	LD

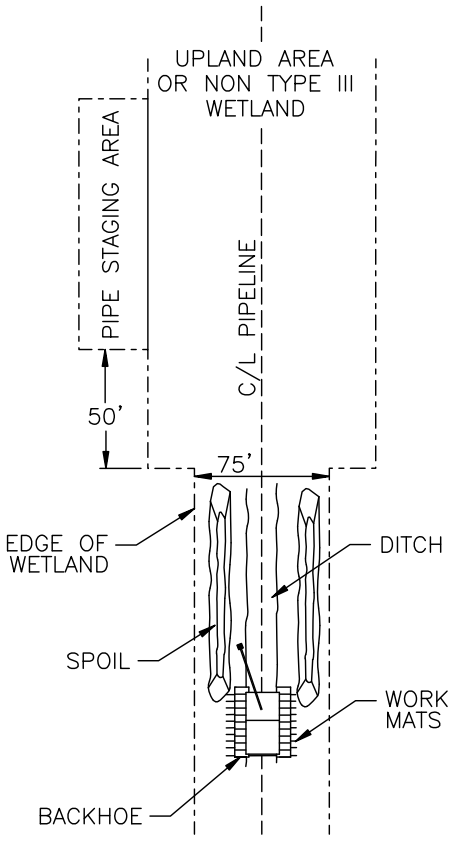
Figure 1.7-7
Type II "Wet" Saturated Wetland Crossing

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/21/13	LB	RG	LD	21040	21040-510-TYP-20063	1 OF 1



CROSS SECTION

SCALE: N.T.S.



PLAN VIEW

SCALE: N.T.S.

CONSTRUCTION PROCEDURE NOTES:

1. REDUCE THE CONSTRUCTION RIGHT-OF-WAY TO 75 FEET OR LESS IN TYPE III WETLAND.
2. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
3. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER SPCC PLAN.
4. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
5. RESTRICT ROOT GRUBBING TO ONLY THE AREA OVER THE DITCHLINE.
6. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
7. UTILIZE AMPHIBIOUS EXCAVATORS (PONTOON MOUNTED BACKHOES) OR TRACKED BACKHOES SUPPORTED BY FABRICATED TIMBER MATS OR FLOATS, TO EXCAVATE TRENCH. IF FABRICATED TIMBER MATS ARE USED FOR STABILIZATION, THE BACKHOE SHALL GRADUALLY MOVE ACROSS THE WETLAND BY MOVING THE MAT FROM IMMEDIATELY BEHIND TO IMMEDIATELY IN FRONT OF THE BACKHOE'S PATH.
8. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT EDGE OF RIGHT-OF-WAY AND ALONG WETLAND EDGE AS REQUIRED.
9. FABRICATE PIPE IN A STAGING AREA OUTSIDE THE TYPE III WETLAND AS INDICATED ON THE CONSTRUCTION DRAWINGS.
10. LEAVE HARD PLUGS AT THE EDGE OF TYPE III WETLAND UNTIL JUST PRIOR TO PIPE PLACEMENT.
11. FLOAT PIPE IN PLACE, LOWER-IN, INSTALL TRENCH PLUGS AT WETLAND EDGES OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR AND BACKFILL IMMEDIATELY.
12. REMOVE ANY MATS OR FILL CONSISTING OF NON-NATIVE MATERIAL FROM WETLANDS UPON COMPLETION.
13. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY AND INSTALL PERMANENT EROSION CONTROL.
14. WETLANDS CROSSED USING PUSH/PULL METHOD TEND TO BE TOO WET FOR EFFECTIVE SEEDING. HOWEVER, IF THE SITE IS DRY ENOUGH AND IF DIRECTED BY THE ENVIRONMENTAL INSPECTOR, THE RIGHT-OF-WAY SHALL BE SEEDED WITH ANNUAL RYE GRASS TO STABILIZE THE AREA UNTIL INDIGENOUS WETLAND SPECIES CAN RE-ESTABLISH THEMSELVES.

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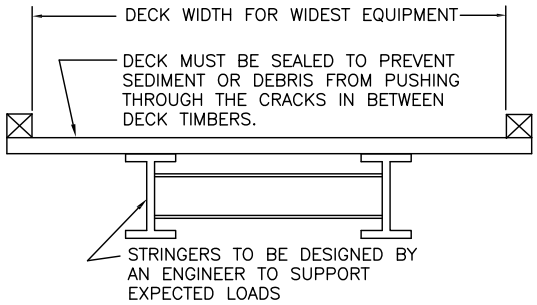
A	ISSUED FOR REVIEW	08/21/13	LD

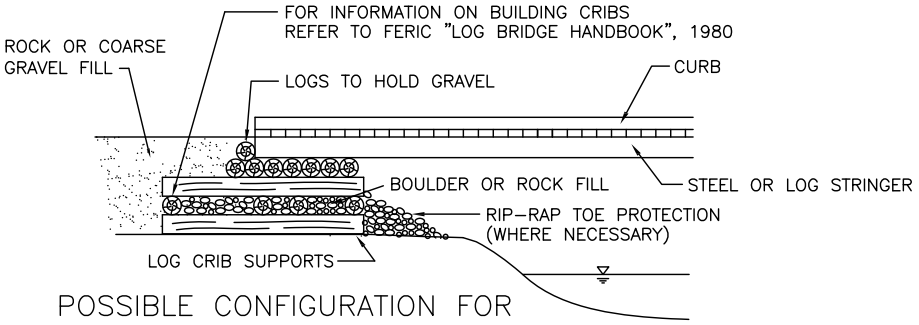
Figure 1.7-8
Type III "Wet" Flooded Wetland Crossing Push/Pull

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/21/13	LB	RG	LD	21040	21040-510-TYP-20064	1 OF 1

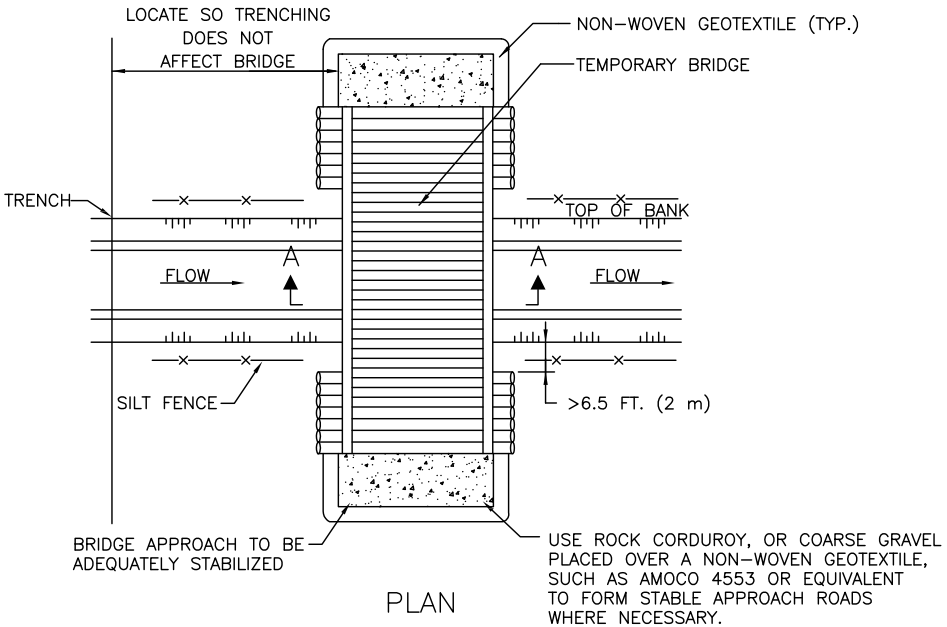


ALL BRIDGES TO HAVE CURBS 6" OR HIGHER TO CONTAIN SEDIMENT OR DEBRIS.

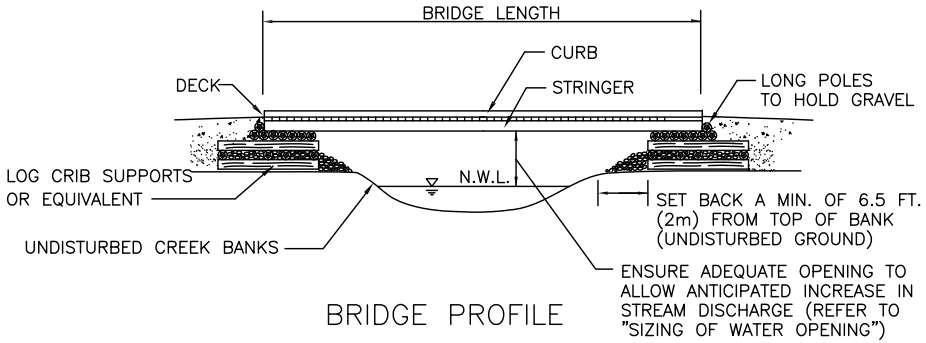
SECTION "A–A"



POSSIBLE CONFIGURATION FOR TEMPORARY CRIB ABUTMENT



PLAN



BRIDGE PROFILE

THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES TO BE FOLLOWED AT ALL TEMPORARY BRIDGE CROSSINGS.

1. A PRE–FABRICATED BRIDGE OR FLATBED RAILCAR , FLEXI–FLOAT OR FLUMED VEHICLE CROSSING MAY BE SUBSTITUTED FOR THE TEMPORARY BRIDGE.

2. INSTALL THE BRIDGE IN A MANNER THAT WILL MINIMIZE SEDIMENT ENTERING THE WATER. STRINGERS MUST BE DESIGNED TO SUPPORT THE LOADS EXPECTED ON THE BRIDGE. CURBS AT LEAST 6 IN. HIGH MUST BE INSTALLED ALONG THE EDGE OF THE DECK TO CONTAIN SEDIMENT AND DEBRIS ON THE BRIDGE. FASTENERS CONNECTING COMPONENTS MUST BE STRONG ENOUGH TO HOLD THEM IN POSITION DURING THE LIFE OF THE BRIDGE. CRIBS ARE TO BE FILLED WITH ROCK OR COBBLE. RIP–RAP EROSION PROTECTION IS TO BE PLACED AROUND THE CRIBS AND ON ANY FILL SLOPES PROJECTING INTO THE WATER.

3. ROAD APPROACHES LEADING TO THE BRIDGE MUST BE RAISED AND STABLE SO EQUIPMENT LOADS ARE SUPPORTED A SUFFICIENT DISTANCE BACK FROM THE WATER TO REDUCE SEDIMENT AND DEBRIS ENTERING THE STREAM FROM EQUIPMENT TRACKS. DO NOT USE SOIL TO CONSTRUCT OR STABILIZE EQUIPMENT BRIDGES. IF CUTS ARE NEEDED TO OBTAIN A SATISFACTORY GRADE, THEY ARE TO BE DUG WITH SIDE DITCHES AND STABLE SLOPES. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO KEEP SEDIMENT ON LAND (E.G., SILT FENCING, FILTER CLOTH, RIP–RAP, SEED AND MULCH, ETC.).

4. PERIODICALLY CHECK BRIDGE INSTALLATION AND REMOVE ANY BUILD–UP OF SEDIMENT OR DEBRIS ON THE BRIDGE.

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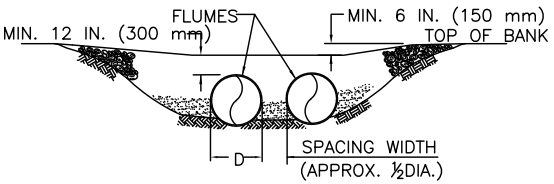
A	ISSUED FOR REVIEW	09/20/13	LD

TYPICAL TEMPORARY BRIDGE

Figure 1.7-9A

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040–510–TYP–20061	1 OF 1



SECTION "A–A"
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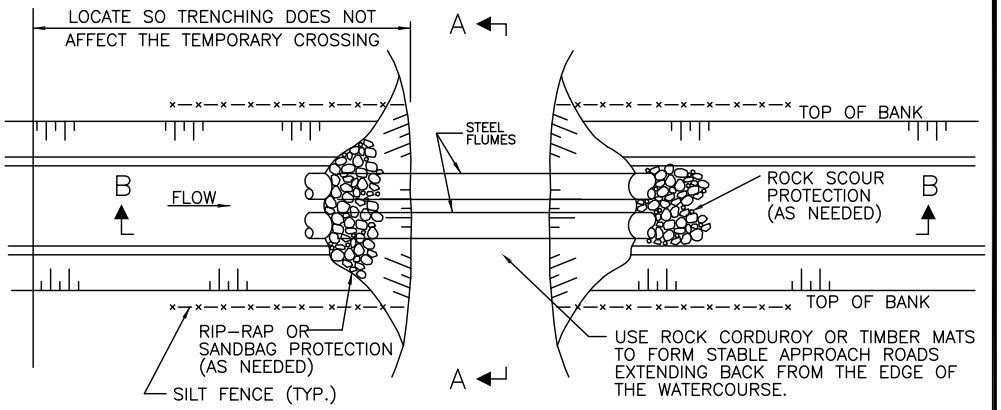
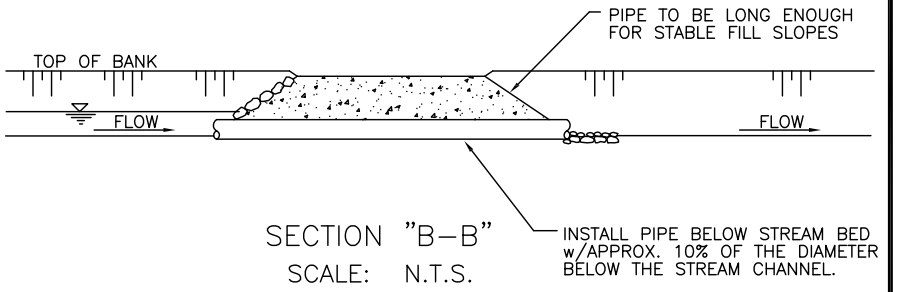


PLAN VIEW
SCALE: N.T.S.



SECTION "B–B"
SCALE: N.T.S.

THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES TO BE FOLLOWED AT ALL TEMPORARY FLUME VEHICLE CROSSINGS.

1. A PORTABLE FLEXI–FLOAT, OR TEMPORARY BRIDGE MAY BE SUBSTITUTED FOR THE TEMPORARY FLUME CROSSING.

2. THE LENGTH OF THE FLUME SHALL BE SUFFICIENT TO SPAN THE ENTIRE AREA REQUIRED FOR VEHICULAR ACCESS, EXTENDING 4 FT. BEYOND TOE OF FILL MATERIAL, SO TRENCHING WILL NOT AFFECT THE ROAD CROSSING. A LONGER PIPE IS TO BE USED, IF NEEDED, TO MAINTAIN STABLE SIDE SLOPES. FLUME CAPACITY TO BE BASED ON THE 2–YEAR DESIGN FLOW OR MAXIMUM FLOW ANTICIPATED TO OCCUR DURING INSTALLATION, AS SPECIFIED IN CONSTRUCTION DOCUMENTS.

3. WHERE PRACTICAL, BACKFILL AROUND THE PIPES AT THE ROAD WITH CLEAN, COARSE ROCK FILL MATERIAL. IF SCOUR IS POSSIBLE, RIP–RAP IS TO BE PLACED ON THE STREAM BED DOWN–STREAM OF THE PIPE OUTLET EXTENDING A MINIMUM OF TWO PIPE DIAMETERS. ALTERNATIVELY, TIMBER EQUIPMENT MATS, SAND BAGS OR TIMBER CORDUROY MAY BE USED TO FORM THE TRAVEL SURFACE.

4. TO REDUCE MUD ENTERING THE WATER FROM EQUIPMENT TRACKS, THE APPROACH ROAD LEADING TO THE CULVERT CROSSING MUST BE RAISED AND STABLE SO EQUIPMENT LOADS ARE SUPPORTED A SUFFICIENT DISTANCE BACK FROM THE WATER. IF CUTS ARE NEEDED TO OBTAIN A SATISFACTORY GRADE, THEY ARE TO BE DUG WITH SIDE DITCHES AND STABLE SLOPES. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO LIMIT THE POTENTIAL FOR SEDIMENT TO ENTER THE WATERBED (E.G., CHECK DAMS, SILT FENCE, RIP–RAP, SEED AND MULCH, SEDIMENT TRAPS, ETC.).

5. PERIODICALLY CHECK THE TEMPORARY CROSSING INSTALLATION AND REMOVE ANY BUILD–UP OF SEDIMENT OR DEBRIS ON THE BRIDGE. DISPOSE OF THIS MATERIAL AT LEAST 100 FT. FROM THE WATERCOURSE AND ABOVE THE HIGH WATER LEVEL.

FSC FLORIDA SOUTHEAST CONNECTION PROJECT

UniversalPegasus INTERNATIONAL

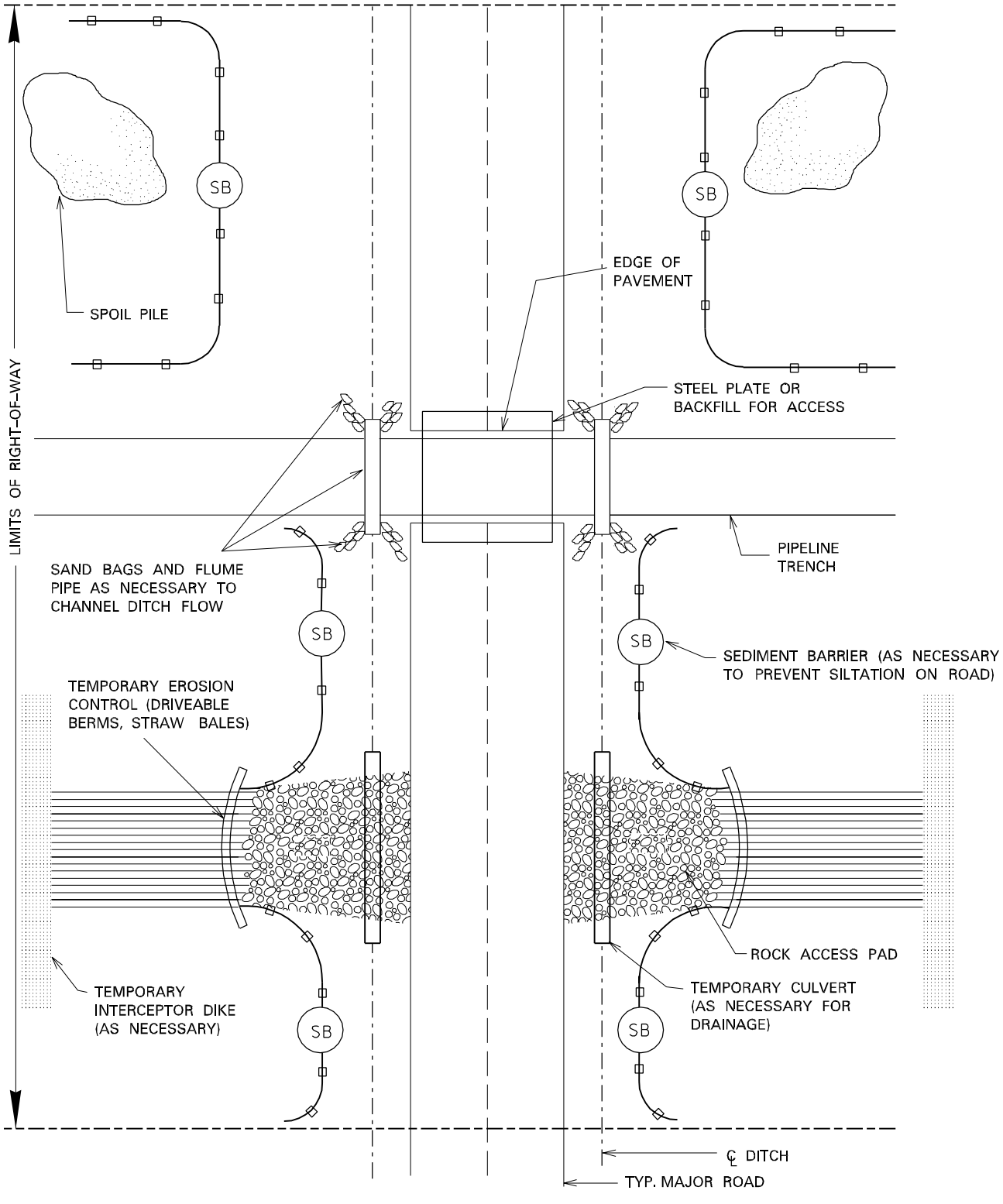
FLORIDA SOUTHEAST CONNECTION

NO.	REVISION	DATE	APPR.
B	ISSUED FOR 30% DESIGN	10/25/13	LD
A	ISSUED FOR REVIEW	09/20/13	LD

TYPICAL FLUME EQUIPMENT CROSSING

Figure 1.79B

SCALE	DATE	DRAWN	CHECKED	APPROVED	PROJ. NO.	DRAWING NUMBER	SHEET
N.T.S.	08/08/13	LB	RG	LD	21040	21040–510–TYP–20060	1 OF 1



(SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND / OR STRAW BALES

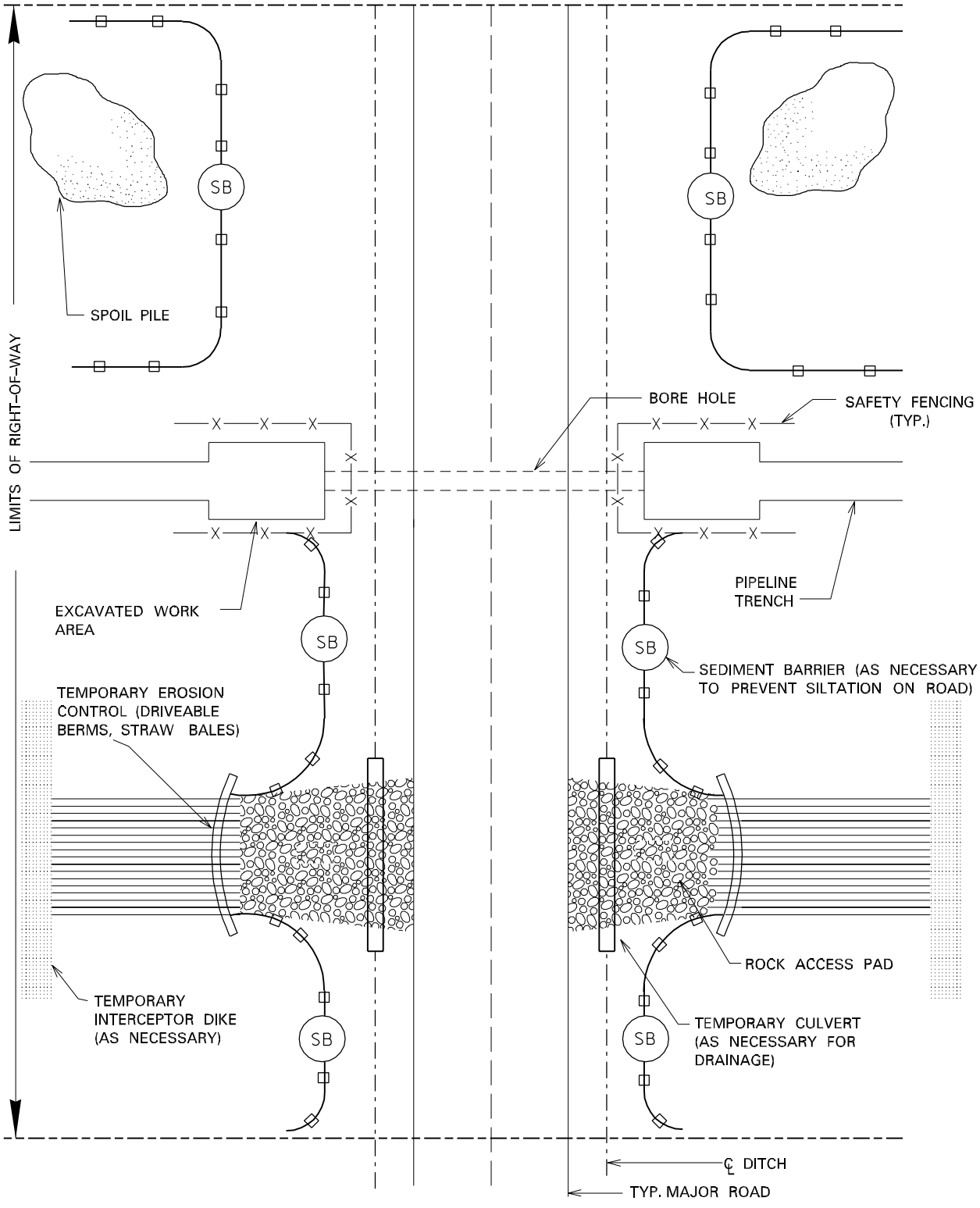
$$$$$$USERNAME$$$$
$$$$$$SYTIME$$$$$$

I.G. ESE0025.DGN

TYPICAL PAVED ROAD CROSSING CONTROL MEASURES (OPEN CUT)

Figure 1.7-10

DWG. ES–0025 REV.



(SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND / OR STRAW BALES

$$$$$$USERNAME$$$$$
$$$$$$SYTIME$$$$$

I.G. ESE0026.DGN

TYPICAL PAVED ROAD CROSSING CONTROL MEASURES (BORED)

Figure 1.7-11

DWG. ES–0026 REV.

APPENDIX 1A

Located in Volume II-B- Supporting Drawings and Maps

- Alignment Sheets (Scale 1-inch = 200 feet)
- HDD Site-Specific Plans [NOTE: not included in this draft]
- Full Size USGS Quadrangle Maps
- National Wetland Inventory (NWI) Maps
- Typical Right-of-Way Configurations
- Meter Station Plot Plan

Located in Volume III- Privileged & Confidential

- Landowner Lists
- Cultural Resources Information

APPENDIX 1B

8.5”x 11” USGS Quadrangle Map Excerpts

APPENDIX 1C

Correspondence

FLORIDA SOUTHEAST CONNECTION

AGENCY CORRESPONDENCE AND CONTACT LIST

Date	Agency	Meeting Location	Primary Contact	Agency Representatives		FSC Representatives		Meeting Description
4/22/2014	US Fish & Wildlife Service	USFWS Office 1339 20th Street Vero Beach, FL	Ted Martin	Ted Martin	Biologist	Jena Mier John Tessier Phil Simpson	Senior Env Specialist Env Specialist Env Consultant (ECT)	Project update and discuss listed species to be addressed in permit applications.
4/21/2014	South Florida Water Management District	3301 Gun Club Rd West Plam Beach, FL 33406	Mindy Parrott	Mindy Parrott Ray Palmer Bert Trammell Steve Coughlin Boyd Gunsalus	Lead Env Analyst Section Leader Section Leader Section Admin - Land Stewardship Lead Env Scientist	Jena Mier	Senior Env Specialist	Project update. Discuss SFWMD lands impacted by FSC project.
2/24/2014	Environmental Protection Agency	400 North Congress Ave, Suite 120 West Palm beach, FL 33401	Ron Miedema	Ron Miedema Beth Walls	EPA Scientist EPA Region 4 (NEPA Coordinator)	Jena Mier	Senior Env Specialist	Project and staff introduction
2/11/2014	US Army Corps of Engineers	701 San Marco Blvd. Jacksonville, FL	Mark Evans	Mark Evans Kelly Unger	Project Manager Section Chief	Agnes Ramsey Jena Mier John Tessier Lisa Ricker Phil Simpson	Senior Env Specialist Senior Env Specialist Env Specialist Consultant (ECT) Consultant (ECT)	Pre-application meeting to discuss upcoming dredge/fill permit submittal.
2/10/2014	Florida Department of Environmental Protection	3319 Maguire Blvd., Suite 232 Orlando, FL	Lisa Prather	Lisa Prather Kim Eisele Brittany Banko Jason Andreotta Irene Arpayoglou	Environmental Manager (Central) Environmental Specialist (Central) Environmental Specialist (SW) Environmental Manager (SE) Environmental Specialist (SE)	Agnes Ramsey Jena Mier John Tessier Lisa Ricker Phil Simpson	Senior Env Specialist Senior Env Specialist Env Specialist Consultant (ECT) Consultant (ECT)	Pre-application meeting to discuss upcoming ERP submittal.
2/3/2014	Florida Fish and Wildlife Conservation Commission	700 Universe Blvd Juno Beach, FL 33408	Jennifer Goff	Jennifer Goff Marissa Krueger Ben Shepherd	Biological Administrator Biological Scientist Biological Scientist	Agnes Ramsey Jena Mier John Tessier Lisa Ricker Phil Simpson	Senior Env Specialist Senior Env Specialist Env Specialist Consultant (ECT) Consultant (ECT)	Update meeting to discuss project. Discuss potential listed species concerns.
1/22/2014	US Fish & Wildlife Service	USFWS Office 1339 20th Street Vero Beach, FL	Ted Martin	Ted Martin	Biologist	Jena Mier John Tessier Agnes Ramsey Phil Simpson Hernan Machicado Lisa Ricker Jeff Brandt Richard Brightman Dave Santilli	Senior Env Specialist Env Specialist Senior Env Specialist Env Consultant (ECT) Director Gas Infrastructure Env Consultant (ECT) Consultant (TRC) Attorney Director Construction	Introduction of the project to FWS staff and discuss potential listed species to be addressed in permit applications.
1/8/14-1/10/14	Florida Department of Environmental Protection (Southwest District)	Route in Osceola County	Brittany Banko	Brittany Banko Mark Langford	Environmental Specialist Environmental Specialist	John Tessier	Env Specialist	Wetland Field Review
1/7/14-1/9/14	Florida Department of Environmental Protection (Southeast District)	Route in Osceola County	John Renfranz	John Renfranz Cindy Lott Irene Arpayoglou	Environmental Specialist Environmental Specialist Environmental Specialist	Kristin Peekstok Dan Moretz Jim Lindsay	Env Specialist Env Specialist Env Project Manager	Wetland Field Review
1/7/2014	Florida Department of Environmental Protection (Central District)	Route in Osceola County	Lisa Prather	Lisa Prather Kim Eisele	Environmental Manager Env Specialist	John Tessier	Env Specialist	Wetland Field Review
11/8/2013	US Army Corps of Engineers	701 San Marco Blvd. Jacksonville, FL	Tori White	Tori White Mark Evans Steve Sullivan Christina Storz Osvaldo Collazo Kelly Unger	Deputy Chief Project Manager Project Manager Assistant Direct Counsel Branch Chief Section Chief	John Tessier Jena Mier Phil Simpson Richard Brightman Hernan Machicado Lisa Ricker Timohty Riley Matt Raffenberg	Env Specialist Senior Env Specialist Env Consultant (ECT) Attorney Gas Infrastructure Director Env Consultant (ECT) Attorney Env Director	Project coordination and application submittal discussion

FLORIDA SOUTHEAST CONNECTION

AGENCY CORRESPONDENCE AND CONTACT LIST

Date	Agency	Meeting Location	Primary Contact	Agency Representatives		FSC Representatives		Meeting Description
11/4/2013	Florida Department of Environmental Protection (Central District)	3319 Maguire Blvd., Suite 232 Orlando	Lisa Prather	Lisa Prather Kim Eisele Jason Androeotta	Environmental Manager Env Specialist Environmental Manager	John Tessier Jena Mier Phil Simpson Richard Brightman Hernan Machicado Lisa Ricker Agnes Ramsey	Env Specialist Senior Env Specialist Env Consultant (ECT) Attorney Gas Infrastructure Director Env Consultant (ECT) Senior Env Specialist	Project coordination and application submittal discussion
10/15/2013	St. Lucie County Staff	County Administration Building 2300 Virginia Ave. Fort Pierce, FL 34982	Mark Satterlee	Mark Satterlee Karen Smith Faye Outlaw	Planning Director Environmental Director County Administrator	Jena Mier Amy Brunjes John Tessier Bob Sharra Pete Cocotos (Phone)	Senior Env Specialist External Affairs Manager Env Specialist Director- Project Development Attorney	Project update meeting
10/11/2013	Martin County Staff	2401 SE Monterey RoadStuart, FL 34996	Harry King	Aaron Stanton Laura Winchser Colleen Holmes Harry King Michael Durham Elizabeth Lenihan Ed Fielding Nicki Van Vonno	Engineering Project Manager Engineering Administrator Senior Paralegal Principal Planner County Attorney Asst County Attorney County Commissioner Growth Management Director	Jena Mier John Tessier Richard Brightman (phone)	Senior Env SpecialistEnv SpecialistAttorney	Project update meeting
10/10/2013	Osceola County Staff	County Admin Bldg 1 Courthouse Square Kissimmee, FL 34741	Richard Keck	Richard Keck Cori Carpenter	Environmental Service Manager Senior Planner	Nick Blount Wendi Jeannin Jena Mier John Tessier	External Affairs Manager B&B Promotions Senior Env Specialist Env Specialist	Project update meeting
9/9/2013	State of Florida Project Introduction Meeting	Carr Building 3800 Commonwealth Blvd Tallahassee, FL 32399	Tim Rach- DEP	Jennifer Goff Allyson Minick Tim Rach Gregg Walker Clay Covrson Scott Woolam Rich Mospens Cindy Mulkey Hillary Powell Christianne Ferraro Kimberly Eisele Debra Laisure Albert Gagne Ann Seiler Ben Shepherd Bobby Bull Carlos Herd Connie Webel Lauren Greenfield Jason Andreotta Betty Behnke John Johnson Brittany Banko Louis Bustamante Nick Vitani Kelley Boatwright	Biological Administrator Submerged Lands and Env Resources Submerged Lands and Env Resources Division of Rec and Parks Chief Land Manager DEP Siting Coordination Case Manager Program Manager, ERP Coordinator Submerged Lands and Stormwater Submerged Lands and Stormwater Env Manager DEP Siting Coordination Case Manager Biological Scientist DEP Siting Coordination Case Manager Director Water Supply Division Env Manager Air/ERP Env Manager ERP Coordinator DEP Emergency Response Air/ERP Permitting CUP Permitting CUP Permitting Air/ERP Permitting Coordinator	Jena Mier John Tessier Tim Riley Bob Sharra Hernan Machicado Richard Brightman Brad Floyd Phil Simpson Jude Dawson	Senior Env Specialist Env Specialist Attorney Development Director Gas Infrastructure Director Attorney Env Consultant Env Consultant Env Consultant	State-wide Project Introduction Meeting to identify agencies with potential interest in project
8/14/2013	South Florida Water Management District	18150 SW Martin Hwy	Boyd Gunsalus	Boyd Gunsalus Bert Trammell	Lead Env Scientist Section Leader	Jena Mier Hernan Machicado	Senior Env Specialist Gas Infrastructure Director	Discuss FSC pipeline crossing location
8/14/2013	Martin County Staff	18150 SW Martin Hwy	Baret Barry	Baret Barry	Env Lands Coordinator	Jena Mier Hernan Machicado	Senior Env Specialist Gas Infrastructure Director	Discuss FSC pipeline crossing location
8/14/2013	NRCS	18150 SW Martin Hwy	Lakelle Pritchett	Lakelle Pritchett	Agriculutral Engineer	Jena Mier Hernan Machicado	Senior Env Specialist Gas Infrastructure Director	Discuss FSC pipeline crossing location

From: D'Orval, Brigitte <BrigitteDOrval@polk-county.net>
Sent: Friday, April 18, 2014 1:36 PM
To: Tessier, John
Cc: Bohde, John; Deardorff, Thomas
Subject: RE: Florida Southeast Connection- Polk County
Attachments: Florida Southeast Connection Gasline Project Impacted.pdf

John,

Attached you will find a map and a table with the parcel ID numbers which illustrates projects within ¼
mile of the proposed pipeline. Please let me know if you have any questions.

Thank You,

Brigitte D'Orval
Senior Planner
Land Development Division
330 W. Church St.
Drawer GM03, P.O. Box 9005
Bartow, FL 33831-9005
Ph: (863) 534-6490
From: Tessier, John [mailto:John.Tessier@nee.com]
Sent: Tuesday, April 15, 2014 9:41 AM
To: D'Orval, Brigitte
Cc: Bohde, John
Subject: RE: Florida Southeast Connection- Polk County

That will be great. Thanks.

John Tessier
Environmental Specialist
Environmental Services Department

Florida Southeast Connection, LLC.
700 Universe Blvd
Juno Beach, FL 33408
Office: 561-694-4131
john.tessier@nee.com

From: D'Orval, Brigitte [mailto:BrigitteDOrval@polk-county.net]
Sent: Tuesday, April 15, 2014 9:31 AM
To: Tessier, John
Cc: Bohde, John
Subject: RE: Florida Southeast Connection- Polk County

John,

I'm hopeful I can complete the task by April 25th. Please let me know if you need this sooner.

Thank You,

Brigitte D'Orval
Senior Planner
Land Development Division
330 W. Church St.
Drawer GM03, P.O. Box 9005
Bartow, FL 33831-9005
Ph: (863) 534-6490

From: Tessier, John [mailto:John.Tessier@nee.com]
Sent: Tuesday, April 15, 2014 9:23 AM
To: Bohde, John
Cc: Deardorff, Thomas; D'Orval, Brigitte
Subject: RE: Florida Southeast Connection- Polk County

Excellent. Thank you for your help.

Brigitte- If you have any questions please don't hesitate to contact me.

Thanks,

John Tessier
Environmental Specialist
Environmental Services Department

Florida Southeast Connection, LLC.
700 Universe Blvd
Juno Beach, FL 33408
Office: 561-694-4131
john.tessier@nee.com

From: Bohde, John [mailto:JohnBohde@polk-county.net]
Sent: Monday, April 14, 2014 1:27 PM
To: Tessier, John
Cc: Deardorff, Thomas; D'Orval, Brigitte
Subject: RE: Florida Southeast Connection- Polk County

Mr. Tessier:

Good afternoon. Brigitte D'Orval with our staff will be researching this information and have you a

response very soon with respect to any projects in the identified area.

I appreciate your patience. If you have any questions please let me or Brigitte know. I have copied Brigitte to this email.

Thanks
John

John M. Bohde, AICP | Director | Land Development Division
330 W. Church Street | 863-534-6792 | 863-534-6407 (fax)
P.O. Box 9005, Drawer GM03 | Bartow, FL 33831-9005
JohnBohde@polk-county.net

From: Tessier, John [mailto:John.Tessier@nee.com]
Sent: Thursday, April 10, 2014 4:32 PM
To: Deardorff, Thomas
Subject: Florida Southeast Connection- Polk County

Dear Tom,

As you know Florida Southeast Connection, LLC (FSC) is currently working on a natural gas pipeline transmission project, known as the Florida Southeast Connection (the Project), proposed to cross through Polk County for approximately 52 miles. Currently, we are assembling a series of resource reports that will be submitted to the Federal Energy Regulatory Commission as part of the certification process required for the Project approval. As part of this process, FSC staff is contacting local county and city planning officials to determine if there are any proposed developments that have either been permitted or have been applied for within 0.25 miles of the project. Attached please find an overall project map, a shapefile, and a KMZ file of the proposed centerline to assist you in your review.

Thank you in advance for your help. If you have any questions please don't hesitate to contact me by phone or email.

John Tessier
Environmental Specialist
Environmental Services Department

Florida Southeast Connection, LLC.
700 Universe Blvd
Juno Beach, FL 33408
Office: 561-694-4131
john.tessier@nee.com

Please Note: Florida has a very broad Public Records Law. Most written communications to or from State and Local Officials regarding State or
Local business are public records available to the public and media upon request. Your email communications may therefore be subject to public
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disclosure.

Florida Southeast Connection Map
Impacted Level 2 Projects
Polk County, FL

PROJECT	LEVEL_OF_R	TYP	PROJECT NAME	PARCEL_ID
55929	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	NEW DESTINY CHURCH	272612-702500-004160
46562	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	CAMPBELL CRANE COMPANY 6713	272613-704000-000140
52179	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	ST. HELENA SAND MINE 9713	272913-860510-000170
43593	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	MONIER LIFETILE TRAINING CENTR	283003-000000-041040
42882	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	JAY BEE'S RESTAURANT	293007-000000-021050
45137	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	MONIER LIFETILE 0803	283003-000000-023010
47154	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	FLORIDA ROCK-DIAMOND SAND MINE	283003-000000-044020
46568	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	LAKEWALES FACILITY RINKER 0803	283003-000000-013000
53918	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	CEMEX CONSTRUCTION MATERIALS FLORIDA LLC 0810/0811	283010-000000-011010
54853	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	CITROSUCO NORTH AMERICA, INC.	283002-000000-021010
51568	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	CARSON MINI-WAREHOUSES 0812	283012-000000-033090
53568	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	CALVARY BAPTIST CHURCH 0914	293014-000000-032030
55527	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	SAND HILL FIRE RESCUE STATION	272813-000000-011020
46402	LEVEL 2	LEVEL_2: SUBDIVISION SITE REVIEW	PROVIDENCE N4	272613-000000-011000
55887	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	PROGRESS ENERGY FLORIDA LOUGHMAN SUBSTATION	272612-702500-004100
46346	LEVEL 2	LEVEL_2: SUBDIVISION SITE REVIEW	AVIANA TWO A	272612-702000-003000
56001	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	MOUNTAIN LAKE CORPORATION	272922-866300-001180
56824	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	LAKE AURORA CHRISTIAN ASSEMBLY	283012-000000-021010
47096	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	N. DAVENPORT MHE # 2 VERIZON	272613-000000-014010
53804	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	THE PENTECOSTALS OF LAKE WALES 0804	283004-000000-042040
54715	LEVEL 2	LEVEL_2: NON-RESIDENTIAL SITE PLAN	HAINES CITY EAST SUBSTATION 7819	282719-000000-041010
42985	LEVEL 2	LEVEL_2: SUBDIVISION SITE REVIEW	TROPICAL LAKES	272612-702000-019041
54194	LEVEL 2	LEVEL_2: SUBDIVISION SITE REVIEW	WATERSONG AKA COUNTRY CREEK	272624-000000-012010

LEGEND

- Approved Site Plans QuarterMile Buffer Intersect
- FSC Centerline 0.25 mile Buffer
- FSC Centerline 20140214
- Approved Site Plans Within 0.25 miles
- Roads
- Polk County Boundary
- Lakes
- Municipal Boundaries

Miles
0 1 2 4 6 8

N
W E
S

Created by
Polk County
Board of County Commissioners
ITGIS
Path: C:\GIS\VE_D_LAST_COMPUTER_DIT51_MJ\Florida Southeast Connection Gas Pipline 4 2014\Florida Southeast Connection Gasline Project_Impacted_Level_2_Projects.mxd
Date: 4/18/2014Time: 1:26:02 PM

Sumter Lake Orange Pasco Osceola Hillsborough Manatee Hardee Highlands Okeechobee

T 24 T 25 T 26 T 27 T 28 T 29 T 30 T 31 T 32

R 23 R 24 R 25 R 26 R 27 R 28 R 29 R 30 R 31 R 32

POLK CITY AUBURNDALE LAKE ALFRED DAVENPORT HAINES CITY LAKELAND WINTER HAVEN LAKE HAMILTON DUNDEE EAGLE LAKE BARTOW MULBERRY LAKE WALES HIGHLAND PARK HILLCREST HEIGHTS FROSTPROOF FORT MEADE

From: Richard Keck <rkec@OSCEOLA.ORG>
Sent: Friday, April 18, 2014 12:41 PM
To: Tessier, John
Subject: RE: Florida Southeast Connection- proposed developments

John,
As we spoke earlier. The only development I am aware of as your project goes through Osceola County
is the proposed industrial site on the east side of 441 at the junction of SR60. It looks as if your line will
be going on the West side of 441, so I don't see a conflict there. Where your project enters from the
Compression station proposed location, it immediately crosses into Polk County, and only our roadway
is affected.

Please let me know if you need any additional information.

Richard Keck
Environmental / Development Review
Osceola County
407.742.0247

From: Tessier, John [mailto:John.Tessier@nee.com]
Sent: Friday, April 18, 2014 11:06 AM
To: Richard Keck
Subject: Florida Southeast Connection- proposed developments

Richard,

Thanks for the return call on Monday regarding the proposed developments within 0.25 miles of the FSC
project.

Attached was the original request I had sent to Mahmoud (it got kicked back because there was a shapefile attached). Could you provide me an email response recapping what you had told me over the
phone? We will file it with our FERC Resource Reports to capture the coordination efforts regarding this
topic.

Thanks,

John Tessier
Environmental Specialist
Environmental Services Department

Florida Southeast Connection, LLC.
700 Universe Blvd
Juno Beach, FL 33408
Office: 561-694-4131
john.tessier@nee.com

FLORIDA SOUTHEAST CONNECTION™

APPENDIX 1D

Landowner Lists (Provided in Privileged and Confidential Volume)

FLORIDA SOUTHEAST CONNECTION™

APPENDIX 1E

Invasive Species Management Plan for the FSC Project

Invasive Species Management Plan for the Florida Southeast Connection Project

June 2014

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Appendix A Invasive Plant Species List
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1.0 INTRODUCTION

1.1 Project Description

The FSC Project involves the construction and operation of approximately 127 miles of up to 36-inch-diameter pipeline. The FSC Project starts in Osceola County, Florida at the interconnection with Sabal Trail within the Central Florida Hub and will traverse Polk, Osceola, Okeechobee, St. Lucie, and Martin Counties, terminating at the Martin Clean Energy Center in Martin County, Florida. A summary of the FSC Project pipeline facilities and a location map of the FSC Project pipeline facilities is provided in Resource Report 1 – General Project Description.

FSC has prepared this Invasive Species Management Plan ("ISMP") for the construction activities associated with the FSC Project to revegetate the right-of-way immediately following construction of the natural gas pipeline and aboveground facilities as well as long-term post-construction monitoring of the right-of-way as required by applicable regulatory agencies. Invasive plants are non-native plants that are disruptive in a way that causes environmental or economic harm or harm to human health. When not properly managed, invasive plants out-compete and crowd out native plants, potentially altering the way other plants, animals, soil, and water interact within native ecosystems, often causing harm to other species as well (CIPWG 2012).

Invasive plants may reduce native plant diversity by competing for available resources, including light, water, and minerals. They may alter soil conditions by secreting chemicals that inhibit seed germination or growth of other plants. They may disrupt nutrient cycling and soil characteristics in invaded areas by changing the amount, composition, or rate of decay of leaf litter. Additionally, invasive plants that are closely related to native species may hybridize with their native relatives, reducing genetic diversity and potentially breeding out certain native genotypes. In addition to native plant community impacts, invasive species can cause changes in native habitat structure and food availability that can impact other organisms and their behaviors, including breeding success of bird species and displacement of native plants that serve as food sources (Sarver et al. 2008).

The Florida Fish and Wildlife Conservation Commission, Invasive Plant Management Section is the lead agency in Florida responsible for coordinating and funding two statewide programs controlling invasive aquatic and upland plants on public conservation lands and waterways throughout the state. The Invasive Plant Management Species Section also insures that beneficial native aquatic plants in Florida's ponds, lakes, and rivers are protected through its permitting programs and funding research to find more cost effective management techniques (FWC, 2014). Additionally, the University of Florida Center for Aquatic and Invasive Plants provides plant information and photos, and invasive species management plans for targeted species on its Institute of Food and Agricultural Sciences ("IFAS") Extension website (UF IFAS Extension, 2014). FSC is aware that invasive species management is a topic of significant concern in the State of Florida. Consequently, FSC has developed this Project-specific ISMP in an effort to provide the most current and site appropriate invasive species management during construction and operation of the Project.

1.2 Objectives

The specific objective of this ISMP is to control invasive plant species by means of limited herbicide application in conjunction with other control methods, such as mechanical removal, mowing, and cutting, when necessary. The rationale for controlling invasive species with herbicides is to ensure that the existing ecosystem is not compromised by the colonization and dominance of invasive species. The movement of vehicles, equipment, and personnel, and the transport of materials and/or construction debris to and from areas that are inhabited by invasive species could result in the unintentional spread of these species during construction. Additionally, areas that have been disturbed by human activity may provide an opportunity for the colonization and spread of invasive species. This plan will serve as a guidance document for the control of invasive plant species during construction and operation of the Project and to provide the necessary tools for successful control of invasive species. This plan is subject to modifications as data collection warrants.

It may not be possible to eradicate invasive species in the FSC Project area because of such issues as seed drift or colonization from off-site locations. Therefore, FSC's overall goal is to control the invasive species to the extent that wetlands and uplands are not dominated by the invasive species to the point where the functions and values of the systems/habitats are adversely compromised. FSC has included the use of best management practices ("BMPs") to control the transport of invasive species from areas where they may currently occur along the FSC Project route. Measures, such as training personnel in the identification of invasive species, inspecting and cleaning equipment, and practices to encourage rapid stabilization, restoration, and revegetation of disturbed work areas, have been incorporated to minimize adverse impacts resulting from the presence of invasive species. FSC's plan, outlined in the following sections, will be to implement a program to reduce the level of invasive species to a non-dominant position during the first three years post-construction and then incorporate this program into the operational right-of-way mowing/maintenance plan, thereby keeping the invasive species populations at non-dominant levels.

FSC will ensure the BMPs detailed in this ISMP are implemented by contractors during all phases of construction. Requirements of the ISMPs will be identified to contractors during the required preconstruction environmental training. Compliance as well as non-compliance with these requirements will be recorded in the field by Environmental Inspectors (EIs), and details of the activities will be captured in the weekly construction inspection reports, which will be submitted to the FERC for review and comment.

2.0 EXISTING CONDITIONS

The Project crosses multiple land use types in Florida, from human-altered landscapes, including residential, agricultural, commercial/industrial, transportation corridors (roadways, railroad), and utility transmission corridors, to relatively undisturbed natural landscapes, including forested uplands, open land, forested wetlands, non-forested wetlands, waterbodies, and areas classified as open water. Human altered landscapes often create suitable conditions for establishment of the quick-germinating, fast-growing, nutrient-poor-soil-loving species that typically characterize invasive plant species.

FSC delineated wetlands and waterbodies and completed a wetland functional assessment along the FSC Project. Wetlands and waterbodies were delineated and assessed within a 300-foot-wide survey corridor along the length of the 127-mile-long pipeline route, an approximately 120-foot-wide survey corridor centered over all potential access roads, and a number of

contractor yards/station sites. The wetland delineation was performed using a combination of desktop review of existing data and maps as well as a field survey. Concurrent with wetland/waterbody delineations, field staff collected data on invasive and noxious species within the survey corridor where present within upland and wetland data collection plots.

Plant community types along the FSC Project route were determined based on a review of aerial photography, existing land use classifications, and field surveys. Descriptions of existing typical vegetative cover types along the FSC Project route are based on the natural community classification systems described in the Florida Land Use, Cover and Forms Classification System ("FLUCFCS") (FDOT, 1999). Developed or managed land uses/land covers mapped along the FSC Project route consist of residential, commercial and services, industrial, mining, institutional, recreational, open land, agricultural, disturbed land, transportation, communication, and utilities. According to the FLUCFCS, these categories include low-density residential, medium-density residential, commercial and services, industrial, extractive, institutional, recreational, open land, cropland and pastureland, tree crops, nurseries and vineyards, specialty farms, other open lands, sands and other lands, disturbed land, transportation, communication, utilities, and solid waste disposal. The vegetation cover classes present include 300, 400, and 600 FLUCFCS series classifications.

Non-native/invasive plant species potentially occurring along the FSC Project route is provided in Table 3.3-2 in Table 2.0. Plant species listed are categorized according to the Florida Exotic Pest Plant Council Invasive Plant List (FLEPPC, 2013). The list defines Category 1 species as invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused. Category II species are defined as invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species. These species may become ranked Category I, if ecological damage is demonstrated.

Table 2.0

Non-native/Invasive Plant Species with the Potential to Occur Along the FSC Project Route

Common Name	Scientific Name
Category I Species	
Cinnamomum camphora	Camphor tree
Colocasia esculenta	Wild taro
Dioscorea bulbifera	Air-potato
Eichlornia crassipes	Water-hyacinth
Imperata cylindrica	Cogon grass
Lantana camara	Lantana
Ludwigia peruviana	Peruvian primrose willow
Lygodium japonicum	Japanese climbing fern
Lygodium micrphyllum	Old world climbing fern
Melinis repens	Natal grass
Panicum repens	Torpedo grass
Pistia stratiotes	Water lettuce

Table 2.0

Non-native/Invasive Plant Species with the Potential to Occur Along the FSC Project Route

Common Name	Scientific Name
Salvinia minima	Water spangles
Sapium sebiferum	Chinese tallow
Schinus terebinthifolius	Brazilian pepper
Solanum viarum	Tropical soda apple
Urena lobata	Ceaser's weed
Urochloa mutica	Para grass
Category II Species	
Alternanthera philoxeroides	Alligator weed
Hemarthria altissima	Limpo grass
Source: Environmental Consulting & Technology (ECT), Inc., 2014.	

3.0 INVASIVE SPECIES MANAGEMENT

3.1 Measures to Prevent or Control the Transport of Invasive Plant Species

FSC will perform the following measures to prevent or control the transport of invasive plant species:

- Prior to construction, FSC will provide training to educate Project contractor(s) and subcontractor(s) with respect to identifying invasive plant species and the site-specific protocols for preventing or controlling transport of invasive plant species within or outside of the Project workspace areas. These protocols include the various cleaning or decontamination methods to be used on the Project. In addition, the contractors will be instructed to stay within access roads and designated workspace areas, which will minimize impacts to undisturbed locations.
- Except where noted below, all measures to prevent or control the transport of invasive plant species will be implemented for both Category I and Category II populations, as defined in Section 2.0, above.
- Environmental Inspectors ("EI") will be employed during construction to monitor and provide oversight and implementation of this ISMP.
- Sediment and erosion control devices will be installed across the construction right-of-way on slopes upgradient of wetlands and along the edge of the construction right-of-way to prevent spoil from migrating into these areas during construction. These measures also will help to prevent the dispersion of seeds and root masses from invasive plant species into wetlands currently unaffected by invasive species.
- Vehicles, equipment, and materials (including equipment mats) will be visibly inspected for remnant soils, vegetation, and debris, and they will be cleaned of these materials before they are brought to the Project area or moved to another wetland within the construction right-of-way.
- To prevent the spread of seeds, roots, or other viable plant materials, equipment used in areas containing invasive plant species will be power-washed with clean water (no soaps or chemicals) before moving from an area populated with invasive species. The wash water will not be discharged within 100 feet of a waterbody, wetland, or stormwater conveyance (ditch, catch basin, etc.). If sufficient space is not available to provide the area necessary for a cleaning station on-site, upon approval of the EI, equipment used within an area containing invasive plant species may be power-washed adjacent to the area, located within the approved right-of-way and/or additional temporary workspaces ("ATWS"), provided that the wash water does not discharge within 100 feet of any waterbody, wetland, or stormwater conveyances.
- An elevated wash rack station will be installed and used for the washing of construction vehicles in sites only where both:
  - The construction equipment exits near a wetland identified as containing invasive species vegetation; and
  - The construction equipment is to enter an adjacent upland or another wetland, within the next 1,000 linear feet along the construction right-of-way that are free of invasive species.

- Wash stations will be established based upon locations where invasive species were identified during biological field surveys. Wash rack stations will be situated a minimum of 100 feet from wetlands and waterbodies, as well as stormwater conveyances, and water used will be clean (no soaps or chemicals). Soil and plant material collected under the wash rack station will be disposed of off-site in accordance with applicable regulatory agency requirements.
- Dependent on site conditions, where the use of water to wash invasive plant material from equipment is not feasible, an alternative method available is using brushes and compressed air or power blowers to clean equipment of dirt, seeds, roots, or other viable plant materials, before moving from an area populated with invasive species. If sufficient space is not available to provide the area necessary for a cleaning station on-site, upon approval of the EI, equipment used within an area containing invasive plant species may be cleaned adjacent to the area, located within the approved right-of-way and/or ATWS.
- An elevated cleaning rack station will be installed and used for the cleaning of construction vehicles in sites only where both:
  - The construction equipment exits near a wetland identified as containing invasive species vegetation; and
  - The construction equipment is to enter an adjacent upland or another wetland, within the next 1,000 linear feet along the construction right-of-way that are free of invasive species.

  Soil and plant material collected under the cleaning rack station will be disposed of off-site in accordance with applicable regulatory agency requirements.
- To prevent or minimize the potential introduction of invasive plant species from the Project area to other areas or regions, all vehicles, equipment, and materials (including swamp mats) will be inspected for, and cleaned of, any visible soils, vegetation, and debris before moving to another area of the Project.
- Water for dust control and other uses may come from municipal water supplies/sources. If surface waters are used, equipment will be disinfected afterwards.
- Loose plant and soil material that have been removed from clothing, boots, and equipment or generated from cleaning operations will be disposed of off-site, and soil material will be transported in a secure manner, and disposal must occur at either a landfill-incinerator or a State approved disposal facility.
- If an area remains populated with invasive plant species upon completion of work (its preconstruction condition), the invasive material cleaned from equipment used within that construction area may remain within the infested area, provided that no filling of a wetland will occur.
- If upland invasive species must be cut within the Project area during construction, the slash will either be used within the same construction area that is infested, provided that no filling of any wetlands or adjacent areas will occur.
- Revegetation of wetlands will be expedited by removing and segregating the upper 12 inches of topsoil from over the trench and spoil storage areas, except in locations with standing water or heavily inundated soils, or where no topsoil layer is evident. Stripped topsoil will be stockpiled separately from subsoil to ensure preservation of the native seed bank.
- Following pipeline installation, the trench will be backfilled, and the area will be re-contoured to its original grade. Segregated topsoil will be replaced, and natural drainage patterns will be restored to facilitate natural re-establishment of native vegetation.

- After final re-grading, the restored right-of-way will be seeded with a seed mix free of invasive species to restore herbaceous cover over the disturbed right-of-way and help to prevent establishment of invasive species, which can colonize at disturbed sites.
- FSC will not treat areas outside its proposed construction right-of-way for invasive species.
- Expediting construction in and around wetlands and limiting the amount of equipment and construction activities within wetlands will reduce the amount and duration of disturbances. In addition, equipment used within wetlands will be tracked, often operating on top of construction mats. These measures will minimize the amount of soil disturbance within wetlands in which invasive species might colonize.
- To the extent practicable, the movement of soils, gravel, rock, and other fill materials infested with invasive plants to locations relatively free of invasive plants will be avoided. Soil, gravel, rock, and other fill material will come from sources on and off the site that are visibly free of invasive plants, if such sources are available.
- Revegetation of disturbed areas will utilize seed and other plant materials that have been checked by EIs and certified by suppliers as noxious-weed-free.

3.2 Measures To Prevent or Control the Transport of Invasive Insect Species

Invasive insect species potentially occurring within the Project area include the Asian citrus psyllid (*Diaphorina citri* Kuwayama), citrus leafminer (*Phyllocnistis citrella*), redbay ambrosia beetle (*Xyleborus glabratus*), Africanized honey bee ("AHB"), exotic fruit flies, lovebugs, and many others (FDACS, 2013). FSC identified several areas located along the Project where commercial citrus operations would be crossed by the Project. These areas identified in Resource Report 8 – Land Use, Recreation, and Aesthetics. FSC is not proposing to implement any special construction techniques when crossing these citrus groves. During easement negotiations, FSC would negotiate appropriate compensation with affected landowners for the loss of production on both a temporary and permanent basis. Following construction, the landowner may replant the temporary right-of-way. However, in response to the potential spread of citrus canker and other citrus diseases, FSC will take the following steps during construction and operation:

- As a result of the 2004 and 2005 Hurricane Season, the United States Department of Agriculture ("USDA") and the Florida Department of Agriculture and Consumer Services ("FDACS") declared that as of January 1, 2006 citrus canker cannot be eradicated and they began a new program to keep citrus canker disease at low levels to sustain citrus production, protect uninfected growers, and to deal with future diseases.
- As a result of the above, FDACS under its Division of Plant Industries created the Citrus Health Response Program ("CHRP") to establish a management program for citrus canker and a new disease called Huanglonbing disease – citrus greening disease and future citrus diseases.
- CHRP has developed a framework for all segments of the citrus industry; owners, growers, caretakers, harvesters and other groups to share in the responsibility of protecting the Florida citrus industry. This framework is a CHRP Business Plan and

corresponding compliance agreement. Thus, each group writes its own Business Plan thus customizing its disease management program for its unique operation.

3.3 Measures To Prevent or Control the Transport of Invasive Aquatic Species

3.3.1 Hydrostatic Pressure Testing and Horizontal Directional Drilling

Following construction, FSC will hydrostatically pressure test the new pipeline system in accordance with the requirements outlined in CFR Part 192 – Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards. Prior to construction, FSC will obtain applicable water withdrawal and discharge permits required, as well as consult with applicable regulatory agencies to determine general and site-specific requirements to avoid transporting aquatic invasive species.

Once the testing is completed, the hydrostatic test water will be returned to the same watershed(s) from which they were collected, where possible. Hydrostatic test waters will be discharged in level, vegetated upland areas at sufficient distances from surface waters to prevent the overland transport of any aquatic invasive species into a water feature. The rate of discharge flow will be controlled to prevent erosion. Therefore, no treatment of hydrostatic test water for aquatic invasive species is required. Additional protective measures that will be implemented during hydrostatic testing operations include:

- During the filling of the pipeline, the water intake at the location where water is being taken will be screened with 0.1-inch mesh screen (or as recommended by state agencies) to prevent entrainment of invasive vegetation.
- The intake rate/volume will be low enough to prevent impingement of aquatic species or debris on the screen.
- The intake hose and screen will be kept off the bottom of the waterbody to prevent uptake of sediment.
- No equipment will enter the waterbody, except the pump withdrawal apparatus, which will be cleaned and dried before being used at each waterbody.

3.3.2 Waterbody Crossings

The procedures for all waterbody crossings associated with the Project will be conducted in accordance with the BMPs outlined in FSC's Plan and Procedures. To minimize the potential for the transport of invasive aquatic species, FSC will consult applicable regulatory agencies regarding the known or potential presence of invasive aquatic species. Waterbodies with known or potential populations of invasive aquatic species will be identified to Project personnel to ensure the proper procedures are implemented during in-stream construction activities, such that equipment and materials do not further impact unaffected waterbodies within the right-of-way. Additional BMPs specific to minimizing the potential transport of aquatic invasive species include:

- Restricting equipment and materials to that necessary for waterbody construction, and reviewing all materials to make certain they are visibly free of vegetation and debris prior to entering and exiting a waterbody;
- Conducting equipment washing procedures as identified above, if working in locations populated with aquatic invasive species; and

- Drying off equipment and materials once they are washed or removed from the waterbody containing invasive species, and allowing the dried materials to remain moisture free for at least 48 hours or until they are visibly dry.

3.4 General Management Activities

To provide for post-construction stabilization of the right-of-way and re-growth of native species, FSC proposes to use straw during mulching activities. Disturbed wetland areas within the right-of-way will be restored in accordance with FSC's Procedures. Additionally, any supplemental fill soils or topsoil materials that need to be imported to the Project site for restoration purposes to re-establish preconstruction grades and contours will be clean, debris-free, and chemical contaminant-free soils obtained from reputable suppliers to minimize importation of invasive plant species.

Post-construction monitoring of invasive plant species populations and colonization of the right-of-way will be conducted for a period of three years concurrent with upland and wetland right-of-way restoration monitoring activities. Monitoring reports detailing the success of right-of-way restoration and revegetation measures will identify invasive plant species' colonization locations and densities, which will be used to direct the subsequent species-specific management measures detailed below.

For general invasive plant management and treatment measures, FSC plans to use a foliar herbicide method to control invasive species along the proposed right-of-way. Herbicides will be applied according to manufacturer's printed recommendations and in accordance with applicable agency regulations governing herbicide application. A qualified contractor will be consulted to determine the appropriate method for the application of the approved herbicides and may suggest methods other than foliar herbicide application.

With guidance from a qualified contractor, FSC also will identify the most effective herbicide to use for each application and may modify application techniques of herbicide brands, based on results and site conditions. However, if herbicides are not approved by the FERC and the United States Army Corps of Engineers ("USACE"), then mechanical methods will be used in lieu of herbicides. The following herbicides are being considered for use:

- Roundup Rodeo (Glyphosate) – applied to foliage for control of invasive herbaceous (including grasses) and woody plants; also used as a treatment on cut stumps to prevent re-sprouting. Because this herbicide is non-selective, selective application methods and seasonal timing will be used to prevent impacts on non-target species.
- Garlon (Triclopyr) – applied to foliage for control of invasive, broadleaf herbaceous and woody plants; also used as a treatment on cut stumps to prevent re-sprouting or as a basal bark application to kill woody plants.

Reapplication of herbicides will occur as needed, based on the findings of the monitoring activities listed below. Additionally, mechanical methods may be warranted to remove future growth of invasive species and will be coordinated, as needed.

3.5 Yearly Monitoring and Herbicide Reapplication

During the first three years following construction, invasive species monitoring will occur at least yearly and possibly more frequently during the growing season, as recommended by the qualified contractor. These surveys will be performed during the first three years to determine growth by re-sprouting plants or re-colonization. Treatment and retreatment will be conducted accordingly, with timing to be determined by Constitution and its qualified contractor.

FSC will conduct monitoring for three years. Monitoring after three years will be conducted as needed or according to the FERC, USACE, or FDEP permit conditions or other requirements. Herbicide applications will be managed on an as-needed basis, and eradication efforts will be incorporated into the Project vegetation maintenance plan.

4.0 SUMMARY/CONCLUSIONS

FSC will conduct invasive plant species management within the Project workspace areas in a manner that is consistent with the objective of controlling invasive species, such that they do not pose a threat to the native ecosystems. The proposed management activities outlined within this plan will prevent the inadvertent spread of existing populations of invasive plant species and will promote the establishment of native plant populations. FSC will continue to work with landowners along the Project alignment to identify potential colonizing populations of invasive species within the Project area and will control them subsequent to construction in a manner that is consistent with this plan.

5.0 REFERENCES

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FLEPPC List Definitions: **Exotic** – a species introduced to Florida, purposefully or accidentally, from a natural range outside of Florida. **Native** – a species whose natural range includes Florida. **Naturalized exotic** – an exotic that sustains itself outside cultivation (it is still exotic; it has not "become" native). **Invasive exotic** – an exotic that not only has naturalized, but is expanding on its own in Florida native plant communities.

Abbreviations: **Government List (Gov. List):** P = Prohibited aquatic plant by the Florida Department of Agriculture and Consumer Services; N = Noxious weed listed by Florida Department of Agriculture and Consumer Services; U = Noxious weed listed by U.S. Department of Agriculture. **Regional Distribution (Reg. Dist.):** N = north, C = central, S = south, referring to each species' current distribution in general regions of Florida (not its potential range in the state). Please refer to the adjacent map.

Citation example:

FLEPPC. 2013. List of Invasive Plant Species. Florida Exotic Pest Plant Council. Internet: http://www.fleppc.org/list/list.htm

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For more information on invasive exotic plants, including links to related web pages, visit the Florida EPPC web site: http://www.fleppc.org

Application for Membership in the Florida Exotic Pest Plant Council

Annual Membership Levels
(circle one)

Individual		**Institutional**	
Student	$10	Library	$100
General	$30	General	$100
Donor	$75 +	Contributor	$501 – $10,000
		Patron	$10,001 +

FLEPPC is a 501(c)(3) nonprofit organization.

NAME

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CITY, STATE, ZIP

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E-MAIL

Mail application & dues, payable to FLEPPC, to:

Florida EPPC, Treasurer

PO Box 23426

Fort Lauderdale, FL 33307

(Or join online at www.fleppc.org)

Florida Exotic Pest Plant Council's 2013 List of Invasive Plant Species

*The mission of the **Florida Exotic Pest Plant Council** is to support the management of invasive exotic plants in Florida's natural areas by providing a forum for the exchange of scientific, educational and technical information.*

Note: The FLEPPC List of Invasive Plant Species is not a regulatory list. Only those plants listed as Federal Noxious Weeds, Florida Noxious Weeds, Florida Prohibited Aquatics Plants, or in local ordinances are regulated by law.

Purpose of the List:

To focus attention on —

- the adverse effects exotic pest plants have on Florida's biodiversity and native plant communities,
- the habitat losses in natural areas from exotic pest plant infestations,
- the impacts on endangered species via habitat loss and alteration,
- the need for pest plant management,
- the socio-economic impacts of these plants (e.g., increased wildfires or flooding in certain areas),
- changes in the severity of different pest plant infestations over time,
- providing information to help managers set priorities for research and control programs.

www.fleppc.org

CATEGORY I

Invasive exotics that are altering native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives. *This definition does not rely on the economic severity or geographic range of the problem, but on the documented ecological damage caused.*

Scientific Name	Common Name	Gov. List	Reg. Dis.
Abrus precatorius	rosary pea	N	C, S
Acacia auriculiformis	earleaf acacia		C, S
Albizia julibrissin	mimosa, silk tree		N, C
Albizia lebbeck	woman's tongue		C, S
Ardisia crenata (*A. crenulata* misapplied)	coral ardisia		N, C, S
Ardisia elliptica (*A. humilis* misapplied)	shoebutton ardisia	N	C, S
Asparagus aethiopicus (= *A. sprengeri; A. densiflorus* misapplied)	asparagus-fern		N, C, S
Bauhinia variegata	orchid tree		C, S
Bischofia javanica	bishopwood		C, S
Calophyllum antillanum (*C. calaba* misapplied)	santa maria, mast wood, Antilles calophyllum		S
Casuarina equisetifolia	Australian-pine, beach sheoak	P, N	N, C, S
Casuarina glauca	suckering Australian-pine, gray sheoak	P, N	C, S
Cinnamomum camphora	camphor tree		N, C, S
Colocasia esculenta	wild taro		N, C, S
Colubrina asiatica	lather leaf	N	S
Cupaniopsis anacardioides	carrotwood	N	C, S
Deparia petersenii	Japanese false spleenwort		N, C
Dioscorea alata	winged yam	N	N, C, S
Dioscorea bulbifera	air-potato	N	N, C, S
Eichhornia crassipes	water-hyacinth	P	N, C, S
Eugenia uniflora	Surinam cherry		C, S
Ficus microcarpa (*F. nitida* and *F. retusa* var. *nitida* misapplied)[1]	laurel fig		C, S
Hydrilla verticillata	hydrilla	P, U	N, C, S
Hygrophila polysperma	green hygro	P, U	N, C, S
Hymenachne amplexicaulis	West Indian marsh grass		N, C, S
Imperata cylindrica (*I. brasiliensis* misapplied)	cogon grass	N, U	N, C, S
Ipomoea aquatica	water-spinach	P, U	C
Jasminum dichotomum	Gold Coast jasmine		C, S
Jasminum fluminense	Brazilian jasmine		C, S
Lantana camara (= *L. strigocamara*)	lantana, shrub verbena		N, C, S
Ligustrum lucidum	glossy privet		N, C
Ligustrum sinense	Chinese privet, hedge privet		N, C, S
Lonicera japonica	Japanese honeysuckle		N, C, S
*Ludwigia hexapetala**	Uruguay waterprimrose		C
Ludwigia peruviana	Peruvian primrosewillow		N, C, S
Lumnitzera racemosa	kripa; white-flowered mangrove; black mangrove		S
Luziola subintegra	Tropical American water grass		S
Lygodium japonicum	Japanese climbing fern	N	N, C, S
Lygodium microphyllum	Old World climbing fern	N, U	C, S
Macfadyena unguis-cati	cat's claw vine		N, C, S
Manilkara zapota	sapodilla		S
Melaleuca quinquenervia	melaleuca, paper bark	P, N, U	C, S
Melinis repens (= *Rhynchelytrum repens*)	Natal grass		N, C, S
Mimosa pigra	catclaw mimosa	P, N, U	C, S
Nandina domestica	nandina, heavenly bamboo		N, C
Nephrolepis brownii (= *N. multiflora*)	Asian sword fern		C, S
Nephrolepis cordifolia	sword fern		N, C, S
Neyraudia reynaudiana	Burma reed, cane grass	N	S
Nymphoides cristata	snowflake		C, S
Paederia cruddasiana	sewer vine, onion vine	N	S
Paederia foetida	skunk vine	N	N, C, S
Panicum repens	torpedo grass		N, C, S
Pennisetum purpureum	Napier grass, elephant grass		N, C, S
Phymatosorus scolopendria	serpent fern, wart fern		S
Pistia stratiotes	water-lettuce	P	N, C, S
Psidium cattleianum (= *P. littorale*)	strawberry guava		C, S
Psidium guajava	guava		C, S
Pueraria montana var. *lobata* (= *P. lobata*)	kudzu	N	N, C, S
Rhodomyrtus tomentosa	downy rose-myrtle	N	C, S
Rhynchelytrum repens (See *Melinis repens*)			
Ruellia simplex[2]	Mexican-petunia		N, C, S
Salvinia minima	water spangles		N, C, S
Sapium sebiferum (= *Triadica sebifera*)	popcorn tree, Chinese tallow tree	N	N, C, S
Scaevola taccada (= *Scaevola sericea, S. frutescens*)	scaevola, half-flower, beach naupaka	N	C, S
Schefflera actinophylla (= *Brassaia actinophylla*)	schefflera, Queensland umbrella tree		C, S
Schinus terebinthifolius	Brazilian-pepper	P, N	N, C, S
Scleria lacustris	Wright's nutrush		C, S
Senna pendula var. *glabrata* (= *Cassia coluteoides*)	climbing cassia, Christmas cassia, Christmas senna		C, S
Solanum tampicense (= *S. houstonii*)	wetland nightshade, aquatic soda apple	N, U	C, S
Solanum viarum	tropical soda apple	N, U	N, C, S
Syngonium podophyllum	arrowhead vine		N, C, S
Syzygium cumini	jambolan-plum, Java-plum		C, S
Tectaria incisa	incised halberd fern		S
Thespesia populnea	seaside mahoe		C, S
Tradescantia fluminensis	small-leaf spiderwort		N, C
Urena lobata	Caesar's weed		N, C, S
Urochloa mutica (= *Brachiaria mutica*)	Para grass		C, S

CATEGORY II

Invasive exotics that have increased in abundance or frequency but have not yet altered Florida plant communities to the extent shown by Category I species. *These species may become ranked Category I, if ecological damage is demonstrated.*

Scientific Name	Common Name	Gov. List	Reg. Dis.
Adenanthera pavonina	red sandalwood		S
Agave sisalana	sisal hemp		C, S
Aleurites fordii (= *Vernicia fordii*)	tung oil tree		N, C
Alstonia macrophylla	devil tree		S
Alternanthera philoxeroides	alligator weed	P	N, C, S
Antigonon leptopus	coral vine		N, C, S
Ardisia japonica	Japanese ardisia		N
Aristolochia littoralis	calico flower		N, C, S
Asystasia gangetica	Ganges primrose		C, S
Begonia cucullata	wax begonia		N, C, S
Blechum pyramidatum (see *Ruellia blechum*)			
Broussonetia papyrifera	paper mulberry		N, C, S
Bruguiera gymnorhiza	large-leaved mangrove		S
Callisia fragrans	inch plant, spironema		C, S
Casuarina cunninghamiana	river sheoak, Australian-pine	P	C, S
Cecropia palmata	trumpet tree		S
Cestrum diurnum	day jessamine		C, S
Chamaedorea seifrizii	bamboo palm		S
Clematis terniflora	Japanese clematis		N, C
Cocos nucifera	coconut palm		S
Cryptostegia madagascariensis	rubber vine		C, S
Cyperus involucratus (*C. alternifolius* misapplied)	umbrella plant		C, S
Cyperus prolifer	dwarf papyrus		C, S
Dactyloctenium aegyptium	Durban crowfoot grass		N, C, S
Dalbergia sissoo	Indian rosewood, sissoo		C, S
Elaeagnus pungens	silverthorn, thorny olive		N, C
Elaeagnus umbellata	silverberry, autumn olive		N
Epipremnum pinnatum cv. Aureum	pothos		C, S
*Eulophia graminea**	Chinese crown orchid		S
Ficus altissima	false banyan, council tree		S
Flacourtia indica	governor's plum		S
Hemarthria altissima	limpo grass		C, S
Hibiscus tiliaceus (See *Taliparitii tiliaceum*)			
Hyparrhenia rufa	jaragua		N, C, S
Ipomoea carnea ssp. *fistulosa* (= *I. fistulosa*)	shrub morning-glory	P	C, S
Kalanchoe pinnata (= *Bryophyllum pinnatum*)	life plant		C, S
Koelreuteria elegans ssp. *formosana* (= *K. formosana; K. paniculata* misapplied)	flamegold tree		C, S
Landoltia punctata (= *Spirodela punctata*)	spotted duckweed		N, C, S
Leucaena leucocephala	lead tree	N	N, C, S
Limnophila sessiliflora	Asian marshweed	P, U	N, C, S
Livistona chinensis	Chinese fan palm		C, S
*Macroptilium lathyroides**	phasey bean		N, C, S
Melaleuca viminalis (= *Callistemon viminalis*)	bottlebrush, weeping bottlebrush		C, S
Melia azedarach	Chinaberry		N, C, S
Melinis minutiflora	molasses grass		C,S
Merremia tuberosa	wood-rose		C, S
Mikania micrantha	mile-a-minute vine	N, U	S
*Momordica charantia**	balsam apple, balsam pear		N, C, S
Murraya paniculata	orange-jessamine		S
Myriophyllum spicatum	Eurasian water-milfoil	P	N, C, S
Panicum maximum (= *Urochloa maxima, Megathyrsus maximus*)	Guinea grass		N, C, S
Passiflora biflora	two-flowered passion vine		S
Pennisetum setaceum	green fountain grass		S
Phoenix reclinata	Senegal date palm		C, S
Phyllostachys aurea	golden bamboo		N, C
Pittosporum pentandrum	Philippine pittosporum, Taiwanese cheesewood		S
Pteris vittata	Chinese brake fern		N, C, S
Ptychosperma elegans	solitaire palm		S
Rhoeo spathacea (see *Tradescantia spathacea*)			
*Richardia grandiflora**	large flower Mexican clover		N, C, S
Ricinus communis	castor bean		N, C, S
Rotala rotundifolia	roundleaf toothcup, dwarf Rotala, redweed		S
Ruellia blechum (= *Blechum brownei*)	green shrimp plant, Browne's blechum		N, C, S
Sansevieria hyacinthoides	bowstring hemp		C, S
Sesbania punicea	purple sesban, rattlebox		N, C, S
Solanum diphyllum	two-leaf nightshade		N, C, S
Solanum torvum	susumber, turkey berry	N, U	N, C, S
Sphagneticola trilobata (= *Wedelia trilobata*)	wedelia		N, C, S
Stachytarpheta cayennensis (= *S. urticifolia*)	nettle-leaf porterweed		S
Syagrus romanzoffiana (= *Arecastrum romanzoffianum*)	queen palm		C, S
Syzygium jambos	Malabar plum, rose-apple		N, C, S
Taliparitii tiliaceum (= *Hibiscus tiliaceus*)	mahoe, sea hibiscus		C, S
Terminalia catappa	tropical-almond		C, S
Terminalia muelleri	Australian-almond		C, S
Tradescantia spathacea (= *Rhoeo spathacea, Rhoeo discolor*)	oyster plant		S
Tribulus cistoides	puncture vine, burr-nut		N, C, S
Vitex trifolia	simple-leaf chaste tree		C, S
Washingtonia robusta	Washington fan palm		C, S
Wedelia (see *Sphagneticola* above)			
Wisteria sinensis	Chinese wisteria		N, C
Xanthosoma sagittifolium	malanga, elephant ear		N, C, S

[1]Does not include *Ficus microcarpa* subsp. *fuyuensis*, which is sold as "Green Island Ficus"

[2]Many names are applied to this species in Florida because of a complicated taxonomic and nomenclatural history. Plants cultivated in Florida, all representing the same invasive species, have in the past been referred to as *Ruellia brittoniana, R. tweediana, R. caerulea*, and *R. simplex*.

*Added to the FLEPPC List of Invasive Plant Species in 2013

Cinnamomum camphora (L.) J. Presl



Common Name: Camphor tree

Synonymy: *C. camphora* (L.) Nees & Eberm., *Camphora camphora* (L.) H. Karst.

Origin: Eastern Asia (China, Taiwan, Korea)

Botanical Description: Evergreen tree potentially to 20 m (65 ft). Twigs green or reddish green; all vegetative parts glabrous; cut stems and bruised leaves giving off a strong aroma of camphor. Leaves simple, alternate; blades entire, but may have wavy margins, mostly ovate, 4-10 cm (1.5-4 in) long and 2-5 cm (0.8-2 in) broad, glossy green above, duller green below, with impressed glands below at major veins. Flowers small, greenish white to cream, in loose panicles on branchlets of season; 6 petaloid parts; 12 stamen parts, usually 5-9 fertile stamens plus smaller sterile staminodes. Fruits small, subglobose drupes, black, seated on persistent floral tubes.

Ecological Significance: Occurs primarily in drier disturbed areas such as roadsides and fencerows, but has invaded natural areas such as mesic hammocks, upland pine woods, and scrubland (e.g., taking over space in Polk County scrub inhabited by the federally endangered native plant, *Ziziphus celata*, or Florida jujube). Introduced to Florida in 1875 and later established in plantations to promote camphor production, but the venture proved unprofitable (Lakela and Wunderlin 1980). Still sold as a shade tree and for windbreaks.

Distribution: Most commonly naturalized in north and central Florida, but also escapes cultivation in southern peninsula (Godfrey 1988, Long and Lakela 1971, Wunderlin 1982). In Florida, documented as invading scrub, sandhill, hardwood hammock, scrubby flatwoods, mesic flatwoods, floodplain forest, lake, stream and spring shores, and ruderal communities. Documented by herbarium specimens in 33 counties as far west as Escambia County to Duval County on the east coast, south through the peninsula to St. Lucie and Lee counties (Wunderlin and Hansen 2004). Has also been reported in natural areas in Gadsden, Wakulla, Hamilton, Columbia, Clay, Levy, Seminole, and Highlands counties (FLEPPC 2005). Naturalized also in Georgia and west to Texas (Small 1933). Cultivated as well in other southern states: Alabama, Mississippi, Georgia, and the Carolinas (Meyer et al. 1994), and in southern California (Bailey and Bailey 1976). By 1997, documented as locally common in the flora from Texas to the Carolinas (van der Werff 1997).

Life History: Main trunk often stout with several secondary trunks arising from it, all supporting a dense evergreen canopy. National cochampion trees found in Florida (in cultivation), in Hardee and Pasco counties, with heights of 22 m (72 ft) and main trunk circumferences of about 9 m (31 ft) (NRBT 1994). Fruits normally abundant on mature trees, with birds often seen to "frolic and feast" on them particularly during late winter (Kurz and Godfrey 1962). For extraction of camphor (an ethereal oil), young shoots are distilled; old trees are felled, chipped, and the wood is steam distilled (Willis 1973). Wood also used for cabinetwork (Bailey and Bailey 1976).

Colocasia esculenta (L.) Schott




Common Name: Taro, wild taro, dasheen

Synonymy: *C. antiquorum* var. *esculenta* Schott, *Caladium esculentum* Hort.

Origin: India, southeastern Asia

Botanical Description: Perennial herb to 1.5 m (4 ft) tall, with thick shoots from a large corm; slender stolons also often produced, along with offshoot corms. Leaf blades to 60 cm (24 in) long and 50 cm (20 in) wide, arrowhead shaped, with upper surface dark green and velvety; leaves peltate (stalked from back of blade); petioles large, succulent, often purplish near top. Inflorescence on a fleshy stalk shorter than leaf petioles; part of fleshy stalk enveloped by a long yellow bract (spathe). Flowers tiny, densely crowded on upper part of fleshy stalk, with female flowers below and male flowers above. Fruit a small berry, in clusters on the fleshy stalk.

NOTE: May be confused with other plants in Florida having large arrowhead-shaped leaf blades, such as the native arums (*Peltandra* spp.) and the exotic elephant's ear (*Xanthosoma sagittifolium*), but leaves of all similar-looking species not peltate (i.e., their petioles are attached at the leaf-blade margin).

Ecological Significance: Brought from Africa to the Americas as a food crop for slaves (Greenwell 1947). Introduced into Florida and other southern states in 1910 by the United States Department of Agriculture as a substitute crop for potatoes (Fairchild 1947, Greenwell 1947). Considered an "aggressive weed" in parts of the Southeast by 1974 (Cook et al.1974). Widely naturalized in Florida along streams, marshy shores, canals, and ditches by 1979 (Godfrey and Wooten 1979). Still promoted as food, feed, and fuel crop for Florida in the 1980s (e.g., O'Hair et al. 1982, Shih and Snyder 1984). Reported as naturalized in 183 public water bodies in 1990 (Schardt and Schmitz 1990); found in 235 public water bodies by 1994 (Schardt 1997). Forms dense growth along river and lake shores, displacing native shoreline vegetation (Akridge and Fonteyn 1981, McCann et al. 1996).

Distribution: Now found throughout the tropics and much of the subtropics. Considered a principal agricultural weed in Puerto Rico and present as a weed in Jamaica (Holm et al. 1979). In Florida, documented as invading water's edge rooting in muck, swamps, blackwater streams, riverine forests, and ruderal communities. Herbarium specimens recorded from 35 counties as far west as Escambia County in the Panhandle through the peninsula south to Miami-Dade and Monroe counties (Wunderlin and Hansen 2004). Dense to scattered populations reported from natural areas throughout Florida, particularly on the peninsula in 16 additional counties (FLEPPC 2005). Also reported from natural areas in southern Georgia, Alabama, Louisiana, and Texas (C. Jacono, United States Geological Survey, 1998 pers. comm.).

Life History: Can grow in a wide range of dry to wet sites (de la Pena 1983). Dispersed primarily by purposeful or accidental movement of vegetative fragments. Only a portion of corm crown and petiole needed to establish a new plant (Begley 1979). Flowers occasionally, fruit not often seen (Godfrey and Wooten 1979). Seed production (2-5 per berry) considered uncommon, with low viability and difficulty in germination (Jackson et al. 1977, Nyman and Arditti 1985, O'Hair et al. 1982, Strauss 1983).

Dioscorea bulbifera L.




Common Name: Air potato, potato yam, air yam

Synonymy: *D. anthropophagum* Chev., *D. hoffa* Cordemoy, *D. sativa* Thunb., *D. sylvestris* de Wild., *Helmia bulbifera* Kunth.

Origin: Tropical Asia

Botanical Description: Vigorously twining herbaceous vine, with small or absent underground tubers. Stems to 20 m (66 ft) or more in length, freely branching above; internodes round or slightly angled in cross section, not winged (as in D. alata). Aerial tubers (bulbils) freely formed in leaf axils, usually roundish, to 12 cm (5 in) x 10 cm (4 in), with mostly smooth surfaces. Leaves long petioled, alternate; blades to 20 cm (8 in) or more long, broadly heart shaped, with basal lobes usually rounded. Flowers rare (in Florida), small, fragrant, male and female arising from leaf axils on separate plants (i.e., a dioecious species), in panicles or spikes to 11 cm (4 in) long. Fruit a capsule; seeds partially winged.

NOTE: May be confused with *D. alata* L. or native wild yams (see note under *D. alata*).

Ecological Significance: Listed by Holm et al. (1979) as a serious weed in west Polynesia. Introduced to the Americas from Africa during the slave trade (Coursey 1967). Apparently introduced to Florida in 1905 as a USDA sample sent to an Orange County horticulturist, Henry Nehrling, who found that it "soon formed impenetrable masses," adding that except for kudzu vine, he had "never seen a more aggressive and dangerous vine in Florida" (Morton 1976). Described in 1971 (Long and Lakela) as being grown ornamentally, but "an unwanted plant in central and south Florida." Noted as "becoming extensively naturalized" in 1977 (Ward) and well established in Miami-Dade and Broward counties (Austin 1978). By 1982 (Bell and Taylor), invading a variety of habitats including pinelands and hammocks. Considered "rampant on undeveloped land" in Hillsborough County (Martinez 1993). Can quickly engulf native vegetation, climbing high into mature tree canopies. Produces large numbers of aerial tubers, which accelerate its spread.

Distribution: Widely distributed in Asia and Africa in the wild state (Coursey 1967) and widely naturalized elsewhere in the tropics and subtropics, including Central and South America (Schultz 1993). In Florida, documented as invading a variety of habitats, such as mesic flatwoods, rockland hammocks, basin marshes, ravine hammocks, sinkholes, floodplain forests, and ruderal communities. Florida herbarium records now reported for naturalized populations in 33 counties, from Escambia County in the Panhandle throughout the peninsula, south to Miami-Dade and Monroe counties, including the Keys (Wunderlin and Hansen 2004). Has also been reported in natural areas from an additional 15 counties (FLEPPC 2005).

Life History: Has a dormant period (like *D. alata*), even in south Florida, with aerial stems dying back during winter months (Schultz 1993). Aerial tubers considered the main storage organ (Coursey 1967), but underground tubers found in Florida populations, to 25 cm in diameter (Schultz 1993). Tubers known to float, aiding in dispersal (Coursey 1967), but plants slowed in growth under flooded conditions (K. Burks, Florida Department of Environmental Protection, unpublished data). Once thought not to flower in Florida (e.g., Long and Lakela 1971), but flowers observed in north Florida, and flowers and fruits in south Florida (Schultz 1993). Cultivated in Oceania and West Indies, but wild-form tubers usually bitter and often poisonous (Martin 1974).

Imperata cylindrica (L.) Raeuschel



Common Name: Cogongrass

Synonymy: *I. cylindrica* (L.) Beauv., *I. brasiliensis* Trinius misapplied

Origin: Southeast Asia

Botanical Description: Perennial grass, growing in loose or compact tufts, from stout, extensively creeping, scaly rhizomes with sharp-pointed tips. Leaf sheaths relatively short, glabrous or pubescent; ligule a membrane, 0.5-1 mm (0.02-0.04 in) long. Leaf blades erect, narrow and pubescent at base, flat and glabrous above, to 1.2 m (4 ft) tall and to 2 cm (< 1 in) wide, with whitish midvein noticeably off center; blade margins scabrous, blade tips sharp pointed. Inflorescence a narrow, dense terminal panicle, white silky and plume-like, to 21 cm (8 in) long and 3.5 cm (1.5 in) wide. Spikelets crowded, paired on unequal stalks, with each spikelet surrounded by long white hairs.

Ecological Significance: Considered one of the top 10 worst weeds in the world, reported by 73 countries as a pest in a total of 35 crops (Holm et al. 1977). Introduced to the United States in 1911 near Mobile, Alabama as packing material in a shipment of plants from Japan (Dickens 1974, Tabor 1949, Tabor 1952); and into Mississippi as a forage crop from the Philippines before 1920 (Dickens and Buchanan 1971, Patterson et al. 1979, Tabor 1949 and 1952, Tanner and Werner 1986). Replanted to Florida from Mississippi for forage and soil stabilization in Gainesville, Brooksville, and Withlacoochee (Hall 1983, Tabor 1949)—these areas now with high densities of naturalized populations (Dickens and Buchanan 1971, Willard 1988). By 1949, more than 405 ha (1,000 acres) of the grass established in central and northwest Florida (Dickens 1974). Now frequent along transportation and utility corridors throughout Florida. Has invaded dry to moist areas including habitats of federally listed endangered and threatened native plant species (K. C. Burks, Florida Department of Environmental Protection, 1997 pers. comm.).

Distribution: Commonly found in humid tropics, but has spread to warm temperate zones worldwide (Hubbard et al. 1944). Reported for parts of Alabama, Georgia, Louisiana, and Mississippi, along with an adventive (but perhaps not persistent) population in South Carolina (Allen and Thomas 1991, Elmore 1986, Bryson and Carter 1993). In Florida, documented as invading xeric hammocks, mesic flatwoods, herbaceous marshes, floodplain forests, and ruderal communities. Herbarium specimens recorded from 34 counties as far west as Escambia County in the Panhandle to Nassau County on the east coast, south to Miami-Dade and Monroe counties (Wunderlin and Hansen 2004). Has also been reported in natural areas from all of Florida's counties except Baker, Broward, Monroe, and Palm Beach (FLEPPC 2005).

Life History: Fast-growing; thrives in areas of minimal tillage, such as orchards, lawns, and roadsides (Patterson et al. 1979). Produces new rhizomes readily, facilitating the plant's spread at newly colonized sites; can propagate by rhizome fragments, but does not survive well under regular deep tilling (Wilcut et al. 1988). Roots and rhizomes remarkably resistant to fire (Bryson and Carter 1993). Disperses over long distances into a variety of habitats by windborne seeds (Bryson and Carter 1993). Flowers in spring or fall, or year-round in central and south Florida (Willard 1988).

Lantana camara L.




Common Name: Lantana, shrub verbena, cherry pie

Synonymy: *L. aculeata* L.

Origin: West Indies

Botanical Description: Scandent, multistemmed, deciduous shrub, to 2 m (6 ft) or more, with stems square, covered with bristly hairs when green, often armed as well with scattered small prickles. Leaves opposite, simple, with petioles to 2 cm (0.8 in) long; blades oval, rough hairy, to 15 cm (6 in) long and 6 cm (2.4 in) wide, with margins blunt toothed and blade bases broad, squared off (truncate); leaves strongly aromatic. Flowers small, multicolored, in stalked, dense, flat-topped clusters to 4 cm (1.5 in) across; corolla a narrow tube with 4 short-spreading lobes; flowers in a single cluster may be white to pink or lavender, yellow to orange or red, changing color over time. Fruit a round, fleshy, 2-seeded drupe, about 5 mm (0.2 in) wide, green turning purple then blue black.

NOTE: May be confused with the endangered endemic native, Florida lantana (*Lantana depressa* Small), with which it has extensively hybridized, but bases of the native's leaf blades are tapered (cuneate), not truncate. Blade bases of the more common native, wild sage (*L. involucrata* L.), also cuneate, its flowers yellow-centered white, its leaves rounder.

Ecological Significance: A serious to common weed in 25 countries and present as a weed in another 22 countries (Holm et al. 1979). A serious, worldwide invader that in some areas has altered habitats and threatens to eliminate populations of native plants and animals (Cronk and Fuller 1995). Can become the dominant understory in open forests (Holm et al. 1977). In Florida, often forms thickets in sunny open areas; commonly invades disturbed sites such as roadsides, spoil islands, pastures, citrus groves, and cultivated woodlands. Also frequent in well-drained undisturbed habitats such as native pinelands, hammocks, and beach dunes. Reported from over 40 natural areas (FLEPPC 2002). Widely promoted for ornamental cultivation since the early 1800s (Mack 1991), with wild plants in Florida representing tetraploid cultivars (Hammer 1997). Has extensively hybridized with all 3 distinct varieties of *L. depressa* (Sanders 1987), contaminating the endemic gene pool.

Distribution: Naturalized in tropical and warm regions worldwide (Sanders 1987). Found on the southern Atlantic Coastal Plain from Florida and Georgia to Texas (Small 1933), and in California and Hawaii as a serious pest (Holm et al.. 1979, Kingsbury 1964). In Florida, documented as invading scrub, sandhill, xeric hammocks, coastal grasslands, coastal berms, coastal strands, coastal rock barren, maritime hammocks, shell mounds, hardwood hammocks, rockland hammocks, prairie hammocks, mesic flatwoods, scrubby flatwoods, wet flatwoods, bottomland forests, and ruderal communities. Documented by herbarium specimens in 53 counties as far west as Escambia County in the Panhandle to Nassau County on the east coast, south through most of the northern counties and all of the southern peninsular counties, including the Keys (Wunderlin and Hansen 2004). Reported in natural areas from Columbia and Walton counties (FLEPPC 2005). Widely cultivated in Florida, with over 100 forms, cultivars, and hybrids available; some of the newer ones considered sterile (Hammer 1997).

Life History: Long recognized as highly toxic to grazing animals; has caused death in children when a quantity of unripe berries was eaten (Morton 1971b). Produces allelopathic substances in the roots and shoots, increasing its competitive ability (Smith 1985, Sahid and Sugau 1993). Strongly resists herbivory, contributing to its pest-plant status outside its natural range (Janzen 1983). Can tolerate fire by regenerating from basal shoots (Smith 1985). Flowers year-round (or May to December in northernmost Florida). Seed dispersed by songbirds (Janzen 1983). 'Gold Mound', 'New Gold', 'Alba', and 'Patriot' cultivars not known to produce viable seed in nursery or landscape plantings (S. Kent, Tree of Life Nursery, 1998 pers. comm.).

Lygodium japonicum (Thunb.) Sw.




Common Name: Japanese climbing fern

Synonymy: *Ophioglossum japonicum* Thunb. ex Murray (sometimes placed in Schizeaceae, ray fern family)

Origin: Eastern Asia, temperate to tropical

Botanical Description: Fern with climbing, twining fronds of indeterminate growth, to 30 m (90 ft) long; main rachis wiry, stemlike. Leafy branches off main rachis (constituting the pinnae) compound, triangular in overall outline, 10-20 cm (4-8 in) long and about as wide. Leaflets (pinnules) lobed, stalked, with terminal lobes often dissected (pinnatifid), basal lobes irregularly lobed or dissected; leaf-blade tissue pubescent below with short, curved hairs. Fertile leaflets contracted in shape, with two rows of sporangia along the leaf margin, which is enrolled to partially cover the sporangia.

NOTE: May be confused with *L. microphyllum* (Cav.) R. Brown, Old World climbing fern, but its leaflets unlobed (usually), glabrous below, articulate stalked (leaving wiry stalks when blade detached).

Ecological Significance: Present as a weed in the Philippines and considered a common weed in Taiwan (Holm et al. 1979). Most frequently naturalized in north and west Florida, in shady or sunny, usually damp, disturbed areas such as yards and roadsides, but also in less disturbed edges of swamps, marshes, lakes, creeks, hammocks, and upland woodlands. Can form tangled masses over ground cover and shrubs, its dense canopy eliminating the underlying vegetation (Nauman 1993a). Reported forming sun-blocking "walls" of fern in tributary floodplains of the Apalachicola River (L.C. Anderson, Florida State University, 1997 pers. comm.), and smothering seedlings of overstory tree species (K.C. Burks, Florida Department of Environmental Protection, 2001 personal observation). Introduced in 1932 as an ornamental (Gordon and Thomas 1994). Reported as weedy in southern Alabama as well (Nauman 1993a).

Distribution: Occurs naturalized in the United States from the Carolinas through Georgia, Florida, Alabama, Mississippi, and Louisiana, to Texas and Arkansas. In Florida, documented as invading upland hardwood and mixed forests, mesic flatwoods, bottomland forests, floodplain forests, basin marshes, strand swamps, baygalls, seepage slopes, and ruderal communities. In Florida, occurs across north and west Florida and south into central Florida, with documented sightings as far south as Hardee and Highlands counties (FL Dept. of Agriculture, unpublished records), and Broward County (R. Pemberton, USDA, 1997 pers. comm.). Verified herbarium specimens collected from naturalized populations in 42 Florida counties as far west as Escambia County in the Panhandle through the peninsula south to Lee and Broward counties (Wunderlin and Hansen 2004). Has also been reported from natural areas in 14 additional counties (FLEPPC 2005).

Life History: North of the frost line, leaflets die in winter but stalks of leaves usually remain intact, providing a "ladder" for climbing stalks of new growth. Spores wind-dispersed, and perhaps carried in dust on moving objects such as vehicles. Thought to prefer soils of circumneutral pH (Nauman 1993a).

Lygodium microphyllum (Cav.) R. Brown



Common Name: Old World climbing fern

Synonymy: *Lygodium scandens* (L.) Sw., *Ugena microphylla* Cav. (sometimes placed in Schizeaceae, ray fern family)

Origin: Africa to Southeast Asia, south Pacific islands, Australia

Botanical Description: Fern with dark brown, wiry rhizomes and climbing, twining fronds of indeterminate growth, to 30 m (90 ft) long; main rachis (leaf stalk above petiole) wiry, stemlike. Leafy branches off main rachis (constituting the pinnae) once compound, oblongish in overall outline, 5-12 cm (2-5 in) long. Leaflets (pinnules) usually unlobed, stalked, articulate (leaving wiry stalks when detached); leaf-blade tissue usually glabrous below; fertile leaflets of similar size, fringed with tiny lobes of enrolled leaf tissue covering the sporangia along the leaf margin.

NOTE: May be confused with *L. japonicum*, whose pinnae are often twice compound (see preceding page).

Ecological Significance: Considered a principal agricultural weed in Malaysia and present as a weed in Vietnam (Holm et al. 1979). Reported from Florida natural areas of Broward, Highlands, Lee, Martin, Palm Beach, and Sarasota counties (FLEPPC 1996). In 1993, infested 1,233 acres (11% of the area) of Jonathan Dickinson State Park and the Loxahatchee National Wild and Scenic River, including many acres of cypress swamps (Roberts and Richardson 1995). By 1995, infested 17,000 acres (12% of the area) of the Loxahatchee National Wildlife Refuge (Palm Beach County), blanketing entire tree islands and even clambering over sawgrass in standing water (Jewell 1996). Poses management problems for both wildfires and prescribed burns because growth into canopy creates an avenue for fire to spread where swamp waters have usually provided a natural barrier. Such crown fires have caused loss of some canopy trees as well as loss of native bromeliads residing on tree trunks (S. Farnsworth, Palm Beach County, 1995 pers. comm.; Roberts 1996).

Distribution: In Florida, documented as invading hardwood hammocks, mesic flatwoods, forested swamps, wet flatwoods, hydric hammocks, floodplain forests, strand swamps, and ruderal communities. Center of dispersal in Florida reported by Beckner (1968) and Nauman and Austin (1978) as Loxahatchee River Basin in southern Martin and northern Palm Beach counties. Herbarium specimens now recorded from 20 counties as far north as Volusia County on the east coast and Hillsborough County on the west coast, south through the peninsula to Miami-Dade and Collier counties (Wunderln and Hansen 2004). Has also been reported in natural areas from Seminole, Pinellas, Indian River, and Okeechobee counties (FLEPPC 2005). Widespread in Old World tropics from Africa and India to Malaysia, and in Australia from Ryukyu Islands south to New South Wales (Singh and Panigrahi 1984, Tagawa and Iwatsuki 1979).

Life History: Reproduction occurs during an alternation of generations between sporophyte and gametophyte life stages. Fertile pinnae house spores within sori which, upon release, may germinate into prothallia given suitable environmental conditions (Hutchinson et al. 2006). *Lygodium* spores have lignified walls, which contribute to long-term viability (Tryon, 1999 pers. comm.). Spores may remain viable for four years or more following release from sori (Mike Lott, pers. comm.). Wiry rhizomes able to accumulate into dense mats 1 m (3 ft) or more thick above native soil (J. Street, Palm Beach County, 1996 pers. comm.). Vegetative growth and production of fertile pinnules continuous throughout year. Can germinate from spores in 6-7 days, with 5-month-old spores still having an 80% germination rate (Brown 1984). Fertile pinnules usually produced where plant receives sunlight, with such exposed locations also aiding windborne dispersal of the spores. Often establishes first at pineland/wetland ecotone. Usually killed back by fire, but not eliminated (Maithani et al. 1986). Hutchinson et al. (2006) has developed a comprehensive management plan for the species, which is available at the FLEPPC Web site (www.fleppc.org).

Panicum repens L.




Common Name: Torpedo grass, quack grass, bullet grass

Synonymy: *P. littorale* Mohr ex Vasey

Origin: Old World

Botanical Description: Perennial grass to 1 m (3 ft) tall, from sturdy, vigorous, widely creeping or floating rhizomes with overlapping brownish to white scales and rigid sharp-pointed (torpedo-like) growing tips. Aerial stems erect or leaning, lower portions often wrapped in bladeless sheaths. Upper leaf sheaths glabrous or hairy, usually at least with hairs on upper margins; ligule a short-ciliate membrane; leaf blades stiff, linear, flat or folded, to 26 cm (10 in) long and 5.3 mm (0.3 in) wide, glabrous or sparsely hairy below, usually long-hairy above, especially near base behind ligule; blade surfaces often with a whitish waxy coating ("bloom"). Inflorescence a loose open terminal panicle, 7-22 cm (3-9 in) long, with branches erect or ascending. Spikelets 2-3 mm long and about 1 mm wide, glabrous, the first glume (outermost spikelet bract) short, truncate, loose, nearly encircling the base of the other spikelet bracts.

Ecological Significance: Reported as a weed of 17 crops in 27 countries, considered one of the most serious grass weeds (Holm et al. 1977). Introduced into the Gulf Coast of United States before 1876, being first collected that year near Mobile, Alabama (Beal 1896). Seed introduced for forage crops in the South from 1926 (Tarver 1979). By 1950, planted in nearly every southern Florida county and in a few central and north-central counties (Hodges and Jones 1950). Quickly forms monocultures that displace native vegetation, particularly in or near shallow waters (Shilling and Haller 1989). Occurred in 70% of Florida's public waters by 1992, with the largest infestation in Lake Okeechobee displacing nearly 5,670 ha (14,000 acres) of native marsh (Schardt 1994). Also reported from parks and preserves throughout Florida (FLEPPC 2005). Has cost an estimated $2 million a year for its management in flood control systems (Schardt and Schmitz 1991). Has seriously infested citrus groves and golf courses throughout Florida (Baird et al. 1983, Fleming et al. 1978).

Distribution: Now found in the tropics and subtropics from approximately lat 43ºS, long 35ºS (Holm et al.1977). Occurs from Florida to Texas in the Southeast (Godfrey and Wooten 1979), northward along the Atlantic Coast to North Carolina (C. Jacono, United States Geological Survey, 1998 pers. comm.), and in California (Small 1933) and Hawaii, where it is a pest in sugarcane (Holm et al. 1977). In Florida, documented as invading scrub, coastal flatwoods, upper tidal marshes, mesic flatwoods, herbaceous wetlands, wet prairies, swales, lake shores, and ruderal communities. Documented by herbarium specimens from 44 counties as far west as Escambia County in the Panhandle to Nassau County on the east coast, south throughout the peninsula to Miami-Dade and Monroe counties, including the Keys (Wunderlin and Hansen 2004). Has also been reported in 13 additional counties (FLEPPC 2005).

Life History: Tolerant of drought and partial shade, and can grow on heavy upland soils, but thrives in moist to wet sandy or organic soil (Hodges and Jones 1950, Holm et al. 1977). Stimulated in its spread by tilling and fertilization (Hodges and Jones 1950). Reproduces principally by rhizome extension and fragmentation (Holm et al. 1977). Flowers nearly year-round, but variable in its seed abundance and viability (Whyte et al. 1959, Peng and Twu 1979, Wilcut et al. 1988).

Rhynchelytrum repens (Willd.) C.E.Hubb.




Common Name: Natal grass, rose natalgrass, Natal red top, ruby grass

Synonymy: *Melinis repens* (Willd.) Zizka, *Rhynchelytrum roseum* (Nees) Stapf & C. E. Hubb. ex Bews, *Tricholaena rosea* Nees

Origin: Africa

Botanical Description: Short-lived, perennial grass with glabrous, erect, slender stems (culms) to 1 m (3.2 ft) tall forming loose, open tufts. Leaves and stems pale green, often with purple blotches, and sometimes rooting from the lower nodes; nodes conspicuously pubescent. Leaf sheaths glabrous or sometimes with long, stiff hairs; leaf blades flat or folded, linear, to 30 cm (12 in) long and 1 cm (0.4 in) wide, often glaucous, upper surface slightly rough. Inflorescence a loose, open, terminal panicle, to 20 cm (8 in) long and 7 cm (2.7 in) wide, purple to pinkish, fading to silvery with age, fluffy, with slender, ascending branches. Spikelets on thin, flexuous stalks and covered with long, soft, wavy hairs, ovate, to 8 mm (0.3 in) long; glumes with short awns.

Ecological Significance: First introduced to Florida in Marion County around 1875 as a pasture grass (Austin 1978), but low palatability prevented success as a fodder species. Herbarium specimens document escaped populations as early as 1923 (FLAS). Now found in over 120 conservation areas throughout Florida across a variety of habitats, including beach dunes, coastal strands, mesic and scrubby flatwoods, pine rocklands, scrub, shell mounds, swamps, disturbed uplands, and hardwood hammock edges (Gann et al. 2001, FLEPPC 2002). One of the most frequently occurring exotic species in south Florida, it was found in over 49% of surveyed lands (Bradley and Gann 1999). Invades disturbed and natural habitats and can form dense monocultures in native vegetation (FLEPPC 2002). Found in dry, harsh environments such as beach dunes and endemic scrub communities of the Central Ridge (FLAS, FLEPPC 2002). Invades undisturbed steep slopes, and in Sonoran Desert grasslands, could "potentially fuel fires in vulnerable desert scrub vegetation" (van Devender et al. 1997). Dominates native grassland communities in Hawaii (Daehler and Carino 1998), where its substantial biomass creates a large fuel bed that may alter fire regimes (Smith and Tunison 1992). A major crop, pasture, and environmental weed in Brazil (Nobrega et al. 1997, Sa 1996), and throughout many South and Central American countries. A very efficient nitrogen-fixing species that can fix over 300 g N/ha/day (Lehane 1981).

Distribution: Herbarium specimens documented from 44 of Florida's 67 counties (Wunderlin and Hansen 2002). Naturalized from California across the southern states to Louisiana, Georgia, North Carolina, north to Maryland, and in Hawaii, Puerto Rico, and the Virgin Islands (USDA NRCS 2002). An invasive weed in Australia, New Zealand, Southeast Asia, China, Philippines, Indonesia, throughout the Pacific and Indian Ocean Islands, Japan, the Mediterranean, and South and Central America (PIER 2002, MOBOT, RIB 2002). Recognized as a worldwide grass weed (USDA ARS 2002). Targeted for removal from commercial production by FNGA/TBWG growers associations (FNGA 2001).

Life History: Fast-growing pioneer species that colonizes degraded land and is resilient to harsh conditions (Palaniappan 1974, Sa 1996). Grows in a wide variety of habitats from swampy ditches and lake margins to dry prairies, mesic woodlands, and longleaf pine savannahs (Hall 1978). Perennial and hardy to -6.6°C (20°F), but survives as an annual in colder climates. Tolerant of many soils, including limestone, sand, nutrient-depleted soil, and soil contaminated with heavy metals (Carneiro et al. 2001, Munkert 2000, Ziegler et al. 2000). Grows in loose soil and crushed shell along roadsides (Landry 1996). Withstands moderate salinity (Onkware 2000). Grows well in arid or semiarid areas (HEAR 2002), but declined in abundance or was dominated by other invasive grasses in low moisture conditions in Hawaii (Daehler and Carino 1998). Resilient to strong winds and tolerates low annual rainfall and acute erosion (Ziegler et al. 2000). Reproduces quickly from wind-dispersed seed (PIER 2002).

SAPIUM SEBIFERUM (L.) ROXB.

Euphorbiaceae/Spurge Family

Common Names: Chinese tallow tree, popcorn tree
Synonymy: *Croton sebiferus* L., *Stillingia sebifera* Michx., *Triadica sebifera* (L.) Small
Origin: Eastern Asia

Botanical Description: Deciduous tree to 16 m (52 ft), commonly to 10 m (33 ft). Sap milky. Leaves simple, alternate; blades entire, broadly ovate, 3-6 cm (1-2.5 in) wide, with broadly rounded bases and abruptly acuminate (tapering to a slender point) tips; petioles slender, 2-5 cm (1-2 in) long. Flowers small, yellow, borne on spikes to 20 cm (8 in) long, with 2-3 sepals (petals absent), 2-3 stamens or 3 styles (plants monoecious). Fruit a 3-lobed capsule, 1 cm (0.5 in) wide, turning brown and splitting open at maturity to reveal 3 dull white seeds, which remain attached for a time.

Ecological Significance: Considered a common agricultural weed in Taiwan, requiring constant effort and expense to hold at bay (Holm *et al.* 1979). Introduced repeatedly to the United States as an ornamental and potential oil crop species (Jones and McLeod 1989). Considered an invasive pest plant in the Carolinas since the 1970s. Has expanded its range on the United States Gulf Coast in low-lying areas, becoming dominant and spreading along roadside ditches and into areas where the soil stays wet (Cameron and LaPoint 1978). Also thrives in upland, well-drained areas near human habitation and in undisturbed areas such as closed canopy forests, in bottomland hardwood forests, shores of waterbodies, and sometimes on floating islands (Godfrey 1988). Survives in both poorly drained freshwater and saline soils as well (Scheld and Cowles 1981). Tends to take over large areas (Bonner 1974).

KAL

Flowers

Distribution: Naturalized in outer coastal plain of South Carolina and adjacent North Carolina, also in Richmond County, North Carolina (Radford *et al.* 1968), south through Florida, and west to eastern Texas (Godfrey 1988). Found throughout Florida south to Manatee County on the Gulf coast and St. Lucie County on the Atlantic coast (Jubinsky 1993). Has potential range through southern Florida to the upper Florida Keys (Broschat and Meerow 1991). Recently found naturalized in Dade County (Wunderlin *et al.* 1995), and by 1996 (Jubinsky and Anderson), recorded as naturalized in 57% of Florida's counties.

Life History: Early growth rate very rapid with flowering and fruiting from the time the tree is about 1 m (3.3 ft) tall. Also suckers from stumps. Flowers in spring (Broschat and Meerow 1991), with fruit ripening August to November. Seeds primarily dispersed by birds and water (Jubinsky 1993).

KAL

Persisting white seeds

KAL

In Lake Jessup conservation area

Schinus terebinthifolius Raddi




Common Name: Brazilian pepper, Florida holly, Christmas berry, pepper tree

Synonymy: None

Origin: Brazil, Argentina, Paraguay

Botanical Description: Evergreen shrub or tree to 13 m (43 ft) tall, often with multi-stemmed trunks and branches arching and crossing, forming tangled masses. Leaves alternate, odd-pinnately compound with 3-11 (usually 7-9) leaflets, these elliptic-oblong, 2.5-5 cm (1-2 in) long, with upper surfaces dark green (lateral veins obvious, lighter in color), lower surfaces paler, and leaflet margins often somewhat toothed. Leaves aromatic when crushed, smelling peppery or like turpentine. Flowers unisexual (dioecious), small, in short-branched clusters at leaf axils of current-season stems; 5 petals, white to 2 mm (.8 in) long. Fruit a small, bright-red spherical drupe.

Ecological Significance: Imported as an ornamental in the 1840s (Barkley 1944). Has invaded a variety of areas including, but not limited to, fallow farmland, pinelands, hardwood hammocks, roadsides, and mangrove forests, in areas with a high degree of disturbance and natural areas with little disturbance (Woodall 1982, Laroche 1994a). Forms dense thickets of tangled woody stems that completely shade out and displace native vegetation. Has displaced some populations of rare listed species, such as the Beach Jacquemontia (*Jacquemontia reclinata* House, US and Florida Endangered), and Beach Star (*Remirea maritima* Aubl., Florida Endangered) (D. F. Austin, Florida Atlantic University, personal observations). Produces certain allelopathic agents, which appear to suppress the growth of other plants (Mahendra et al. 1995). Seeds spread by consumption and deposition of the fruit by wildlife; spread is enhanced by decorative use of branches and fruit (Morton 1978). Estimated to occupy over 283,400 ha (700,000 acres) in central and south Florida (Ferriter 1997). A comprehensive management plan developed by Cuda et al. (2006) for *S. terebinthifolius* details the latest ecological impacts, range expansion, and management techinques.

Distribution: Naturalized in most tropical and subtropical regions, including other South American countries, parts of Central America, Bermuda, the Bahama islands, the West Indies, Guam, Mediterranean Europe, North Africa, southern Asia, and South Africa. In the United States, occurs in Hawaii, California, southern Arizona, and Florida. In Florida, documented as invading scrub, shell mounds, sand dunes, maritime hammocks, coastal strands, coastal hammocks, coastal berms, upland pine forests, cabbage palm savannahs, hydric hammocks, wet flatwoods, strand swamps, and ruderal communities. Documented by herbarium specimens from 33 counties, from Franklin County in the Panhandle, Duval County on the east coast, and south throughout the peninsula to Miami-Dade and Monroe counties, including the Florida Keys (Wunderlin and Hansen 2004). Has also been reported in natural areas from Nassau, Putnam, Flagler, and Lake counties (FLEPPC 2005).

Life History: Sprouts easily from the trunk and roots, even if the plant is undamaged. Seen in flower in every month of the year in Florida, with the most intense period of flowering in the fall season, September through November. Fruits profusely in southern and central Florida, with wildlife consumption of fruits contributing in large part to the spread of seeds (Ewel et al. 1982). Produces chemicals in leaves, flowers, and fruits that irritate human skin and respiratory passages (Ewel et al. 1982, Morton 1978).

Solanum viarum Dunal




Common Name: Tropical soda apple, Sodom apple

Synonymy: *S. khasianum* var. *chatterjeeanum* Sen Gupta

Origin: Brazil, Paraguay, Argentina

Botanical Description: Bushy, prickly herbaceous perennial, to 2 m (6 ft) tall, more commonly 1 m (3 ft) tall; stems armed with broad-based, straight or downward-pointing prickles and clothed in a mixture of stellate and simple glandular or nonglandular hairs (pubescent). Leaves alternate, simple, clearly petioled (these also prickly); blades oval-triangular, nearly as broad as long, to 20 cm (8 in) long and 15 cm (6 in) wide, angular lobed; surfaces dense with fine soft hairs giving blades a velvety sheen (hairs a mix of types as on stems); veins prickly. Flowers white, in small terminal clusters; 5 petals white, recurved; stamens with prominent cream-colored anthers. Fruit a globose berry, 2-3 cm (0.8-1.2 in) wide, green with dark veining, like a tiny watermelon, when immature, dull medium yellow when ripe; seeds about 400 per berry.

NOTE: Distinguished in Florida from other prickly *Solanum* spp. by its straight prickles, mixture of stellate and simple hairs with and without glands, clearly petioled leaves with a velvety sheen, terminal flower clusters, and yellow berries that are dark veined when young.

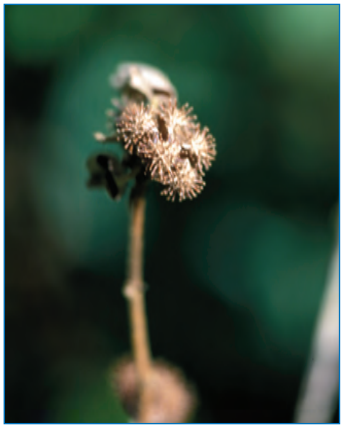
Ecological Significance: A recent accidental introduction, exact means unknown; first collected in Florida in 1988; found in pastures and other open disturbed sites of Glades, Okeechobee, and Polk counties (Wunderlin et al. 1993). From 1990 to 1996, Florida's infestation estimated to have increased from 10,000 ha (25,000 acres) to 200,000 ha (500,000 acres), becoming a major concern of agriculture and a serious threat to Florida natural areas (J. Mullahey, University of Florida, 1997 pers. comm.). Outcompetes native plants, crowding or shading them out (observations of several natural-area managers).

Distribution: In Florida, documented as invading scrub, mesic flatwoods, marl prairies, bottomland forests, strand swamps, and ruderal communities. Documented by herbarium specimens in 30 counties as far west as Leon, Jefferson, and Madison counties south through the peninsula to Collier and Miami-Dade counties (Wunderlin and Hansen 2004). Reported in natural areas from 17 additional counties as far west as Escambia County in the Panhandle through the peninsula to Monroe County, including the Keys (FLEPPC 2005). Now a common weed in fields and groves, a frequent one along roadsides, and turning up more often at pineland and hammock edges. Also present now in adjoining states (Mullahey et al. 1993). Naturalized also in the West Indies, Mexico, Africa, and India (Wunderlin et al. 1993).

Life History: Reaches maturity from seed within 105 days (Mullahey and Cornell 1994). Green stems persist in mild winter temperatures (Coile 1993). Less productive or may die in summer when standing in water (Mullahey and Colvin 1993). Can regenerate shoots from extensive root system; difficult to eradicate (Akanda et al. 1996). Flowers and fruits primarily from September through May, with few fruits produced in summer. Produces 40,000 to 50,000 seeds per plant, with a tested germination rate of 30-100% (Mullahey et al. 1993). Seeds dispersed by birds and other animals, including cattle, deer, feral pigs, and raccoons (Akanda et al. 1996). Also spread by seed-contaminated hay, sod, and machinery.

Urena lobata L.






Common Name: Caesarweed; Caesar's weed; burr-mallow

Synonymy: None

Origin: India and tropical Asia

Botanical Description: Tough, erect, woody perennial herb or sub-shrub, to 3 m (10 ft), but usually to 1.5 m (5 ft); stems and leaves covered with star-shaped hairs; often many branched at base. Leaves simple, alternate, papery, upper surface rough, lower surface grayish, broadly ovate, often with 3-5 shallow, angular lobes at apex, to 10 cm (4 in) long; margins finely toothed, bases heart shaped; petioles to 5 cm (2 in) long; stipules tiny, linear. Flowers small, showy, hibiscus-like, solitary on short stalks in leaf axils, subtended by 5 basally united (involucral) bracts to 0.7 cm (0.3 in); calyx 5-lobed, hairy, to 0.6 cm (0.2 in); petals 5, rose or pink, darker at base, rounded, to 1.5 cm (0.6 in) long; stamens fused into an obvious pink column beneath a 5-lobed style. Fruit a small, barbed, spiny capsule, to 1 cm (0.4 in) across, with 5 prominent segments each containing 1 dark brown seed.

Ecological Significance: Introduced to Florida before 1895 and "escaped to waste places" before 1897 (Chapman 1897, Parsons 1895). Widely naturalized and considered a "serious threat" in hardwood hammocks and roadsides in south Florida by 1976 (Morton 1976). Reported from over 100 conservation areas in central and south Florida (Gann et al. 2001, FLEPPC 2002). Forms thickets, and is often abundant on swamp edges and in wet woodlands (Godfrey and Wooten 1981). Found sprouting in tropical hardwood hammock gaps after Hurricane Andrew (Gordon et al. 1999). May occur as scattered plants but can quickly spread to form dense patches and, occasionally, monocultural stands (FLEPPC 2002). Colonizes pine rocklands and prairie hammocks (Gann et al. 2001). Widespread throughout peninsular Florida in almost all habitat types, including hammocks, disturbed sites (Wunderlin 1998, Austin 1999b), pine flatwoods, sandhills, river edges, maritime forests, salt marshes, and coastal dunes (FLEPPC 2002). Occurs in closed canopy forests in its native range (Oommachan 1977). Declared a noxious weed in Fiji and Hawaii (PIER 2002). Invades coastal dunes in Australia (Batianoff and Franks 1998a). A serious weed in Melanesia and West Polynesia, and common or present as a weed in many countries around the world (Holm et al. 1979). Distributed extensively as a fiber crop and for its many medicinal uses (Austin 1999b). Nectary glands on underside of leaves are used as a food source in Florida by native and nonnative ants (Dreisig 2000).

Distribution: Herbarium specimens documented from 36 counties throughout Florida. Naturalized in Hawaii, Puerto Rico, the Virgin Islands, and Louisiana (USDA NRCS 2002). Weedy in Central and South America, the Caribbean (Fryxell 1988, MOBOT), throughout the Pacific Islands (PIER 2002), Japan (RIB 2002), Australia (Auld and Medd 1992), and most tropical regions of the world. Targeted for removal from commercial production by FNGA/TBWG growers associations (FNGA 2001).

Life History: Fast growing, up to 2.75 m (9 ft) in 5 months; produces large amounts of biomass; may uptake substantial amounts of soil nutrients (Dempsey and Baumann 1970). Grows well in acidic soils (Nascimento and Vilhena 1996) to pH of 3.5 (Souza Filho et al. 2000), and survives in highly eutrophic wastewater (Kent et al. 2000). Withstands occasional flooding; tolerates dry conditions (FLAS, SEPASAL 2002) and a variety of soils, including sandy loam, lateritic gravel, silty clay, fine sand, rich muck, wet prairie, and wetland soils (FTG, Harris 1981b, Dempsey and Baumann 1970). Seeds are highly viable and have high dormancy rates (Harris 1981a), however the hard seed coat requires water soaking or scarification (Veena et al. 2001). Treated seeds had 96-100% germination (Veena et al. 2001), but untreated seeds have very low germination rates (Harris 1981a). Seeds germinate well between pH 5.6-7 and between 20-30°C (68-86°F) (Figueiredo and Popinigis 1980, Harris 1981a). Flowers year-round in Florida (Wunderlin 1998), but may not produce seed in colder climates (Dempsey and Baumann 1970). Barbed fruits readily cling to clothing and are dispersed by animals and humans (Austin 1999b).

Urochloa mutica (Forsk.) Nguyen



Common Name: Pará grass, California grass, buffalo grass, water grass, Scotch grass, Carib grass

Synonymy: *Brachiaria mutica* (Forsk.) Stapf, *Brachiaria purpurescens* (Raddi) Henr., *Panicum muticum* Forsk., *Panicum purpurescens* Raddi

Origin: Africa

Botanical Description: Perennial grass from widely creeping stolons. Stems reclining at base, rooting at the lower nodes, to 1 m (3 ft) tall when erect, to 3 m (15 ft) long when creeping; nodes swollen, densely hairy. Leaf sheaths with dense stiff hairs below, slightly hairy above; ligule a densely ciliate membrane; leaf blades flat, 10-15 mm (0.4-0.6 in) wide and 25-30 cm (10-12 in) long, glabrous but often with small fine hairs on the upper and lower surfaces of the base. Inflorescence a terminal panicle to 20 cm (8 in) long, with 8-20 ascending, alternate branches; spikelets (reduced flowers) dense on the branches, paired, each about 3 mm long, glabrous, often purple tinged.

Ecological Significance: Introduced in most tropical and subtropical regions of the world as a fodder grass, but also considered one of the world's worst weeds; reported as an agricultural pest in 23 crops in 34 countries, including the United States (Holm et al. 1977). Competes aggressively with other plants, with fast growth, high productivity, and allelopathic abilities that allow it to form dense monocultural stands (Chang-Hung 1977, Handley et al. 1989). Probably introduced into the Americas via Brazil "at an early date" (Hitchcock and Chase 1950); may have been introduced into Florida as early as the late 1870s (Austin 1978); recommended for pasturage here in 1919 (Thompson 1919). Invades disturbed low areas such as canals, but also displaces native vegetation along river and lake shorelines and in marshes and swamps. Found in 51 public water bodies in 1982 and 183 water bodies by 1994—down from a 1986 high of 207, or 52% of Florida's public waters (Schardt and Schmitz 1991, Schardt 1997).

Distribution: Now commonly escaped from cultivation in central and south Florida. In Florida, documented as invading coastal berms, hardwood hammocks, mesic and wet flatwoods, bottomland forests, floodplain forests, stream and spring shores, and ruderal communities. Documented by herbarium specimens from 21 counties, from Pinellas on the west to Volusia on the east and south to Miami-Dade and Monroe counties, excluding the Keys (Wunderlin and Hansen 2004). Also reported from natural areas in Leon, Wakulla, Alachua, Lake, Orange, Pasco, Osceola, and Monroe, specifically the Florida Keys (FLEPPC 2005).

Life History: Flourishes in wet conditions, able to form a stolon mat 1 m (3 ft) or more in depth (Holm et al. 1977) and send floating stems of 6 m (18 ft) or more in length across slow-moving water (Handley and Ekern 1981). Also tolerant of drought and of brackish water, but susceptible to frost (Holm et al. 1977). Reproduces and spreads primarily by stem fragments (Sainty and Jacobs 1981). Flowers from September through December in Florida (Hall 1978), but production of fertile seeds apparently low (Thompson 1919).