Appendix I

Additional Temporary Construction Workspace Locations/Acreage

Appendix I. Additional Temporary Construction Workspace Locations/Acreage

Additional Temporary Workspace			
Side	Approx. MP	Area (ft^2)	Acres
Right	0.2	2690	0.061
Right	0.3	2465	0.056
Right	1.7	2534	0.058
Right	1.7	2481	0.057
Left	2.2	2503	0.057
Left	2.2	2595	0.060
Right	2.6	2500	0.057
Right	2.7	2393	0.055
Right	2.7	2393	0.055
Right	2.8	2350	0.054
Right	3	2500	0.057
Right	3.1	2500	0.057
Right	3.2	1762	0.040
Right	3.3	2523	0.058
Left	4.6	2691	0.062
Right	4.7	2636	0.061
Right	4.7	2249	0.052
Right	4.8	2690	0.062
Right	4.9	2588	0.059
Left	4.9	1635	0.038
Right	5.1	2621	0.060
Right	5.2	2621	0.060
Right	5.3	2621	0.060
Left	5.4	4145	0.100
Left	6.4	3546	0.081
Left	6.5	4187	0.096
Left	7.3	2648	0.061
Left	7.4	2731	0.063
Left	7.5	2554	0.059
Left	7.6	2492	0.057
Left	7.6	2492	0.057
Left	7.7	2495	0.057
Left	7.7	2935	0.067
Left	7.8	2536	0.058
Left	7.8	2584	0.059
Left	7.9	2514	0.058
Left	8	2481	0.057
Left	8.4	2481	0.057
Left	8.4	2593	0.060
Left	8.7	2742	0.063
Right	8.9	4987	0.114
Left	9.2	2500	0.057

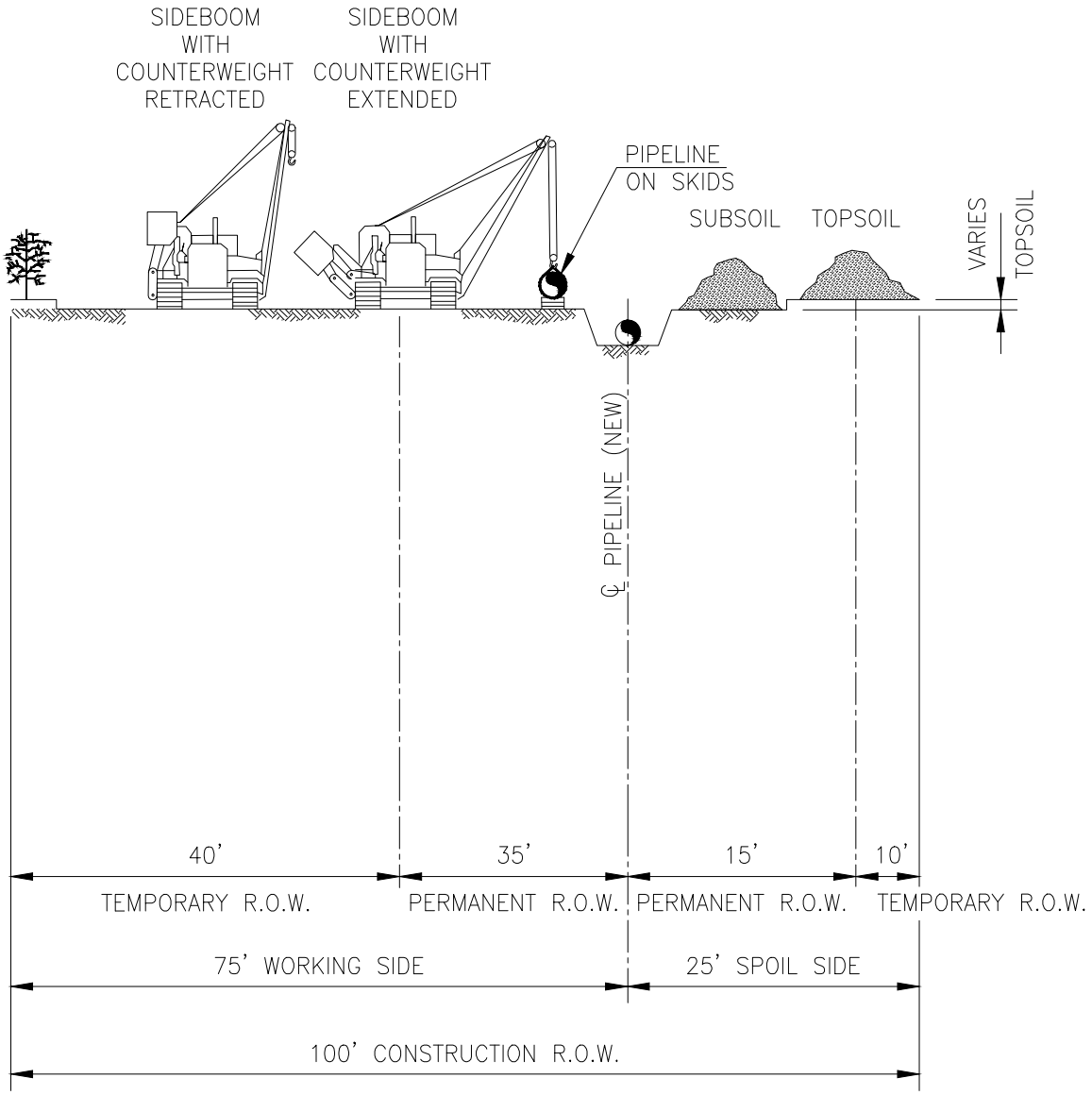
Left	10.2	2500	0.057
Left	10.3	2279	0.052
Left	10.4	2279	0.052
Left	10.5	2279	0.052
Right	11.4	25920	0.595
Right	11.5	24377	0.560
Left	11.6	2485	0.057
Left	11.6	2609	0.060
Left	12.4	2486	0.057
Left	12.5	2488	0.057
Left	12.5	2497	0.057
Left	12.6	2480	0.057
Left	13.4	2542	0.058
Left	13.4	2235	0.051
Left	13.6	2574	0.059
Left	13.6	2524	0.058
Left	14.1	2536	0.058
Left	14.2	2392	0.055
Left	14.4	2722	0.062
Left	14.5	2914	0.067
Left	14.9	2656	0.061
Left	14.9	2627	0.060
Left	15.7	2591	0.060
Left	15.8	2667	0.061
Left	16	1881	0.043
Left	16.1	2460	0.056
Left	16.5	2553	0.059
Left	16.6	2544	0.058
Right	16.8	2270	0.052
Right	16.9	1988	0.046
Right	17.1	2522	0.058
Right	17.5	2504	0.057
Right	17.6	2501	0.057
Right	17.6	2210	0.051
Right	17.7	2425	0.056
Right	18.2	2563	0.059
Right	18.2	2533	0.058
Right	18.7	2525	0.058
Right	18.7	2502	0.057
Left	19.1	2493	0.057
Left	19.2	2500	0.057
Right	19.3	2447	0.056
Right	19.3	2363	0.054
Right	19.4	2324	0.053
Right	19.4	2411	0.055
Right	19.5	2289	0.053
Right	19.6	2453	0.056

Left	20	2325	0.053
Left	20	2328	0.053
Left	20.2	127800	2.934
Right	20.3	57028	1.309
Left	20.5	8137	0.187
Right	20.5	3139	0.072
Right	21	50187	1.152
Left	21	37709	0.866
Right	21.2	2820	0.065
Right	21.6	2531	0.058
Right	21.7	2541	0.058
Right	22.2	100703	2.312
Left	22.2	254937	5.853
Right	22.6	21563	0.495
Left	22.6	22744	0.522
Right	23	995	0.023
Right	23	1450	0.033
Right	23.2	88801	2.039
Left	23.2	82112	1.885
Left	25.5	13583	0.312
Right	25.6	83727	1.922
Left	25.6	557191	12.791
Right	25.8	103543	2.377
Left	26.5	56284	1.292
Right	26.5	135173	3.103
Right	26.6	2459	0.056
Right	26.8	2486	0.057
Right	26.9	4226	0.106
Left	26.9	4852	0.111
Right	27.2	2489	0.057
Right	27.3	2462	0.057
Right	27.5	2461	0.057
Right	27.5	2461	0.057
Left	27.9	2100	0.048
Left	27.9	2524	0.058
Right	28.1	2500	0.057
Right	28.2	2531	0.058
Right	28.9	2390	0.055
Right	28.9	2406	0.055
Left	29.4	2635	0.060
Left	29.4	2252	0.052
Right	29.9	2638	0.061
Right	29.9	2415	0.055
Right	30.3	2387	0.055
Right	30.4	2453	0.056
Right	30.5	2400	0.055
Right	31.6	2456	0.056

Right	31.7	2543	0.058
Right	31.8	2643	0.061
Right	31.9	2595	0.060
Right	31.9	2576	0.059
Right	31.9	2595	0.060
Right	32.1	2586	0.059
Right	32.1	2586	0.059
Right	32.5	1846	0.042
Right	32.7	2455	0.056
Right	32.9	2329	0.053
Right	33	2360	0.054
Right	33.4	2013	0.046
Right	33.5	2210	0.051
Right	33.7	2197	0.050
Right	33.8	2199	0.050
Right	33.9	2638	0.061
Right	34	2636	0.061
Right	34.2	2634	0.060
Right	34.4	2569	0.059
Right	34.5	2470	0.057
Right	34.5	2439	0.056
Right	34.6	2471	0.057
Right	34.6	2679	0.062
Right	34.8	2482	0.057
Right	34.9	2482	0.057
Right	34.9	2482	0.057
Right	34.9	1514	0.035
Right	35.4	2458	0.056
Right	35.4	2418	0.056
Right	35.5	2465	0.057
Right	35.5	2483	0.057
Left	35.6	2458	0.056
Left	35.7	2542	0.058
Right	36.6	2468	0.057
Right	36.7	2515	0.058
Right	36.7	2515	0.058
Right	36.8	2473	0.057
Right	36.9	2535	0.058
Right	36.9	2484	0.057
		Total =	51.55

Appendix II

Typical Right-of-Way and Temporary Construction Workspace Drawings



NOTES:

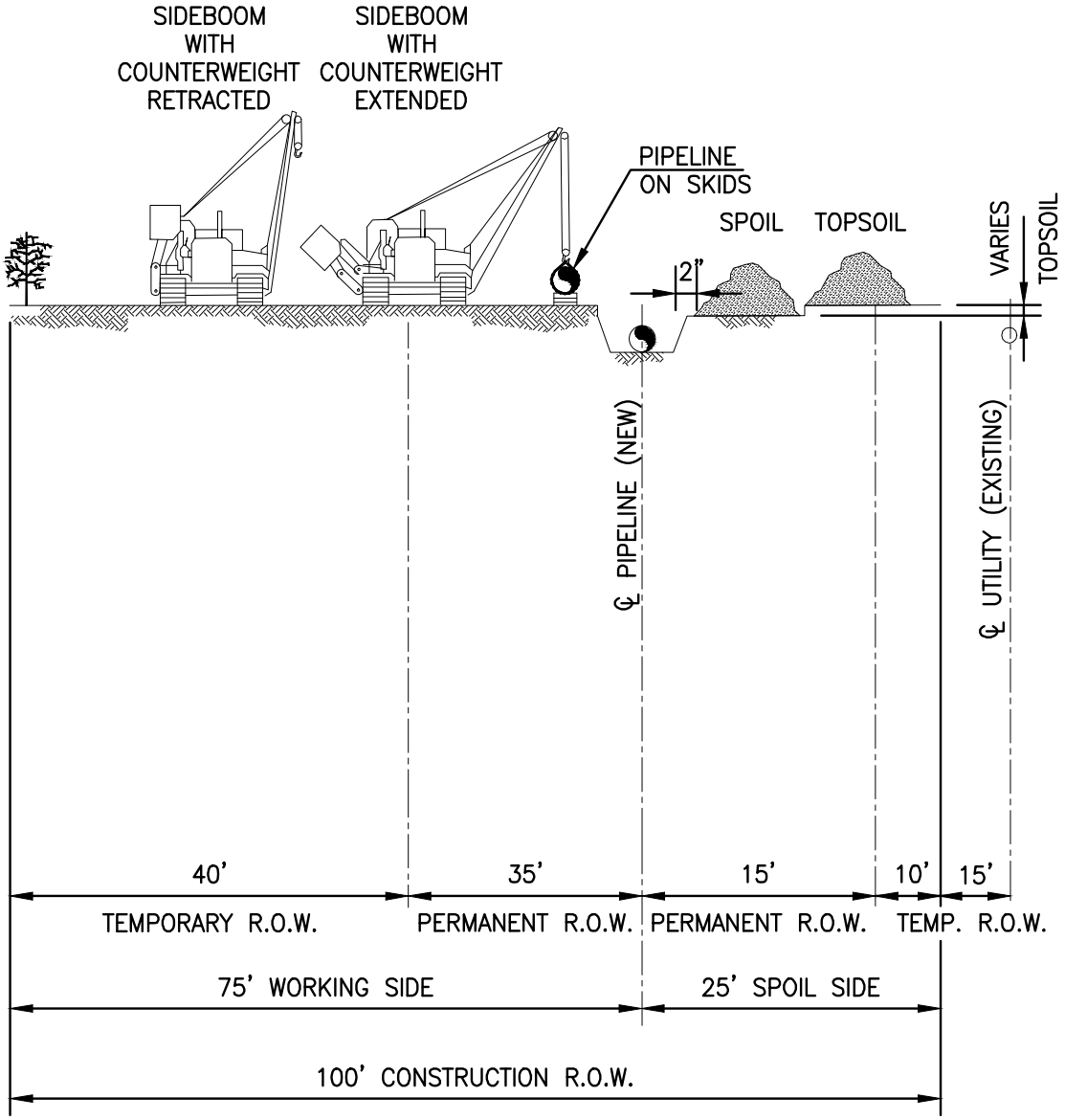
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 30	REV A



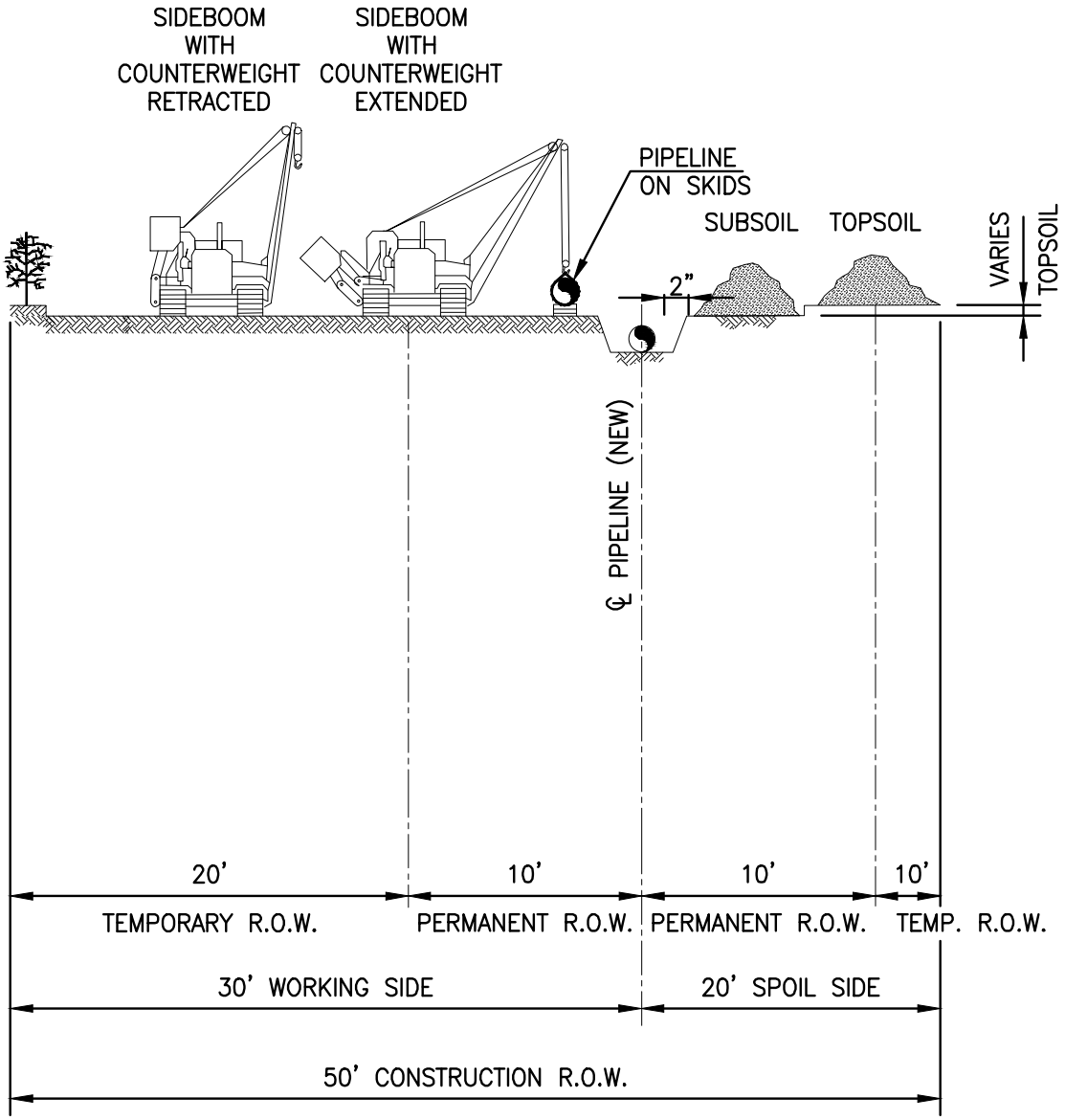
NOTES:

1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.
2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
RIGHT-OF-WAY
PARALLEL TO EXISTING UTILITIES

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 31	REV A



NOTES:

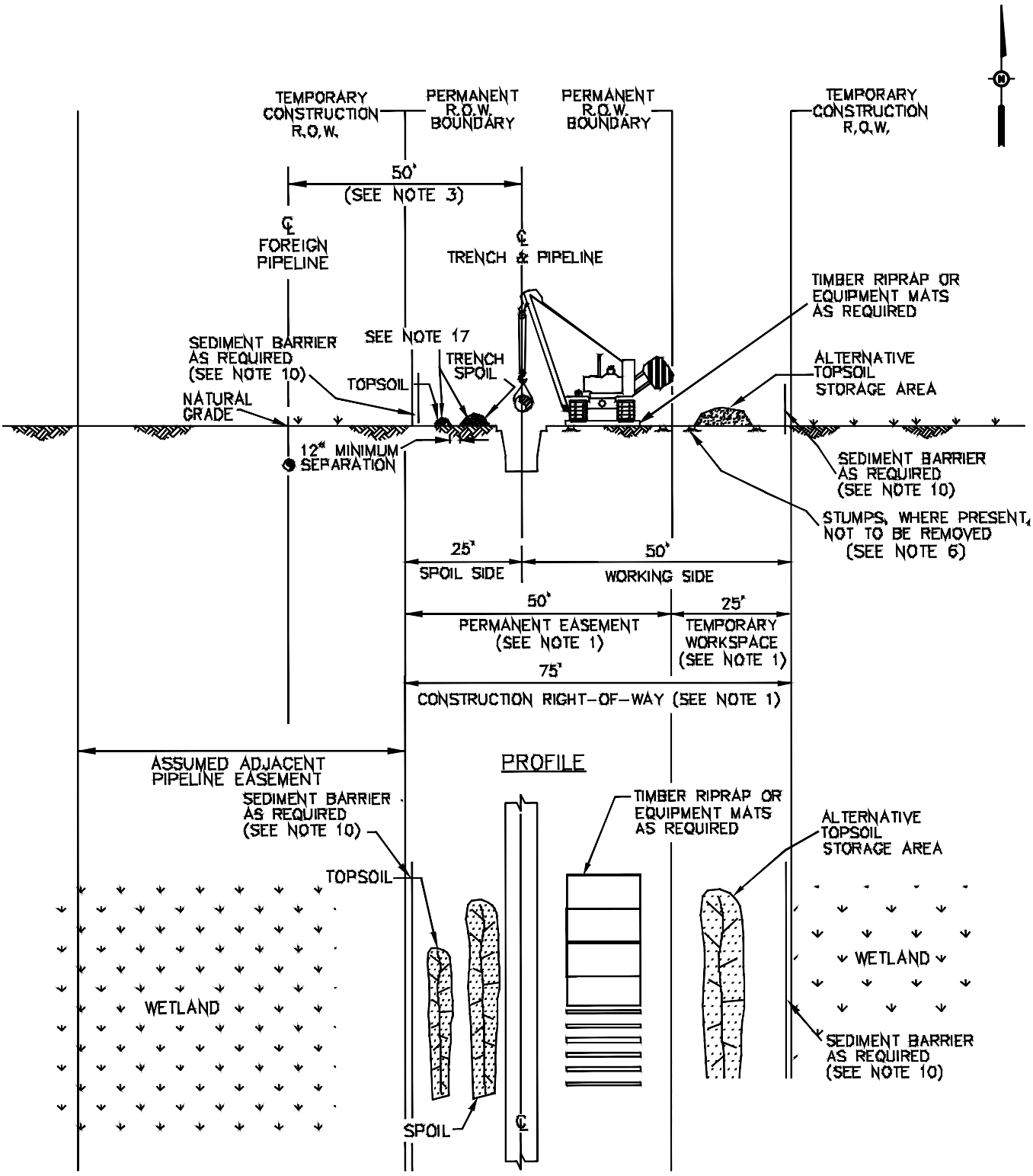
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE ENTIRE 50 FOOT R.O.W. (TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY WITHIN FOREST SERVICE GRASSLANDS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 32	REV A



PLAN VIEW

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY WITHIN WETLANDS (1 OF 2)

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 33	REV A

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT AND 25 FEET OF TEMPORARY WORKSPACE.

2. THE SAME LAYOUT APPLIES WHETHER CONSTRUCTION R.O.W. DOES OR DOES NOT ABUT A FOREIGN R.O.W.

3. IF OFFSET FROM A FOREIGN PIPELINE, THE OFFSET WILL BE 50 FEET FOR MOST WETLANDS, BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.

4. LOCATE ANY EXTRA TEMPORARY WORK SPACE AREAS AT LEAST 50 FEET FROM EDGE OF WETLAND UNLESS OTHERWISE SPECIFIED IN A SITE-SPECIFIC PLAN.

5. CLEARING OF VEGETATION AND TREES IS PROHIBITED BETWEEN TEMPORARY EXTRA WORK SPACE AND THE EDGE OF THE WETLAND.

6. CUT VEGETATION AND TREES OFF AT GROUND LEVEL, LEAVING EXISTING ROOT SYSTEMS IN PLACE AND REMOVE CUTTINGS FROM THE WETLAND FOR DISPOSAL.

7. LIMIT CONSTRUCTION EQUIPMENT TO ONE PASS THROUGH WETLANDS TO THE EXTENT PRACTICABLE.

8. NO REFUELING OF EQUIPMENT OR CONCRETE COATING ACTIVITIES WITHIN 300 FEET OF WETLAND EXCEPT IN ACCORDANCE WITH THE SPCC PLAN. NO STORAGE OF HAZARDOUS MATERIALS WITHIN 100 FEET OF ANY WETLAND.

9. IF SATURATED AT TIME OF CONSTRUCTION, REDUCE SOIL COMPACTION BY UTILIZING WIDE-TRACK OR BALLOON TIRE CONSTRUCTION EQUIPMENT OR NORMAL EQUIPMENT OPERATED ON TIMBER RIPRAP OR EQUIPMENT MATS.

10. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS IMMEDIATELY AFTER INITIAL GROUND DISTURBANCE ACROSS THE ENTIRE CONSTRUCTION R.O.W. IMMEDIATELY UPSLOPE OF THE WETLAND BOUNDARY AND AT THE EDGE OF THE CONSTRUCTION R.O.W. ALONG THE WETLAND AS DIRECTED BY THE COMPANY INSPECTOR.

11. SEGREGATE THE TOP 1 FOOT OF TOPSOIL FROM THE AREA DISTURBED BY TRENCHING, EXCEPT IN AREAS WHERE STANDING WATER OR SATURATED SOILS ARE PRESENT. MAINTAIN 12" SEPARATION BETWEEN TOPSOIL AND TRENCH SPOIL.

12. LEAVE GAPS IN TOPSOIL AND SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING SPOIL PILE.

13. IF SATURATED AT TIME OF CONSTRUCTION, LEAVE HARD PLUGS AT THE EDGE OF WETLAND UNTIL JUST PRIOR TO LOWERING IN.

14. LOWER-IN PIPE, INSTALL TRENCH BREAKERS AT WETLAND EDGES AS DIRECTED BY THE COMPANY INSPECTOR. BACKFILL IMMEDIATELY ON COMPLETION OF CONSTRUCTION.

15. REMOVE ANY TIMBER RIPRAP OR EQUIPMENT MATS FROM WETLANDS UPON COMPLETION OF CONSTRUCTION.

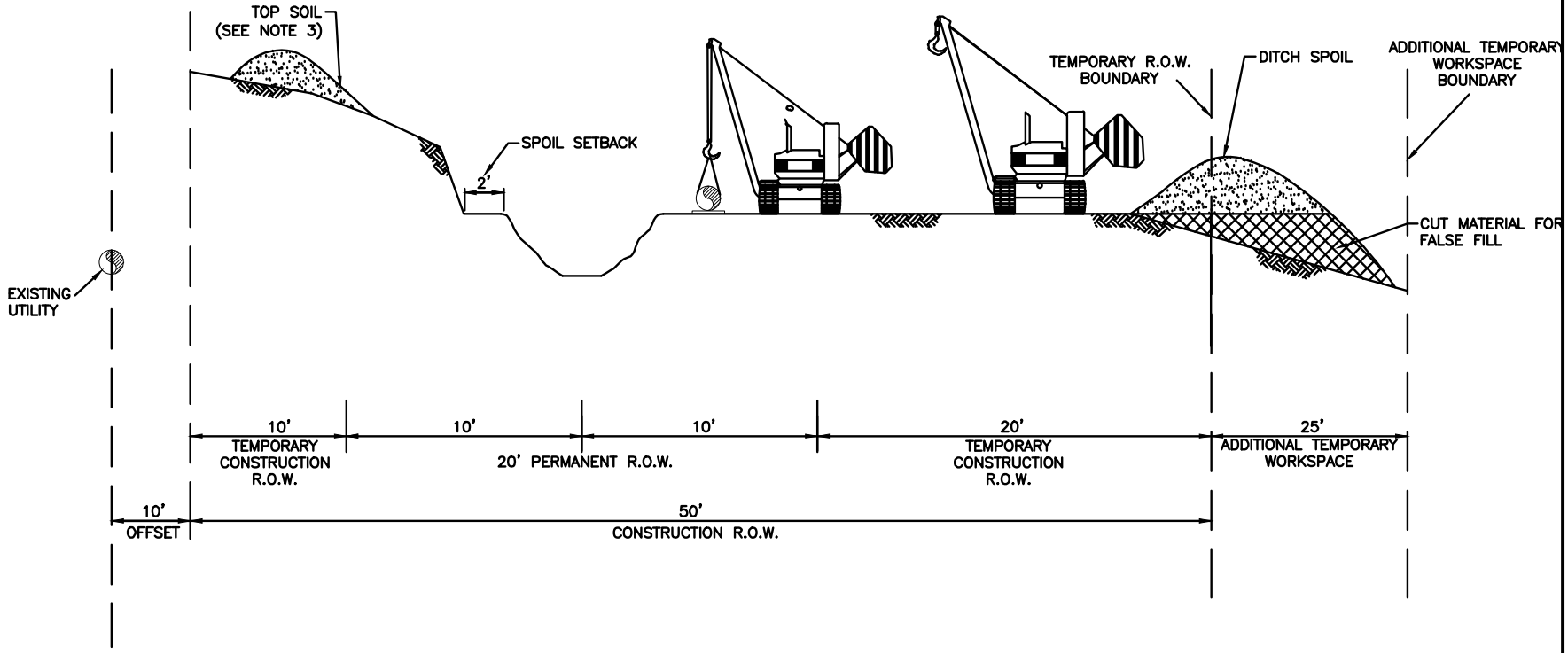
16. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY AND REPLACE TOPSOIL, WHERE SALVAGED, WITHOUT A CROWN OVER THE TRENCH.

17. TOPSOIL AND TRENCH SPOIL RELATIVE POSITIONS CAN, AS DIRECTED BY THE COMPANY INSPECTOR, BE ADJUSTED TO FIT SITE CONDITIONS.

BakkenLink

TYPICAL CONSTRUCTION
RIGHT-OF-WAY
WITHIN WETLANDS (2 OF 2)

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 33	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

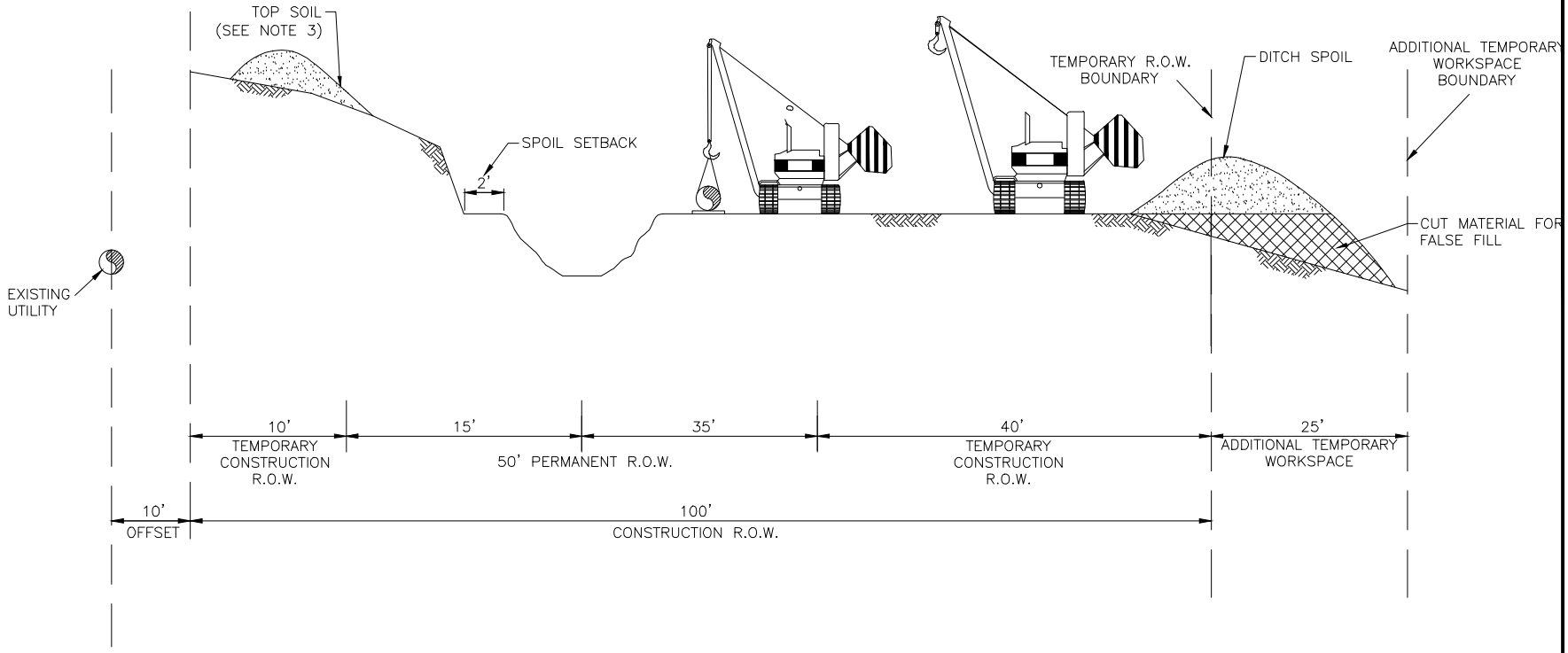
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 20 FEET OF PERMANENT EASEMENT, 30 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL SHALL BE STRIPPED AND SEGREGATED FROM THE ENTIRE 75 FOOT R.O.W.(TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
DOWNWARD SIDE SLOPE
WORKSPACE WITHIN FOREST SERVICE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 34	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

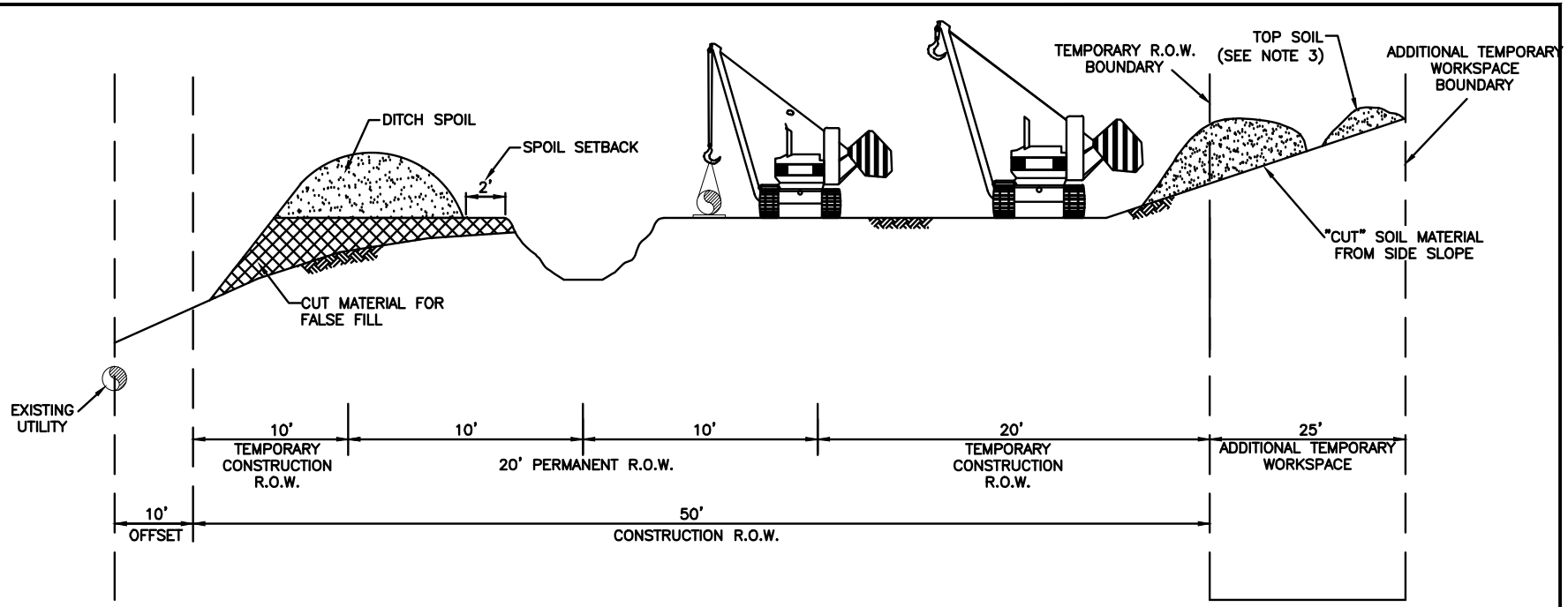
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 125 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT, 50 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
DOWNWARD SIDE SLOPE WORKSPACE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 35	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

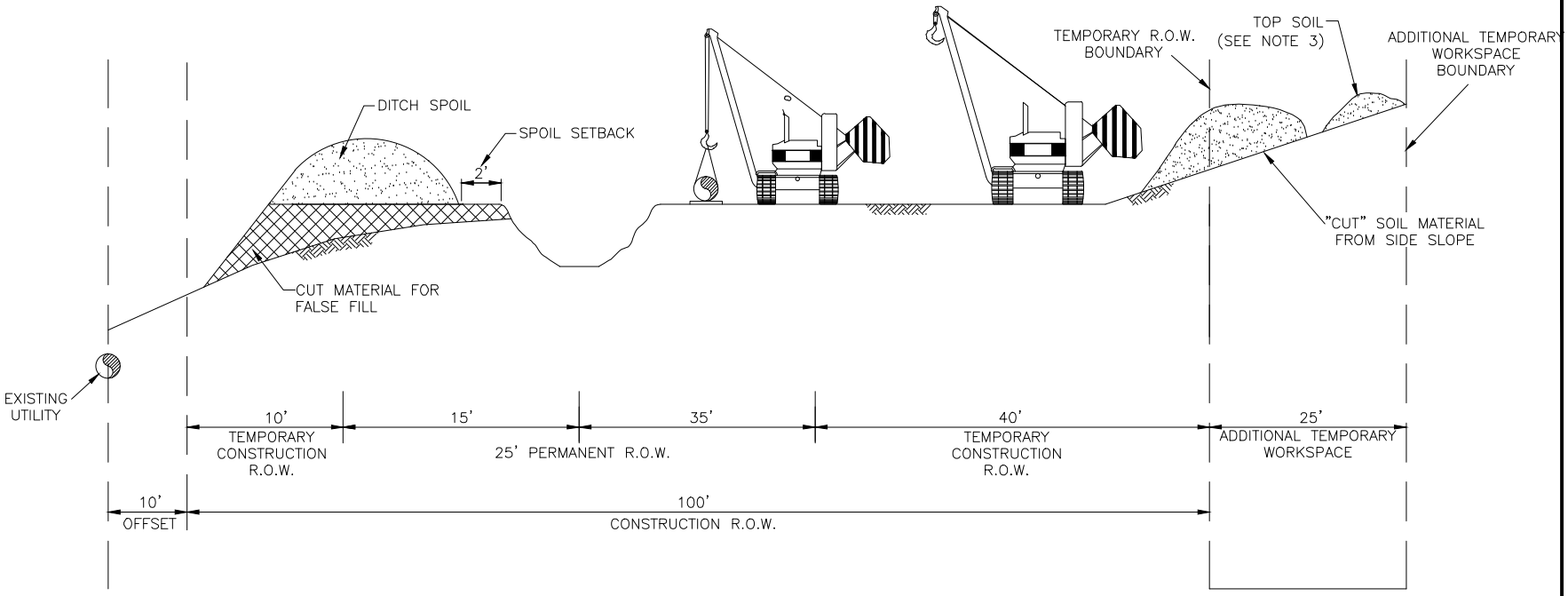
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 20 FEET OF PERMANENT EASEMENT, 30 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOL SHALL BE STRIPPED AND SEGREGATED FROM THE ENTIRE 75 FOOT R.O.W. (TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
UPWARD SIDE SLOPE WORKSPACE
WITHIN FOREST SERVICE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 36	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 125 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT, 50 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

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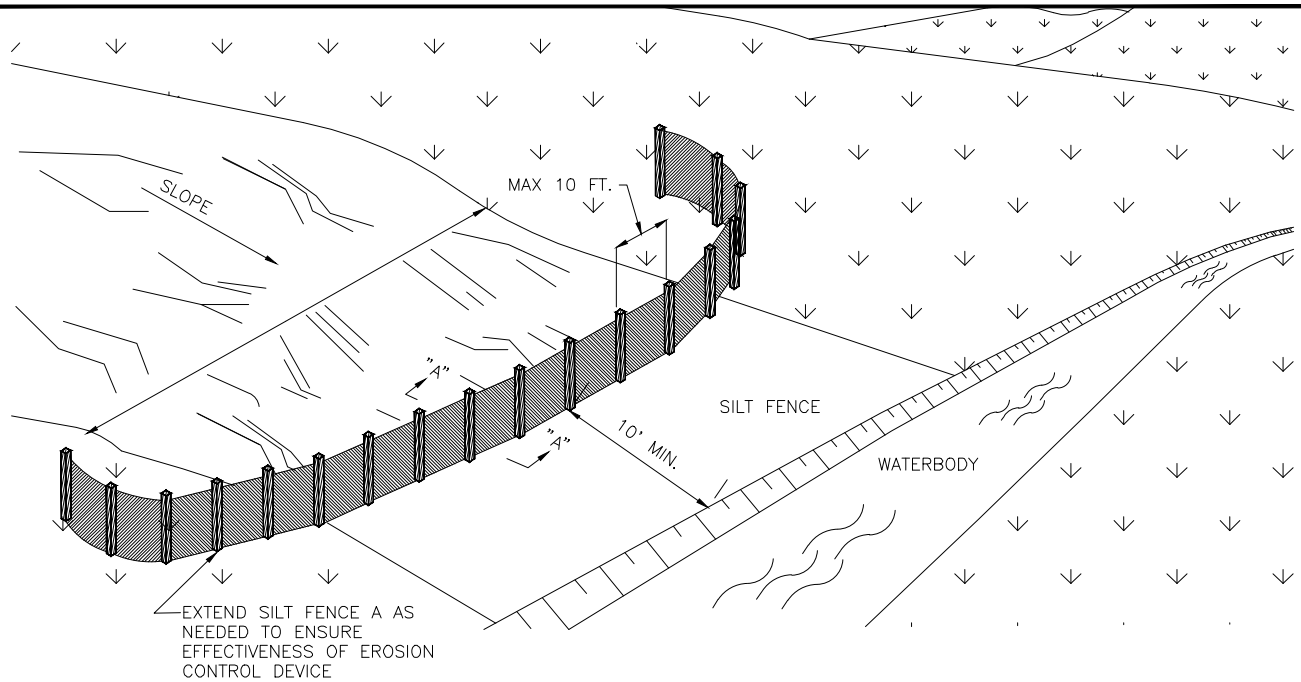
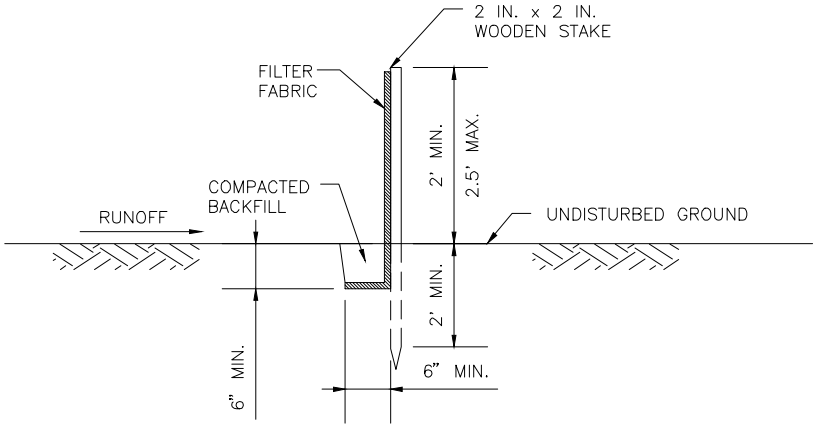
TYPICAL CONSTRUCTION
UPWARD SIDE SLOPE WORKSPACE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 37	REV A

Appendix III

Typical Construction Drawings





SECTION–"A"–"A"

SCALE: NOT TO SCALE

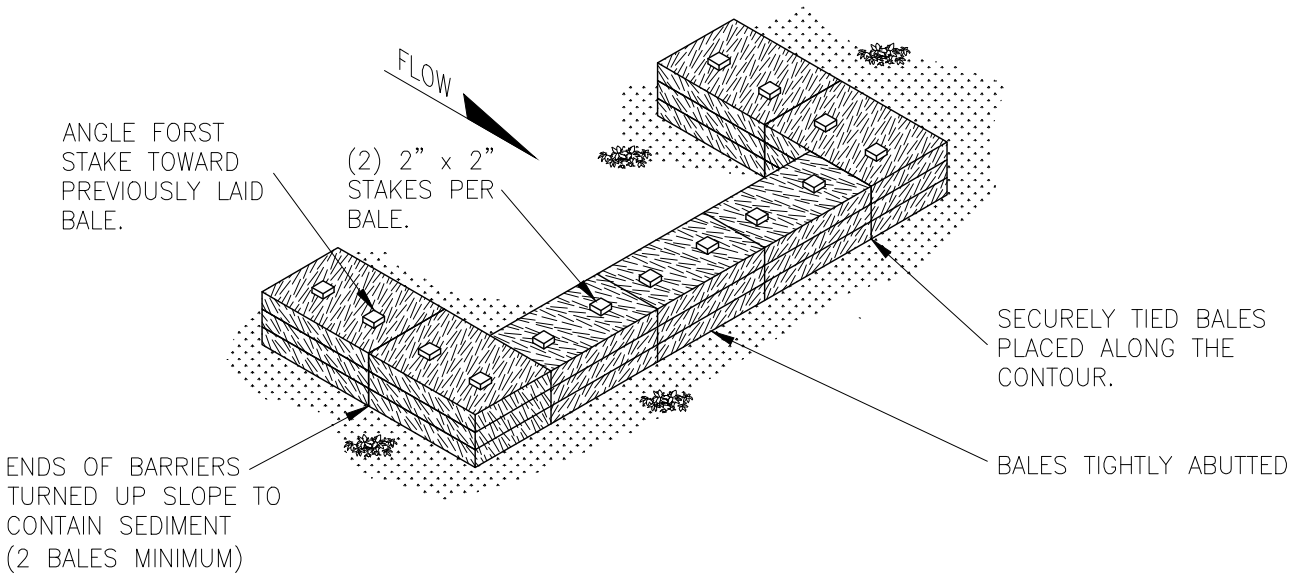
NOTES:

1. SILT FENCES ARE TO BE USED IN AREAS WHERE SHEET FLOW OR RELATIVELY SMALL VOLUMES OF WATER CAN BE EXPECTED TO OCCUR. FOR LARGER VOLUMES SUCH AS WITHIN A DEFINED CHANNEL, A CHECK DAM WILL BE REQUIRED.
2. STAKES ARE TO BE PLACED A MAXIMUM OF TEN (10) FT. OR CLOSER AS CONDITIONS REQUIRE.
3. ATTACH FILTER FABRIC AT EACH POST AT A MINIMUM OF THREE (3) LOCATIONS.
4. THE FILTER FABRIC (MIN. OF 1 FT.) IS TO BE ANCHORED IN A 6 INCH X 6 INCH TRENCH WITH WELL COMPACTED BACKFILL OVER THE FABRIC TO PREVENT UNDERMINING.
5. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF THE SILT FENCE SHALL BE TURNED AND EXTENDED UPSLOPE.
6. SILT FENCES ARE TO BE CHECKED AND MAINTAINED ON A REGULAR BASIS. REMOVE ANY BUILD UP OF SEDIMENT WHEN THE HEIGHT OF SEDIMENT EXCEEDS APPROXIMATELY 20% OF THE HEIGHT OF THE BARRIER.
7. MATERIAL SHOULD BE WOVEN GEOTEXTILE FABRIC SUCH AS EXXON GTF 180 OR MOBILE 600X, OR AN APPROVED EQUIVALENT. SECONDARY REINFORCEMENT SUCH AS A CONSTRUCTION BARRIER FENCE OR WIRE MESH CAN ALSO BE USED BEHIND THE FILTER FABRIC.
8. WHERE ANCHORING CONDITIONS FOR THE SILT FENCE ARE POOR, PLACE ANCHORED STRAW BALES ON DOWNSTREAM SIDE OF THE SILT FENCE
9. MAITAINANCE REQUIREMENTS:
   INSPECT SILT FENCE:
   - DAILY IN AREAS OF ACTIVE CONSTRUCTION
   - WEEKLY IN AREAS OF NO CONSTRUCTION
   - WITHIN 24 HOURS FOLLOWING MAJOR RAIN EVENT
   - REPAIR OR REPLACE SILT FENCE AS NEEDED
   - REMOVE ACCUMILATED SEDIMENTS TO AN UPLAND AREA AS NEEDED

BakkenLink

TYPICAL CONSTRUCTION
SILT FENCE
BARRIER INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–1	REV A



PERSPECTIVE VIEW

NOT TO SCALE

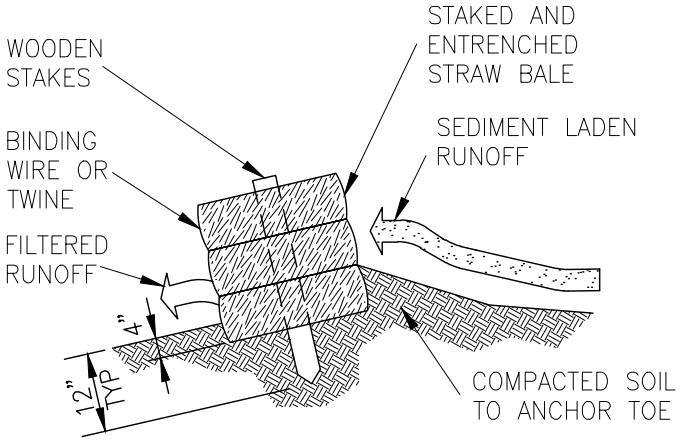
INSTALLATION REQUIREMENTS:

WHEN USING STRAW BALES, PLACE THEM:

- WITH THEIR ENDS TIGHTLY ABUTTING AND EMBEDDED IN THE SOIL A TYPICAL OF 4".
- BETWEEN DISTURBED AREAS AND DOWN-SLOPE ENVIRONMENTAL RESOURCE AREAS.
- AT THE BASE OF ALL SLOPES NEXT TO WETLANDS, WATERBODIES, AND ROAD CROSSINGS.
- AT THE INLET AND OUTLET OF OPEN DRAINAGE STRUCTURES.
- APPROXIMATELY 6 FEET BEYOND THE TOE OF THE SLOPE TO GIVE THE SEDIMENT ROOM TO COLLECT.

KEY IN THE BOTTOM OF THE BALE. IN AREAS WHERE IT IS NOT FEASIBLE TO TRENCH IT IN (LEDGES, ROCKY SOIL,LARGE TREE ROOTS, ETC), USE NATIVE SOIL AS BACKFILL UP-SLOPE OF THE BALE.

IF USED IN CONJUNCTIION WITH SILT FENCE, BALES ARE PLACED UP-SLOPE OF THE SILT FENCE AND DO NOT NEED TO BE TRENCHED IN.



CROSS-SECTION

NOT TO SCALE

MAINTENANCE REQUIREMENTS:

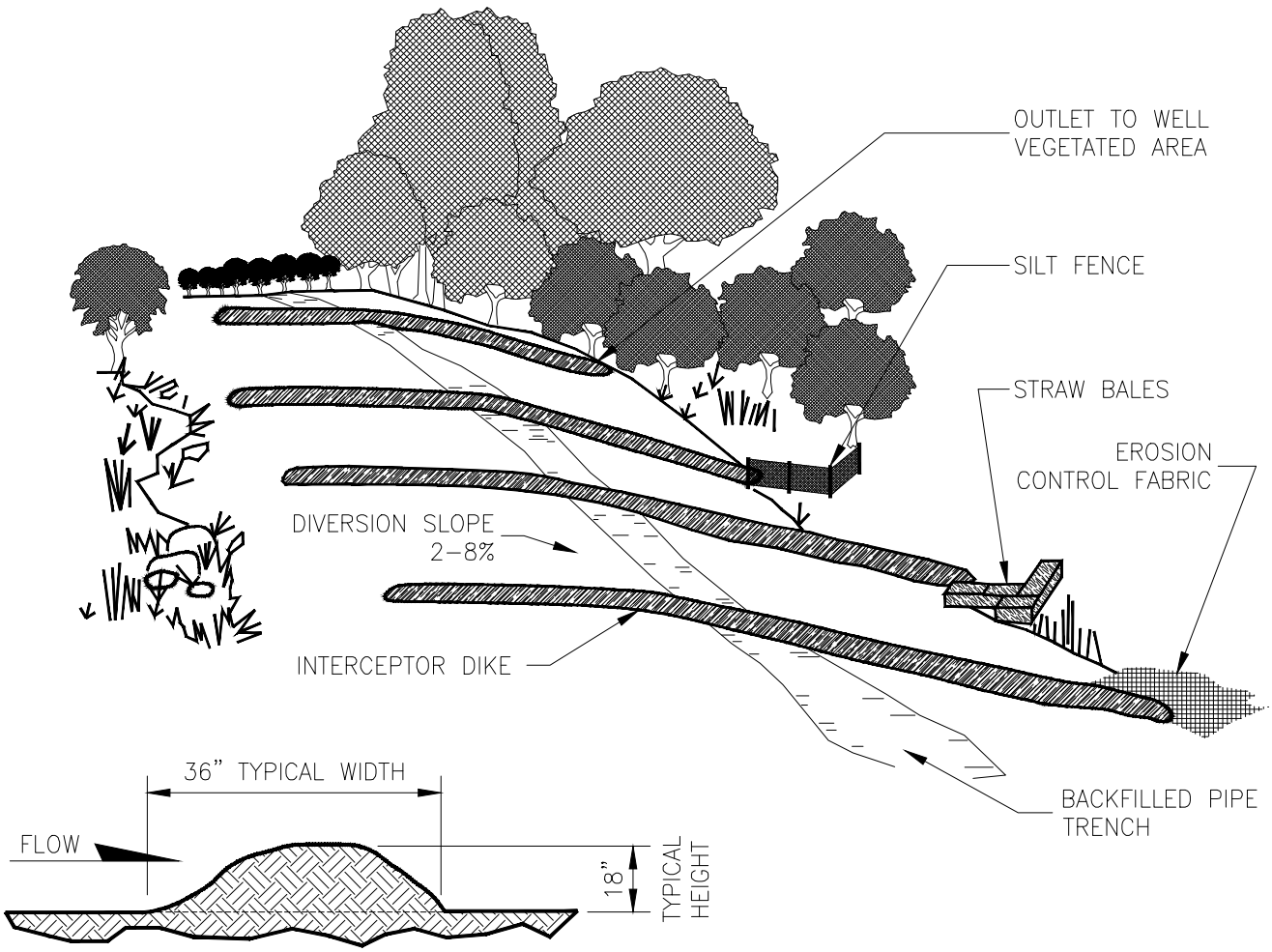
INSPECT BALES:

- DAILY IN AREAS OF ACTIVE CONSTRUCTION.
- WEEKLY IN AREAS WITH NO CONSTRUCTION.
- WITHIN 24 HOURS FOLLOWING EACH MAJOR STORM EVENT.
- REPAIR OR REPLACE BALES AS NEEDED.
- REMOVE ACUMULATED SEDIMENTS TO AN UPLAND AREA AS NEEDED.

BakkenLink

TYPICAL CONSTRUCTION
STRAW BALE INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-2	REV A



CROSS SECTION

NOT TO SCALE

INSTALLATION REQUIREMENTS:

- INSTALL PERMANENT INTERCEPTOR DIKES IN ALL AREAS EXCEPT RESIDENTIAL OR AGRICULTURAL AS NECESSARY TO AVOID EXCESSIVE EROSION (UNLESS AUTHORIZED BY LANDOWNER OR LAND MANAGING AGENCY IN AGRICULTURAL OR RESIDENTIAL AREA).
- MUST BEINSTALLED ON SLOPES GREATER THAT 5% WHERE THE BASE OIF THE SLOPE IS LESS THAN 50 FEET FROM A WATERBODY, WETLAND OR ROAD CROSSING AT THE FOLLOWING MINIMUM SPACING:

SLOPE (%)	SPACING (FT)
5–15	300
>15–30	200
>30	100

- CONSTRUCT USING EARTH FILLED SACKS, STAKED STRAW BALES, SILT FENCE, OR SOIL FOR TEMPORARY OR COMPACTED EARTH AND ROCK TO PERMANENT.
- INSTALL WITH A 2 – 8% OUTFALL ANGLE.
- POSITION OUTFALL TO PREVENT SEDIMENT DISCHARGE INTO WETLADS, WATERBODIES, OR OTHER SENSITIVE RESOURCES.
- FILTER RUN–OFF WATER BY CONASTRUCTIONG THE OUTLET IN A WELL VEGETATED STABLE AREA, OR BY USING AN ENERGY DISSIPATING DEVICE (SILT FENCE, STRAW BALES, EROSION CONTROL FABRIC), AS DIRECTED BY THE ENVIRONMENTAL INSPECTOE.

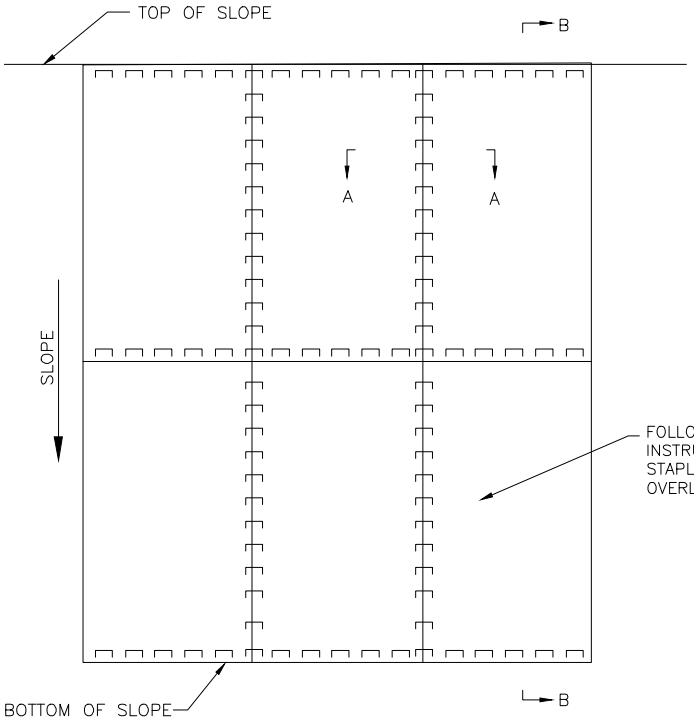
MAINTENANCE REQUIREMENTS:

- INSPECT DURING AND FOLLOWING CONSTRUCTION AND MAKE REPAIRS AS NEEDED.
- KEEP THE CHANNEL FREE OF DEBRIS AND OBSTRUCTIONS.
- SEED AND MULCH PERMANENT INTERCEPTOR DIKES FOLLOWING CONSTRUCTION.

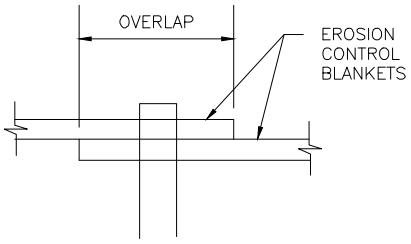
BakkenLink

TYPICAL CONSTRUCTION
INTERCEPTOR DIKE INSTALLATION

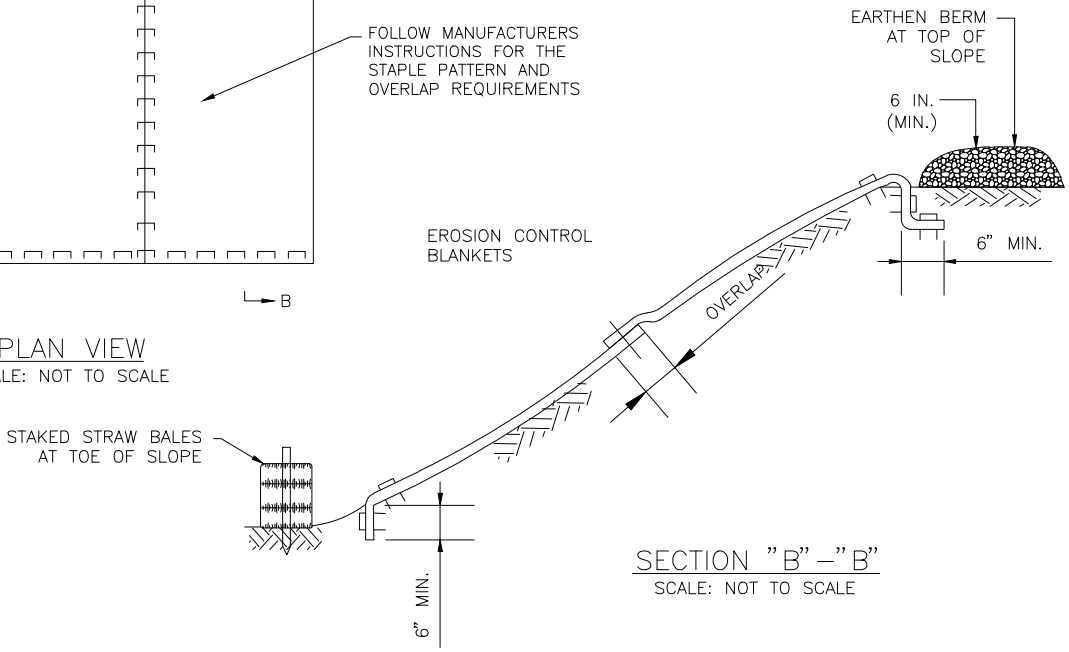
DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–3	REV A



PLAN VIEW
SCALE: NOT TO SCALE



SECTION "A"–"A"
SCALE: NOT TO SCALE



SECTION "B"–"B"
SCALE: NOT TO SCALE

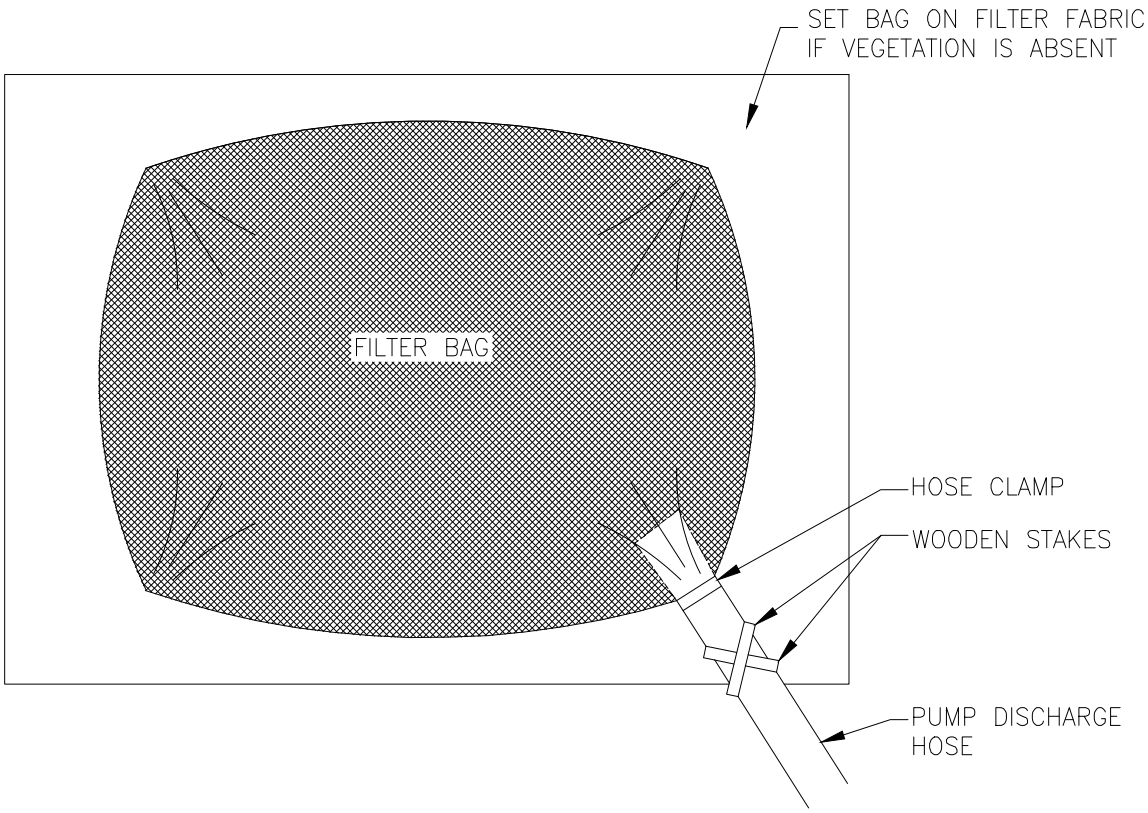
NOTES:

1. EROSION CONTROL BLANKETS SHALL BE NORTH AMERICAN GREEN S 150 FOR SLOPES 3 TO 1 AND SC 150 FOR SLOPES 2 TO 1 OR APPROVED EQUALS.
2. INSTALL BLANKETS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
3. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING GRADING, REMOVAL OF LARGE ROCKS AND DEBRIS, AND THE APPLICATION OF SEED AND FERTILIZER.
4. EROSION CONTROL BLANKETS SHALL EXTEND COMPLETELY ACROSS DISTURBED AREAS TO PROTECT ERODIBLE SURFACES.
5. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A MINIMUM SIX (6) INCHES WIDE AND SIX (6) INCHES DEEP TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
6. ROLL THE BLANKETS DOWN THE SLOPE IN THE DIRECTION OF THE WATER FLOW.
7. AS AN ALTERNATIVE TO STAPLES, WOODEN STAKES CAN BE USED.
8. ENSURE COMPLETE CONTACT BETWEEN THE BLANKETS AND THE SLOPE FACE, ADDITIONAL STAPLES CAN BE USED TO ELIMINATE GAPS.
9. EROSION CONTROL BLANKETS WILL BE INSTALLED AS REQUIRED BY LAND OWNER OR APPLICABLE PERMIT.

BakkenLink

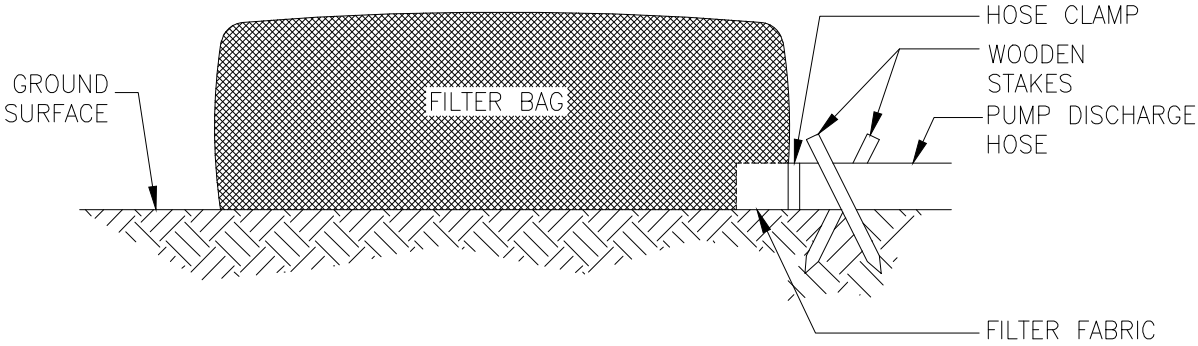
TYPICAL CONSTRUCTION
EROSION CONTROL
BLANKET INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–4	REV A



PLAN VIEW

N.T.S.



CROSS-SECTION

N.T.S.

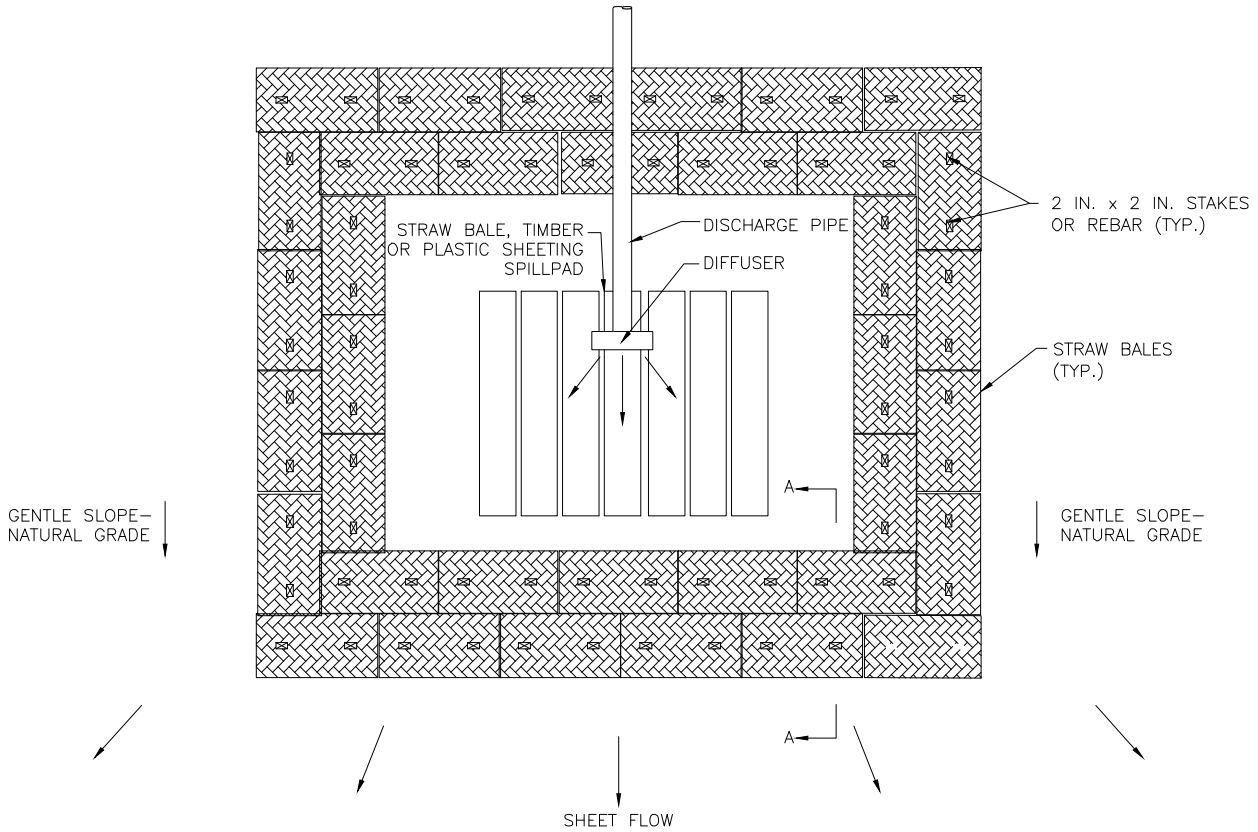
NOTES:

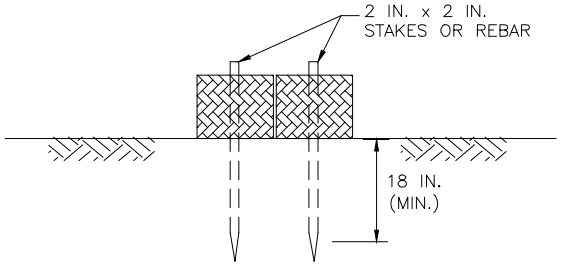
1. LIMIT ONE (1) DISCHARGE HOSE PER BAG.
2. REMOVE DEWATERING STRUCTURE AS SOON AS POSSIBLE AFTER COMPLETION OF DEWATERING ACTIVITIES.

BakkenLink

TYPICAL CONSTRUCTION
FILTER BAG INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-5	REV A





SECTION–"A"–"A"

SCALE: NOT TO SCALE

NOTES:

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

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

3. DIRECT THE PUMPED WATER ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL, WEIGHTED TIMBERS, OR A WOVEN GEOTEXTILE STAKED TO THE GROUND SURFACE, SUCH AS MIRAGI 600X, TERRAFIX 400W, OR A COMPANY APPROVED EQUIVALENT.

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

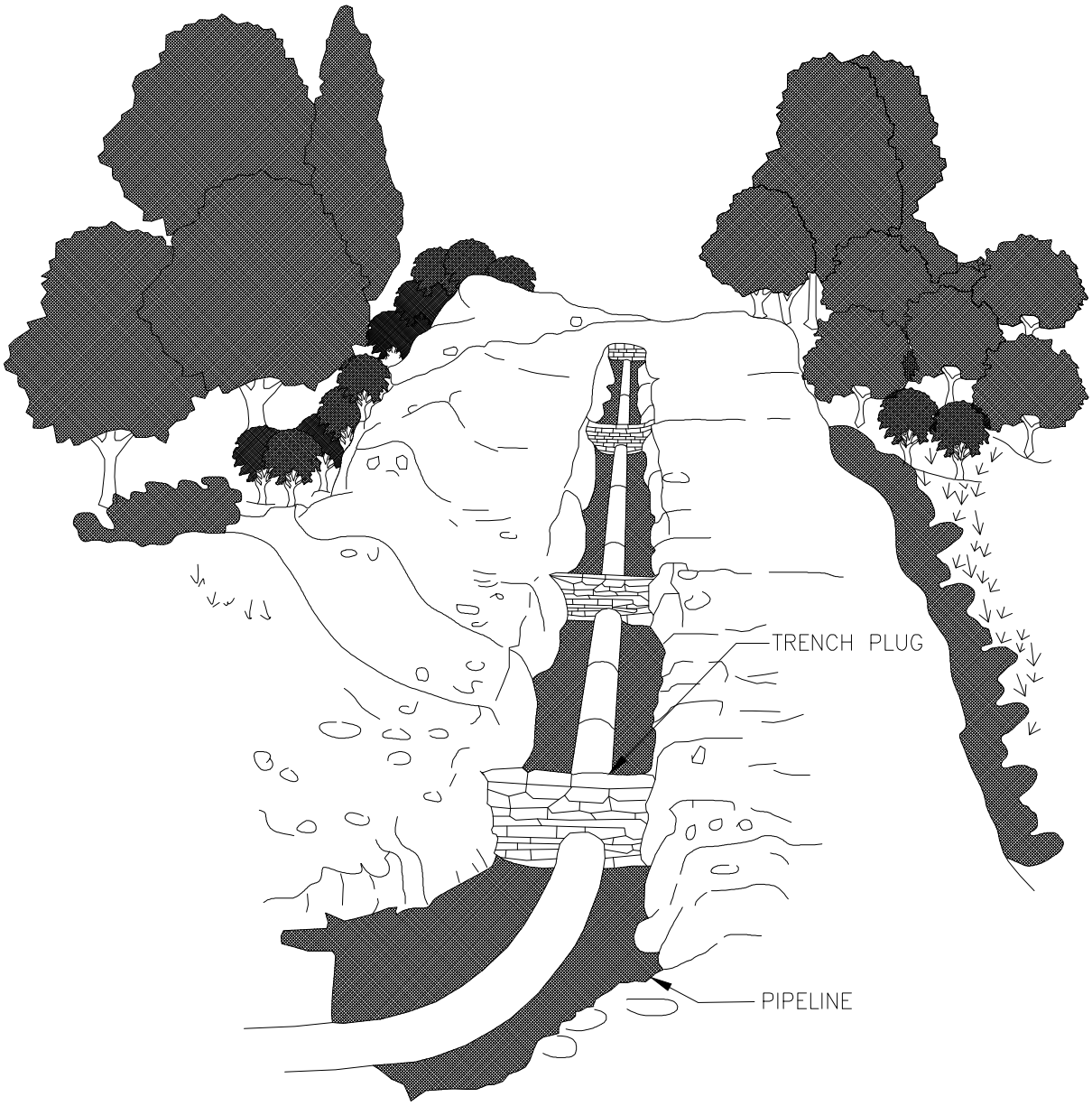
5. DISCHARGE WATER SHALL BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD USING A COMBINATION OF STRAW BALES AND THE NATURAL TOPOGRAPHY. DRIVE TWO (2) STAKES OR REBAR INTO EACH BALE TO ANCHOR THEM IN PLACE.

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

BakkenLink

TYPICAL CONSTRUCTION
STRAW BALE
DEWATERING STRUCTURE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–6	REV A



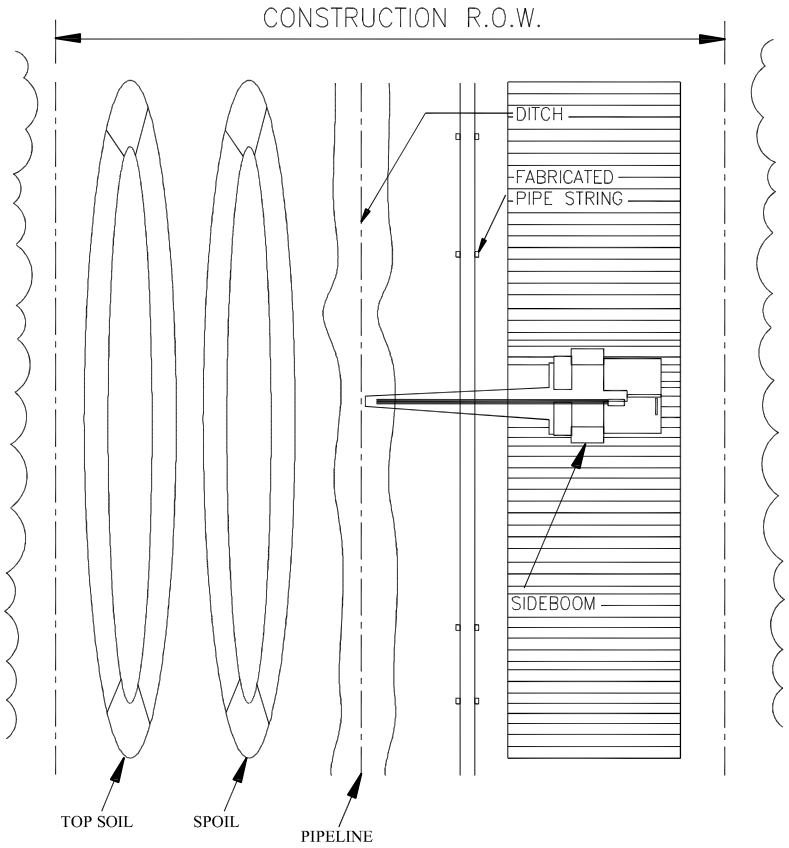
NOTES:

SLOPE (%)	SPACING (FT)
5–15	300
>15–30	200
>30	100

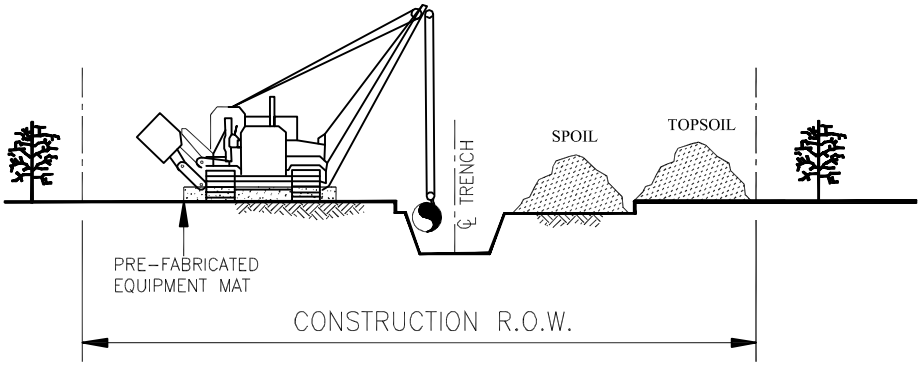
BakkenLink

TYPICAL CONSTRUCTION
PERMANENT
TRENCH PLUGS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–7	REV A



PLAN VIEW



SECTION A-A

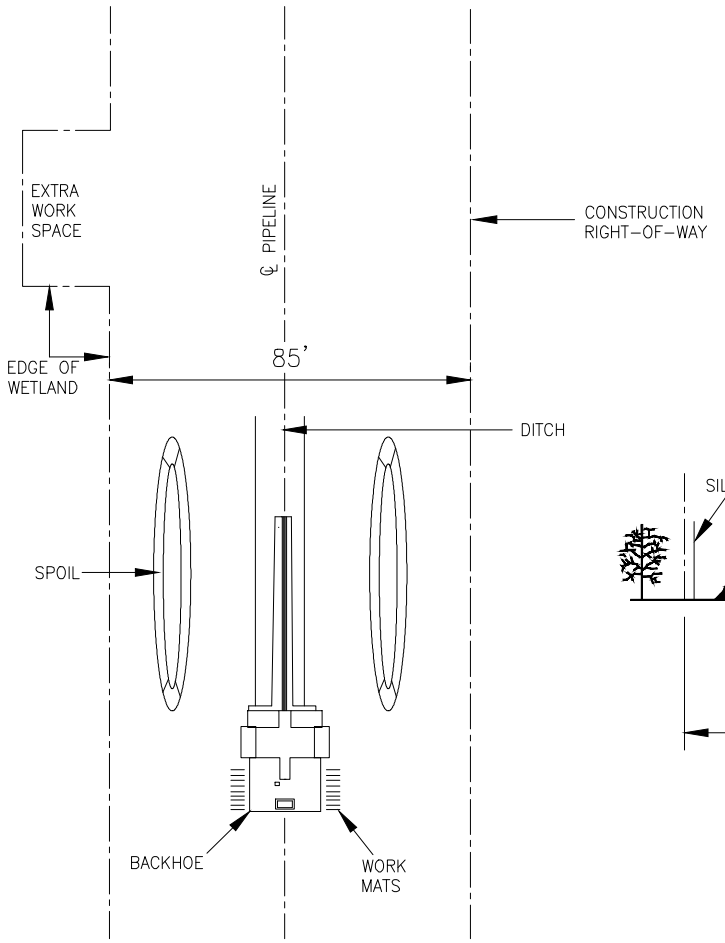
CONSTUCTION PROCEDURES:

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 THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE PROJECT.
4. INSTALL TIMBER MATS/RIPAP THROUGH ENTIRE WETLAND AREA. EQUIPMENT NECESSARY FOR RIGHT-OF-WAY CLEARING MAY MAKE ONE (1) PASS THROUGH THE WETLAND BEFORE MATS ARE INSTALLED.
5. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BLAES AND/OR SILT FENCE) AT DOWNSLOPE 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 AND REMOVED FROM WETLAND FOR DISPOSAL.
7. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
8. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STRING STAGING TRENCH THROUGH WETLANDS.
9. LOWER-IN PIPE, INSTALL TRENCH PLUGS AT WETLAND EDGES AS REQUIRED AND BACKFILL IMMEDIATELY.
10. REMOVE TIMBER MATS OR PRE-FABRICATED MATS FROM WETLAND UPON COMPLETION.
11. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.

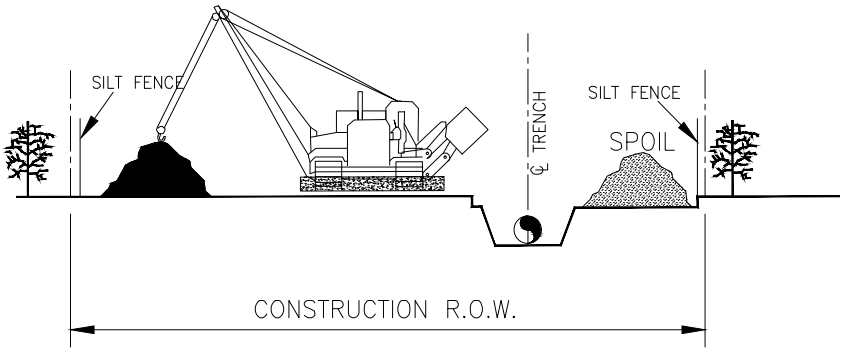
BakkenLink

TYPICAL CONSTRUCTION
STANDARD WETLAND
CROSSING METHOD

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-8	RE A



PLAN VIEW



SECTION A-A

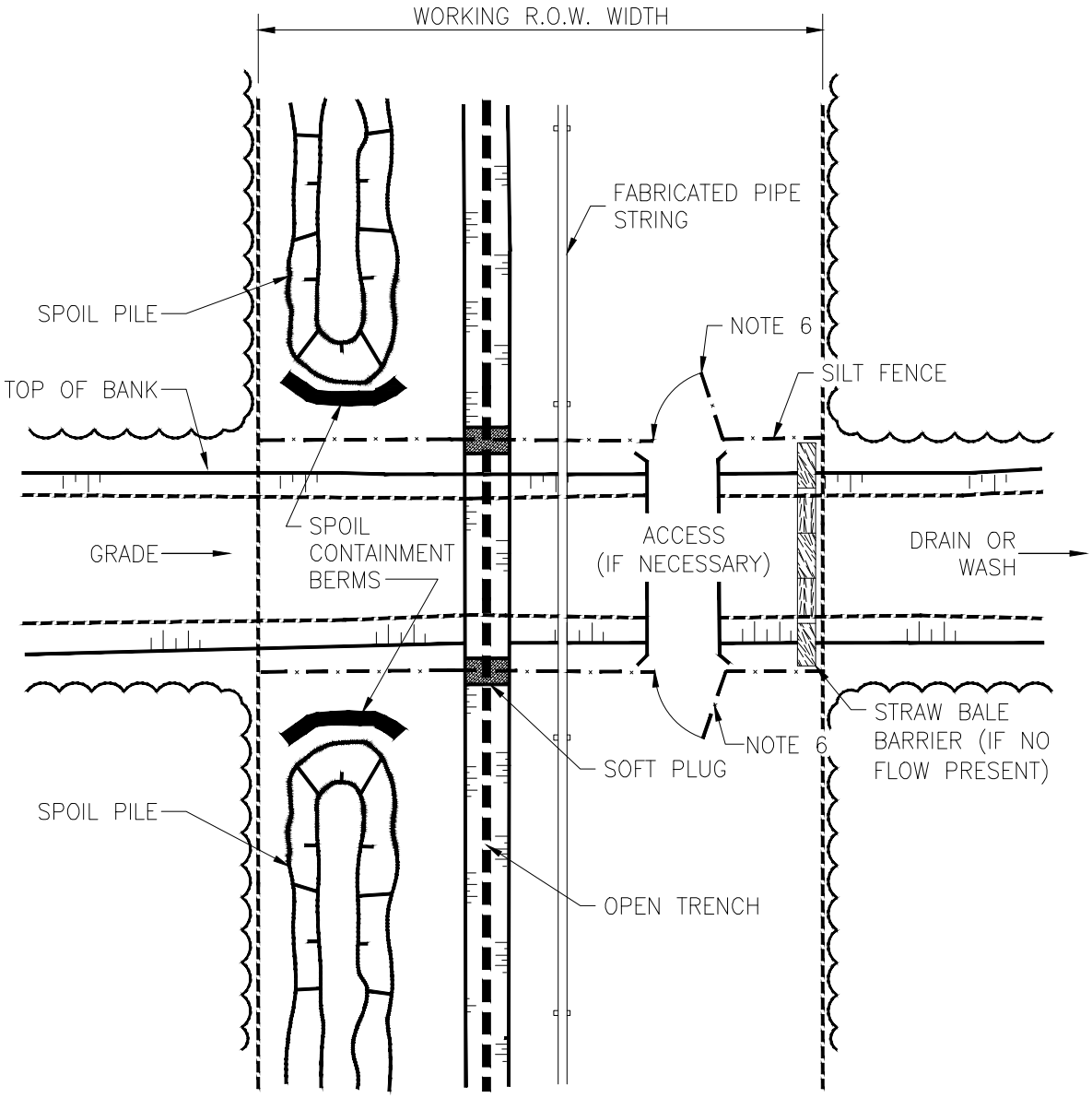
CONSTUCTION PROCEDURES:

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 THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE PROJECT.
4. RESTRICT ROOM GRUBBING TO ONLY THE AREA OVER THE DITCHLINE.
5. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
6. 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.
7. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/ OR SILT FENCE) AT EDGE OF RIGHT-OF WAY AND ALONG WETLAND EDGE IF PRACTICAL.
8. FABRICATE PIPE IN STAGING AREA OUTSIDE THE WETLAND UNTIL JUST PRIOR TO PIPE PLACEMENT.
9. LEAVE HARD PLUGS AT THE EDGE OF THE WETLAND UNTIL JUST PRIOR PLACEMENT.
10. FLOAT PIPE IN PLACE, LOWER-IN, INSTALL TRENCH PLUGS AT WETLAND EDGES WHERE REQUIRED AND BACKFILL IMMEDIATELY
11. REMOVE TIMBER MATS OR PRE-FABRICATED MATS OF NON-NATIVE MATERIAL FROM WETLANDS UPON COMPLETION.
12. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY AND INSTALL PERMANENT EROSION CONTROL.
13. THE CONSTRUCTION RIGHT-OF-WAY FOR THIS TYPE OF CONSTRUCTION SHALL BE 85 FEET.

BakkenLink

TYPICAL CONSTRUCTION
PUSH/PULL WETLAND
CROSSING METHOD

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-9	REV A



PLAN VIEW

NOT TO SCALE

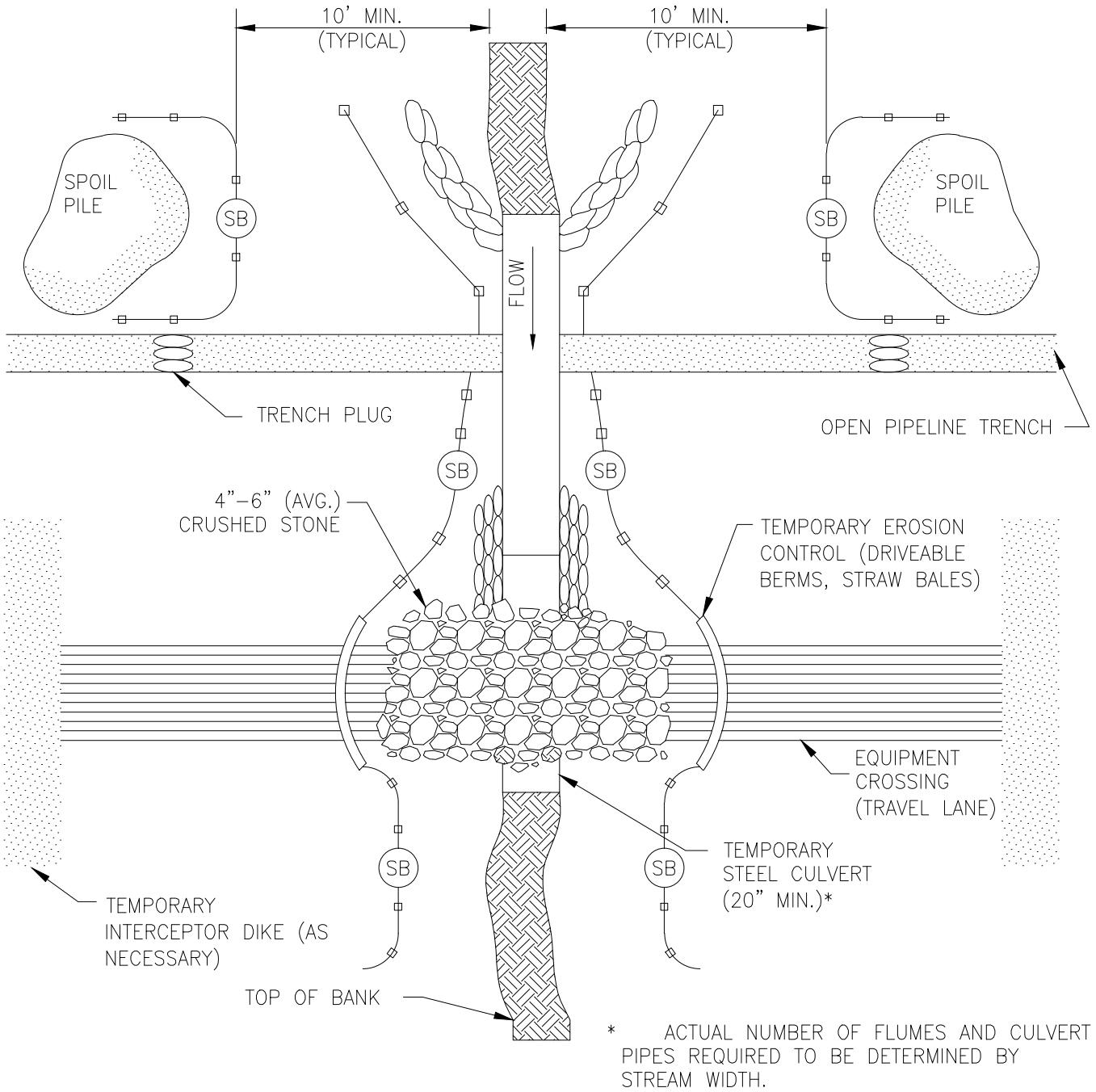
NOTE:

1. APPLICABLE TO MINOR (<10') WATERBODIES THAT ARE NOT FLOWING AT THE TIME OF CONSTRUCTION, OR DO NOT SUPPORT A SIGNIFICANT FISHERY.
2. WEHICLE ACCESS IS ONLY REQUIRED WHERE NECESSARY TO FACILITATE EQUIPMENT MOVEMENT AND MAY CONSIST OF TIMBER MATS, TEMPORARY BRIDGES, RAIL FLATARS OR FLUME CROSSING.
3. INSTALL SOFT PLUGS FOLLWOING EXCAVATION OF MAINLINE DITCH THROUGH CROSSING.
4. INSTALL SEDIMENT BARRIERS AS INDICATED. PROTECT ACCESS WITH SILT FENCE GATES OR STRAW BALE BARRIERS.
5. MAINLINE PIPE SECTION MAY SPAN CROSSING IN PREPARATION FOR LOWER IN.
6. SILT FENCE OR STRAW BALE "GATE" TO BE CLOSED AT NIGHT OR DURING RAINFALL.

BakkenLink

TYPICAL CONSTRUCTION
NON-FLOWING
OPEN CUT CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-10	REV A



NOTES:

1. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES, OR APPROPRIATE MATERIALS.

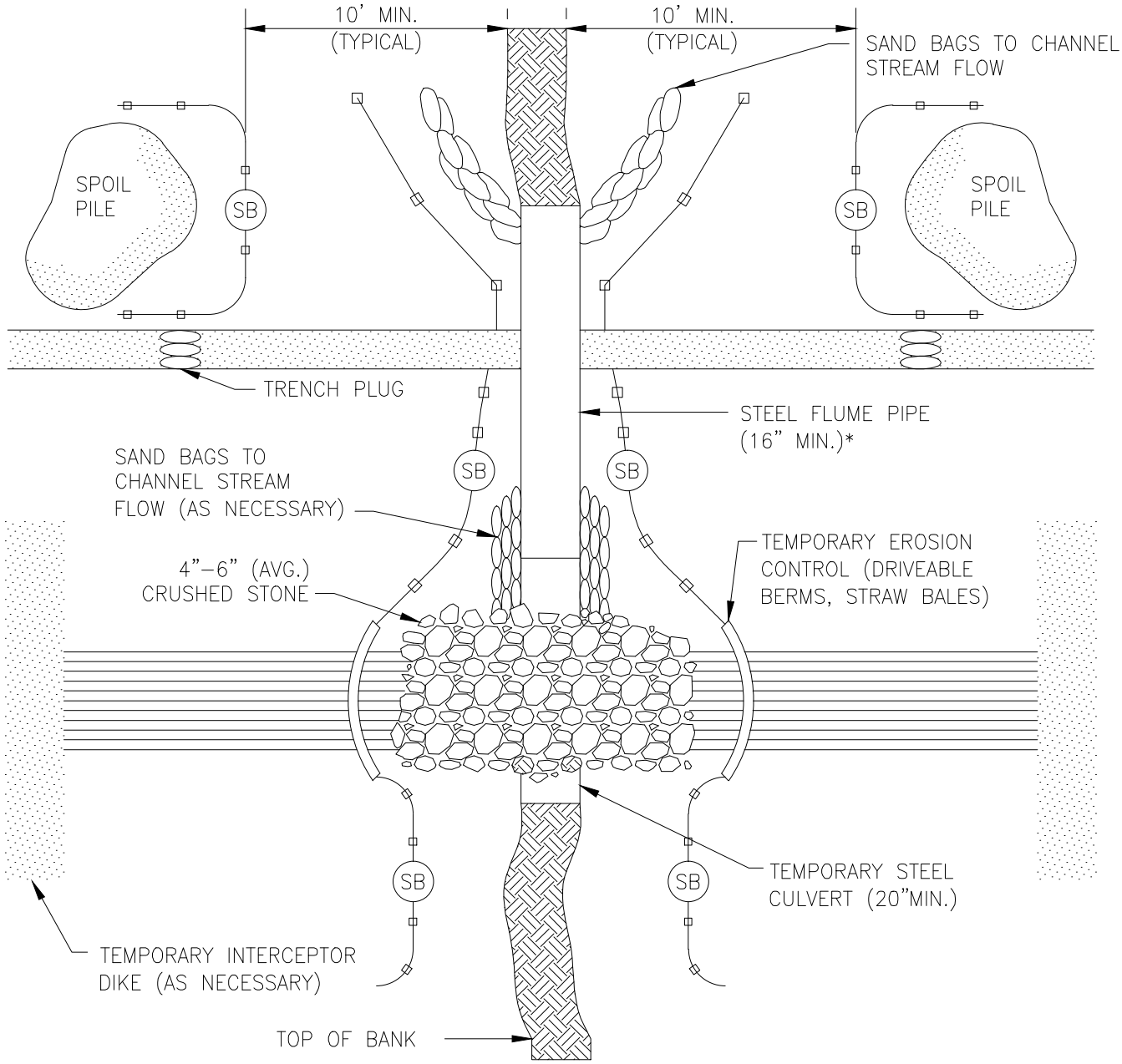
2. FOR MINOR WATERBODIES, COMPLETE TRENCHING AND BACKFILLING IN THE WATERBODY (NOT INCLUDING BLASTING OR OTHER ROCK BREAKING MEASURES) WITHIN 24 HOURS. IF A FLUME IS INSTALLED WITHIN THE WATERBODY DURING MAINLINE ACTIVITIES, IT CAN BE REMOVED JUST PRIOR TO LOWERING IN THE PIPELINE. THE 24-HOUR TIMEFRAME STARTS AS SOON AS THE FLUME IS REMOVED.

3. FOR INTERMEDIATE WATERBODIES, COMPLETE TRENCHING AND BACKFILLING IN THE WATERBODY (NOT INCLUDING BLASTING OR OTHER ROCK BREAKING MEASURES) WITHIN 48 CONTINUOUS HOURS, IF FEASIBLE.

BakkenLink

TYPICAL CONSTRUCTION
WET CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-11	REV A



- ACTUAL NUMBER OF FLUMES AND CULVERT PIPES REQUIRED TO BE CONTINUED BY STREAM WIDTH.

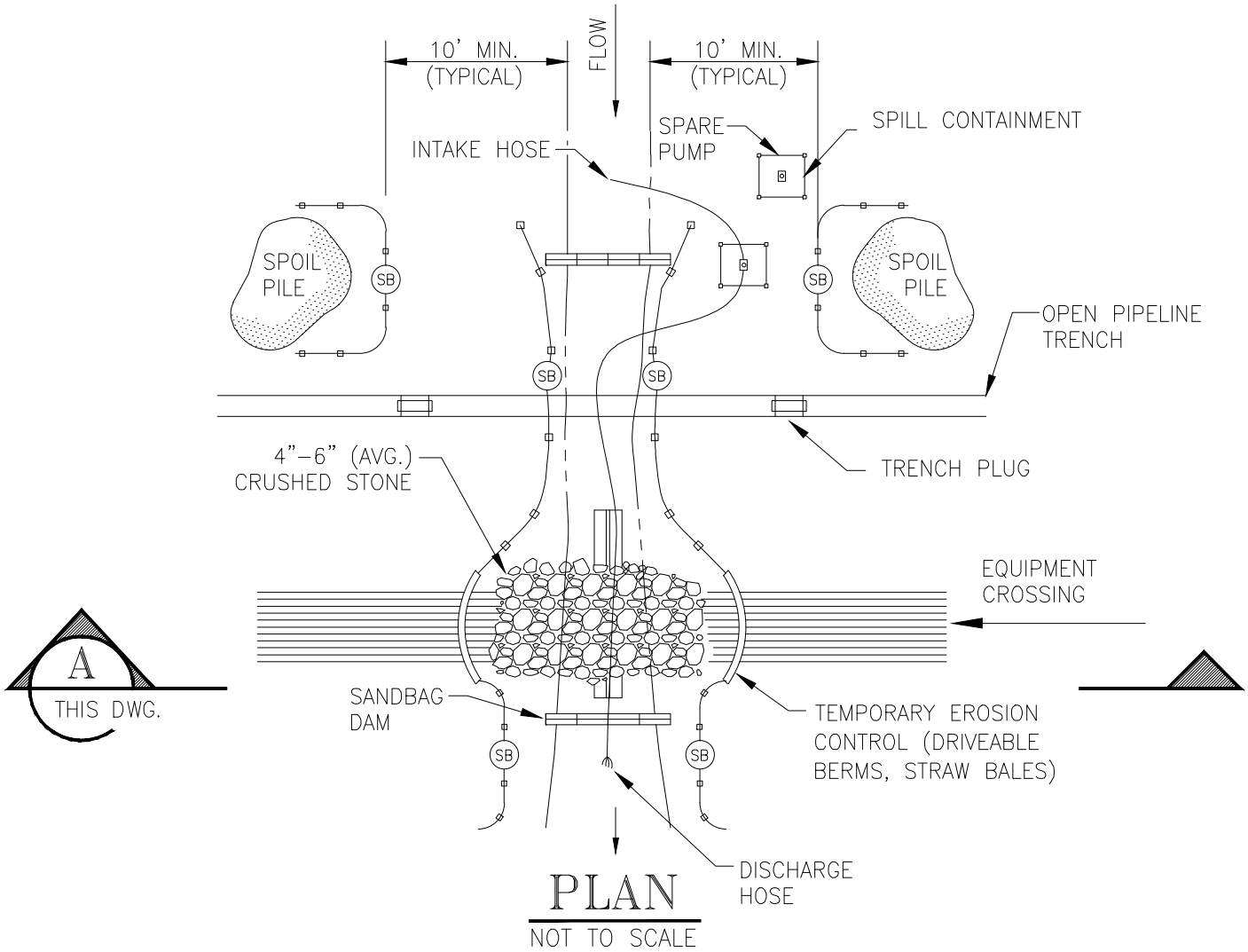
NOTES:

1. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES, OR OTHER APPROPRIATE MATERIALS.
2. SAND BAGS MUST BE FILLED WITH SAND FREE OF SILT, ORGANICS, AND OTHER MATERIAL.
3. ALIGN FLUME(S) TO PREVENT BANK EROSION AND STREAM SCOUR.
4. CONDUCT ALL IN-STREAM ACTIVITY (EXCEPT BLASTING OR OTHER ROCK BREAKING MEASURES) WITH THE FLUME(S) IN PLACE. FLUME PIPE(S) MAY NOT BE REMOVED FOR LOWERING IN OR INITIAL STREAMBED RESTORATION EFFORTS.
5. THE ENDS OF THE FLUME AND CULVERT MUST EXTEND TO AND UNDISTURBED AREA.

BakkenLink

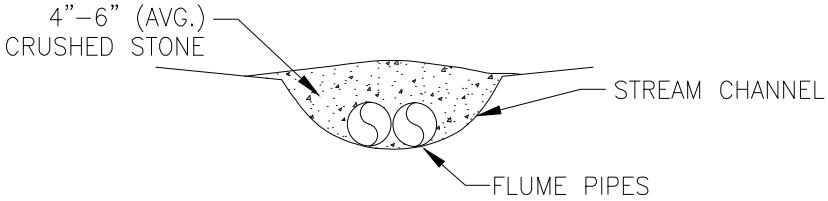
TYPICAL CONSTRUCTION
FLUMED CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-12	REV A



PLAN

NOT TO SCALE



SECTION A

SCALE: NOT TO SCALE THIS DWG.

NOTES:

1. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES, OR APPROPRIATE MATERIALS.
2. INSTALL AND SEAL SANDBAGS UPSTREAM AND DOWNSTREAM OF THE CROSSING.
3. CREATE AN UPSTREAM SUMP USING SANDBAGS IF NATURAL SUMP IS UNAVAILABLE FOR THE INTAKE HOSE.
4. EXCAVATE ACROSS STREAM CHANNEL FOLLOWING WATER REROUTING.
5. DO NOT REFUEL OR STORE FUEL WITHIN 100 FEET OF THE WATERBODY, WHERE FEASIBLE.
6. MONITOR PUMPS AT ALL TIMES DURING STREAM CROSSING PROCEDURE.
7. USE SUFFICIENT PUMPS, INCLUDING ONSITE BACKUP PUMPS, TO MAINTAIN DOWNSTREAM FLOW.
8. SCREEN PUMP INTAKES.
9. NUMBER OF FLUME PIPES FOR EQUIPMENT BRIDGE WILL VARY DEPENDING ON SITE CONDITIONS.

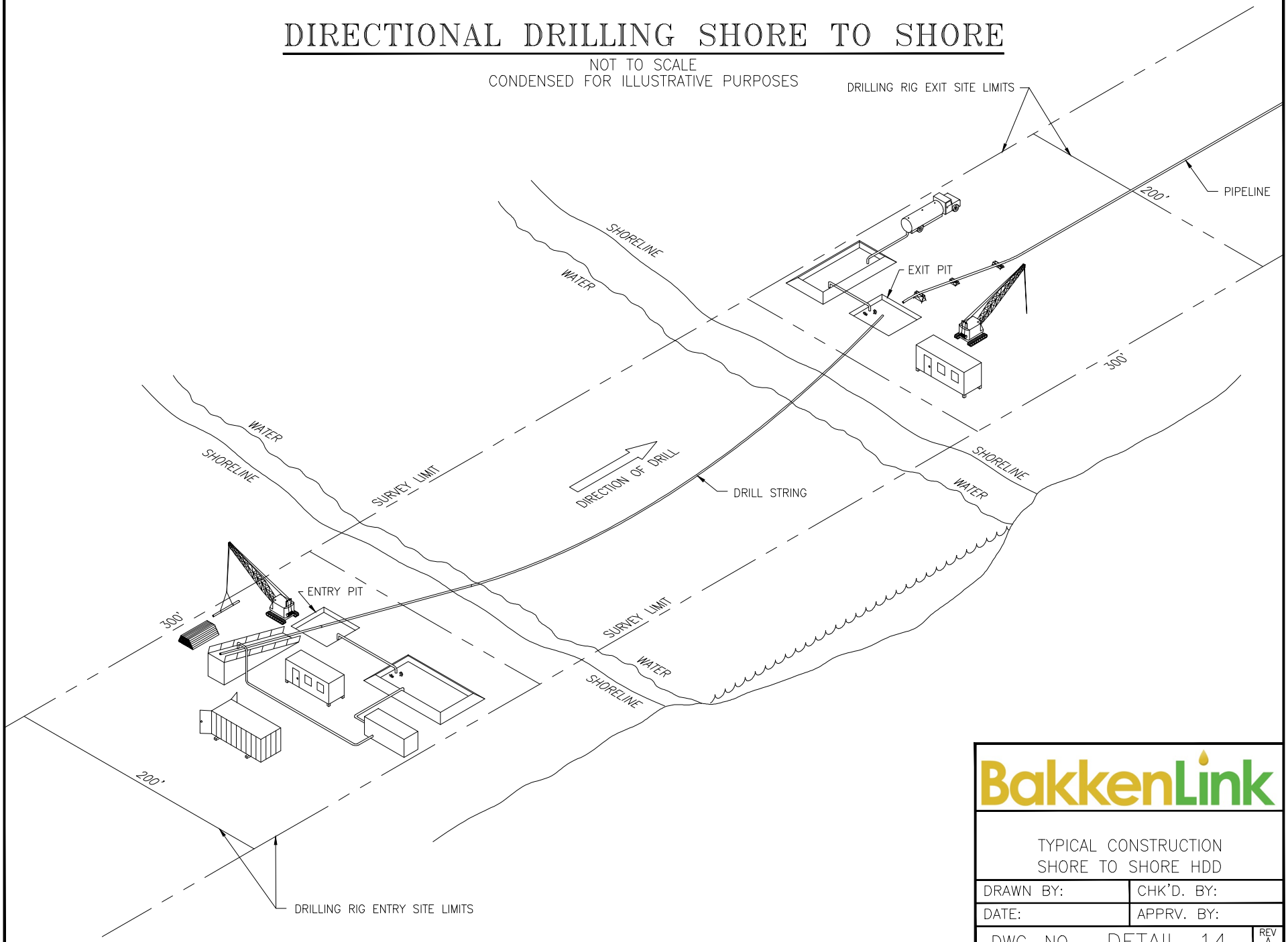
BakkenLink

TYPICAL CONSTRUCTION
DAM AND PUMP CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-13	REV A

DIRECTIONAL DRILLING SHORE TO SHORE

NOT TO SCALE
CONDENSED FOR ILLUSTRATIVE PURPOSES



BakkenLink

TYPICAL CONSTRUCTION
SHORE TO SHORE HDD

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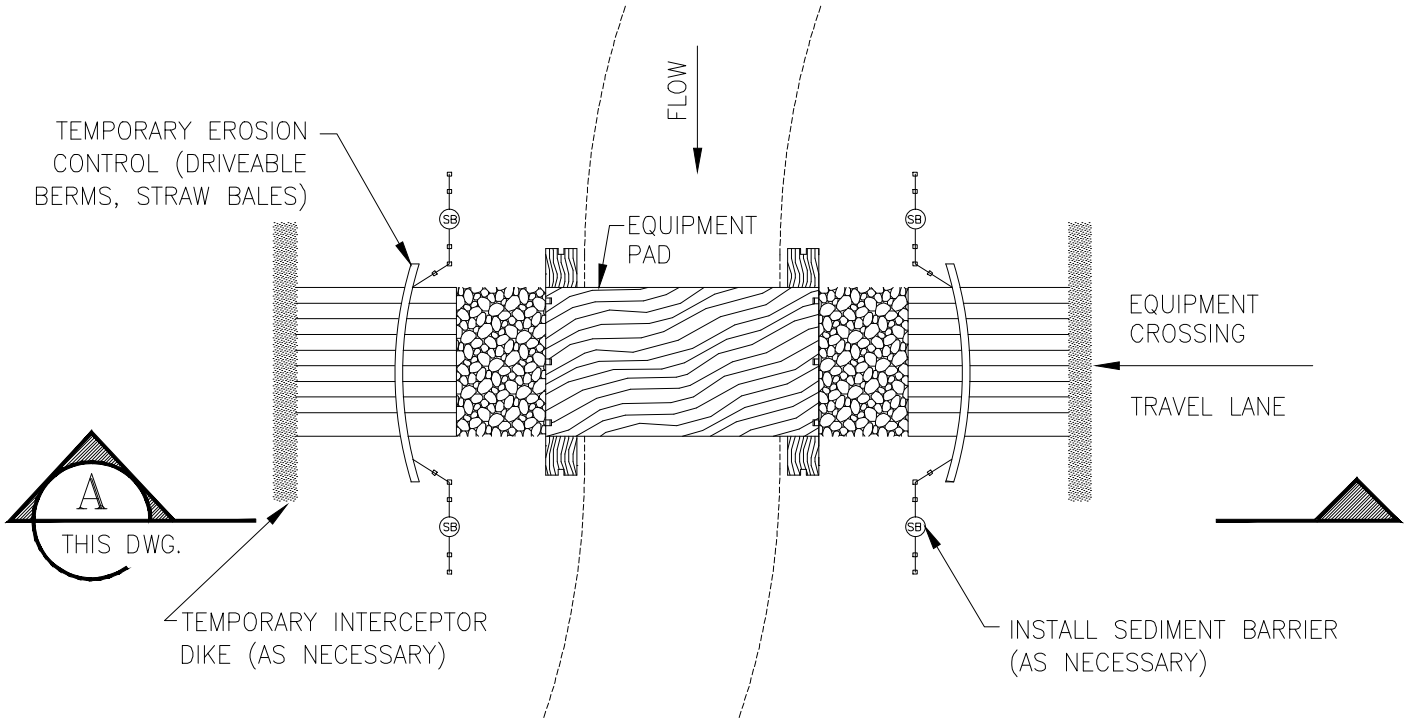
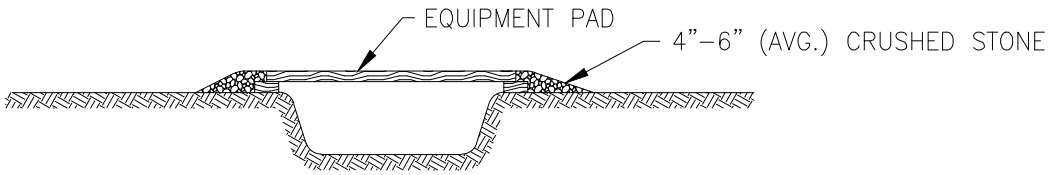
DATE:	APPRV. BY:
DWG. NO. DETAIL–14	REV A



PLAN

NOT TO SCALE



SECTION A

SCALE: NOT TO SCALE

THIS DWG.

NOTES:

1. SB TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES, OR OTHER APPROPRIATE MATERIALS.
2. ADDITIONAL EQUIPMENT PADS CAN BE PUT SIDE BY SIDE IF EXTRA WIDTH IS REQUIRED.
3. EQUIPMENT PAD TYPICALLY CONSTRUCTED OF HARDWOOD; MUST ACCOMODATE THE LARGEST EQUIPMENT USED.
4. CRUSHED STONE MUST EXTEND A MINIMUM OF 10 FEET FROM THE TOP OF THE BANK.
5. CONSTRUCT BRIDGE TO PREVENT SOIL FROM ENTERING WATERBODY.

BakkenLink

TYPICAL CONSTRUCTION EQUIPMENT BRIDGE (PADS & CULVERTS)

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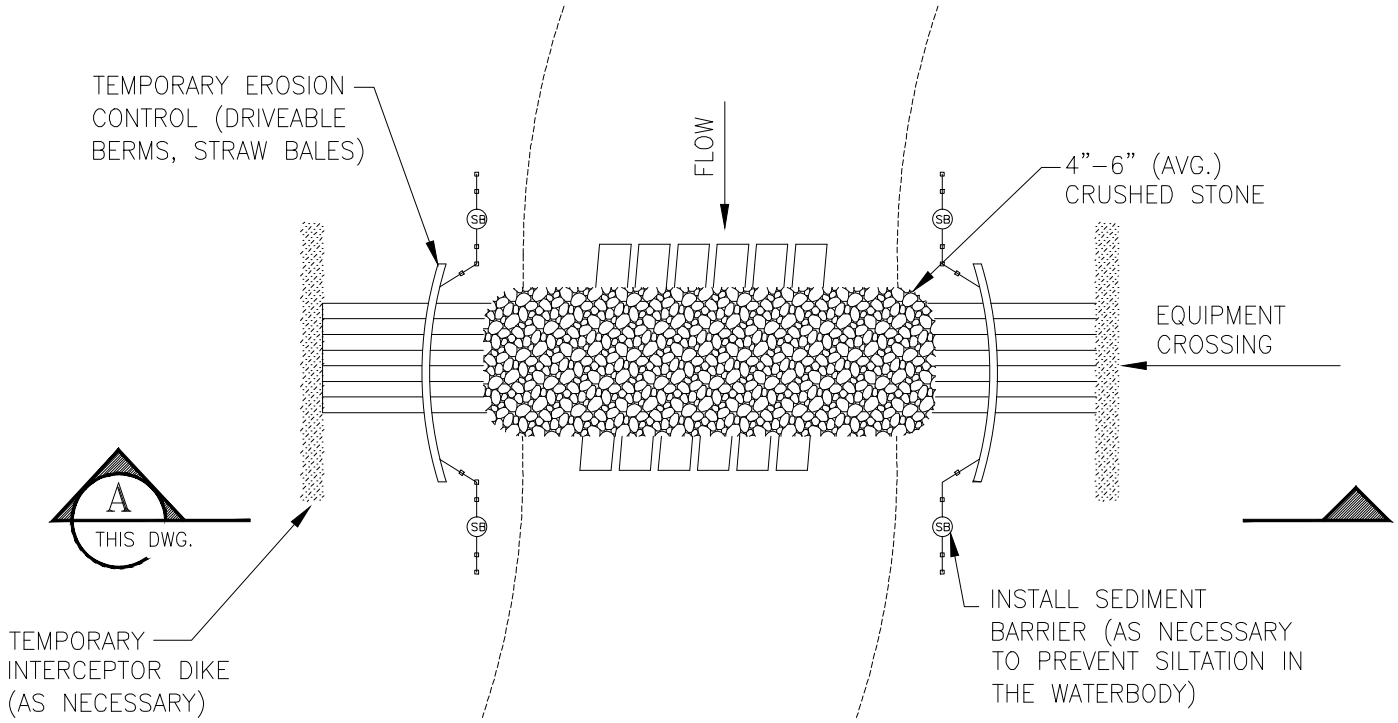
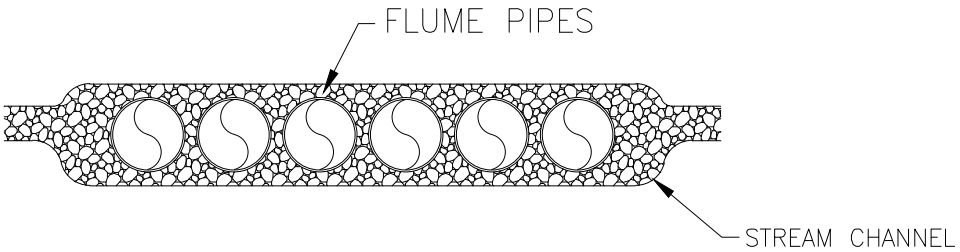
DATE:	APPRV. BY:
DWG. NO. DETAIL–15	REV A



PLAN

NOT TO SCALE



SECTION

SCALE: NOT TO SCALE

A
THIS DWG.

NOTES:

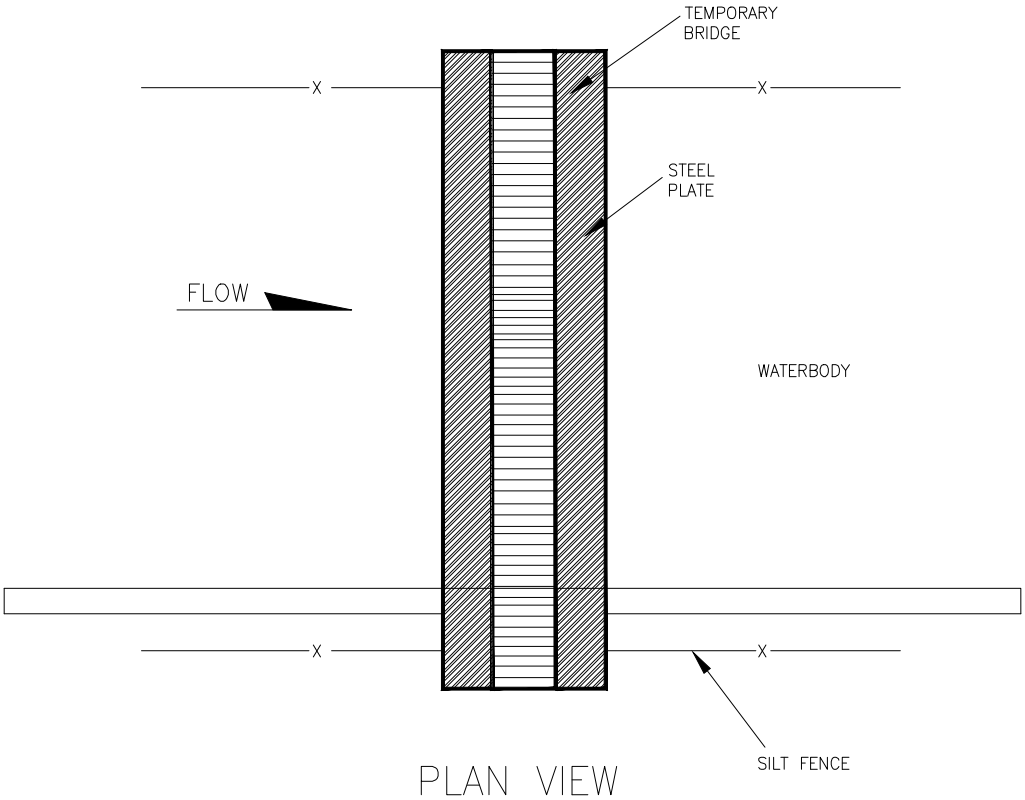
1. ALIGN FLUME PIPES TO PREVENT EROSION AND STREAMBED SCOUR.

2. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCES AND/OR STRAW BALES, OR OTHER APPROPRIATE MATERIALS.

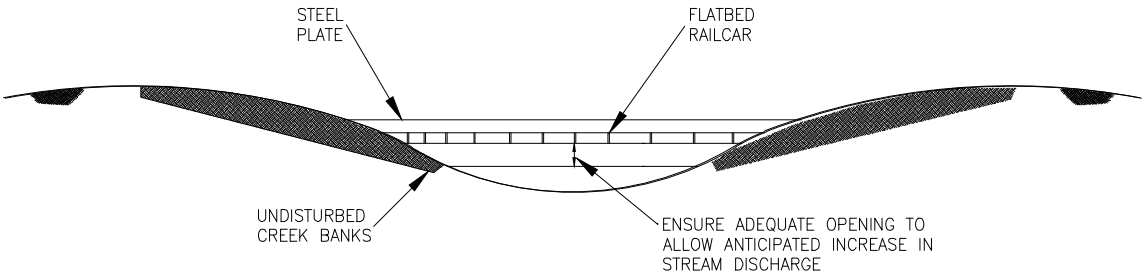
BakkenLink

TYPICAL CONSTRUCTION EQUIPMENT BRIDGE (STONE & CULVERTS)

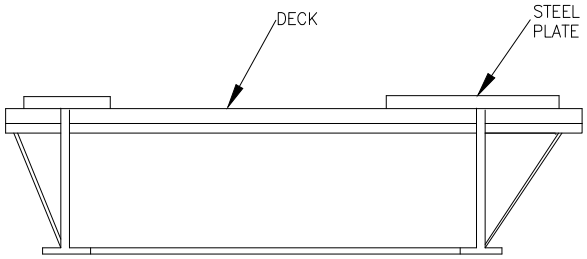
DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–16	REV A



PLAN VIEW



SECTION A–A

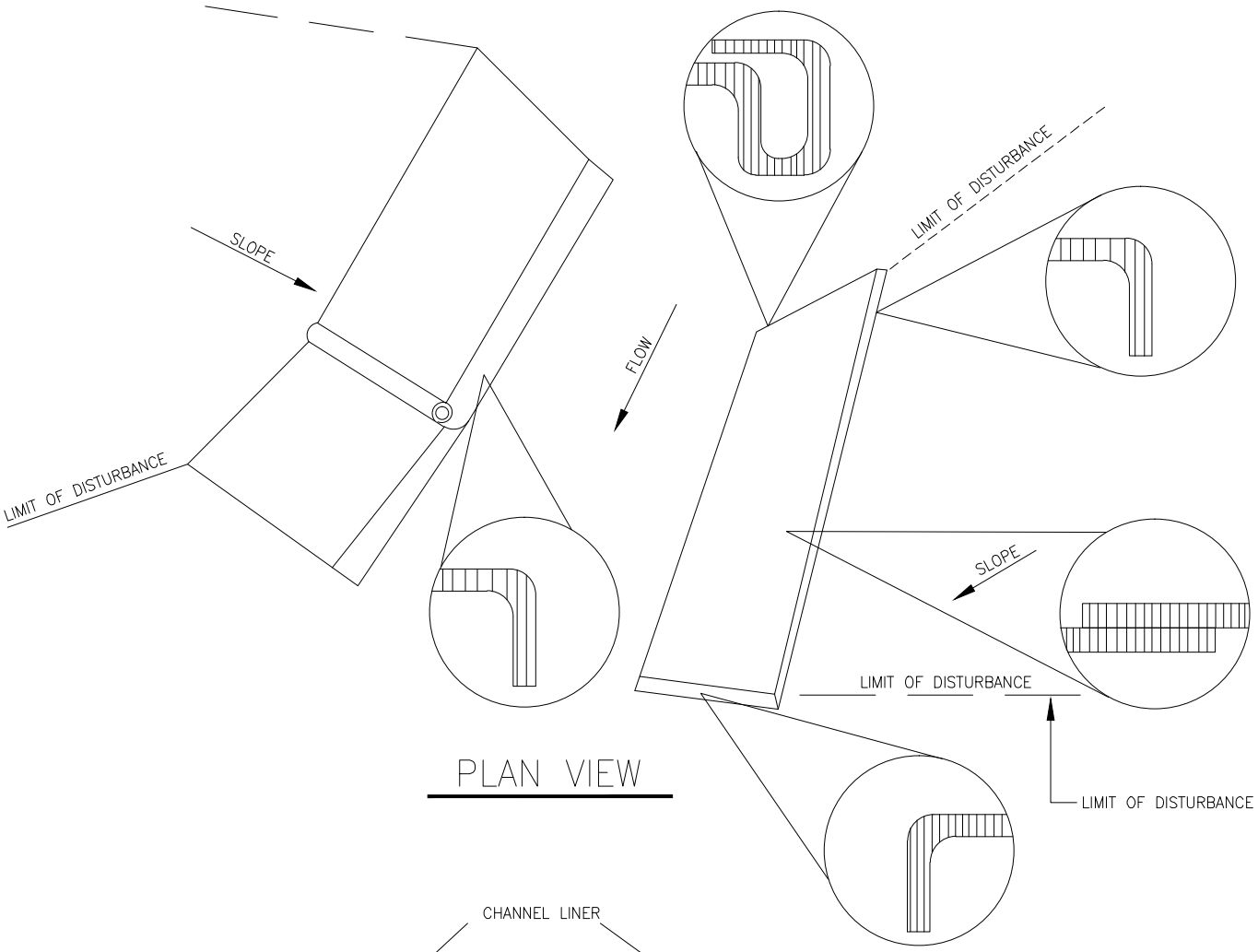


SECTION B–B

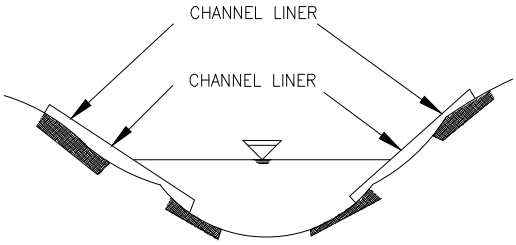
BakkenLink

TYPICAL CONSTRUCTION
RAILCAR
BRIDGE CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–17	REV A



PLAN VIEW



SECTION A–A

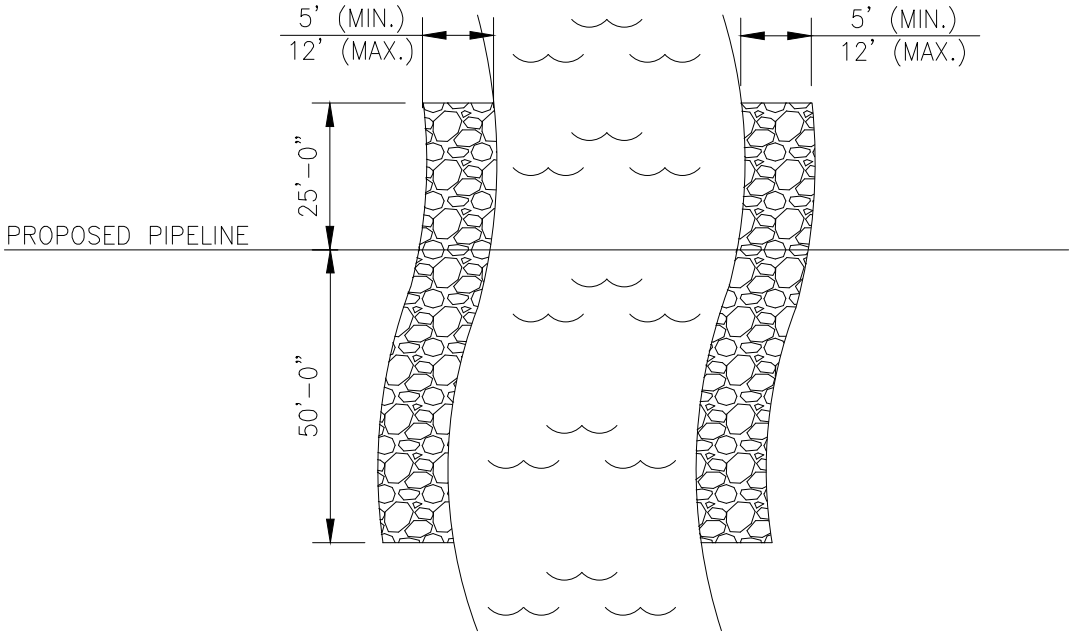
NOTES:

1. INSTALL AND ANCHOR LINERS FOLLOWING MANUFACTURER'S INSTRUCTIONS.
2. PREPARE SOIL BEFORE INSTALLING CHANNEL LINER, INCLUDING THE APPLICATION OF FERTILIZER AND SEED. CHANNEL LINERS SHOULD EXTEND COMPLETELY ACROSS DISTURBED BANK AREAS TO PROTECT ERODIBLE SURFACES.
3. BEGIN AT THE END OF THE CHANNEL BY ANCHORING THE LINER IN A TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
4. ROLL LINER IN DIRECTION OF WATER FLOW.
5. INSTALL LINERS END–OVER–END (SHINGLE STYLE) WITH OVERLAP USING A DOUBLE ROW OF STAGGERED STAPLES 4 INCHES BELOW THE FIRST ROW IN STAGGERED PATTERN.
6. IN HIGH FLOW CHANNEL APPLICATIONS A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FEET INTERVAOLS. USE A ROW OF STAPLES 4 INCHES BELOW THE FIRST ROW IN A STAGGERED PATTERN.
7. INSTALL CHANNEL LINER TO THE TOP OF DEFINED CHANNEL SECTION TO OR MORE ROWS OF BLANKETS MAY BE NECESSARY, THESE LINERS MUST BE OVERLAPPED 4 INCHES AND STAPLED.
8. THE CHANNEL LINER SHOULD EXTEND TO THE BASE OF THE CHANNEL AND STAPLED. FOR CHANNELS WITH VERY LITTLE OR NO FLOW, EXTEND A MINIMUM OF 1 FOOT BELOW WATER LEVEL AND STAPLE IN PLACE.
9. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

BakkenLink

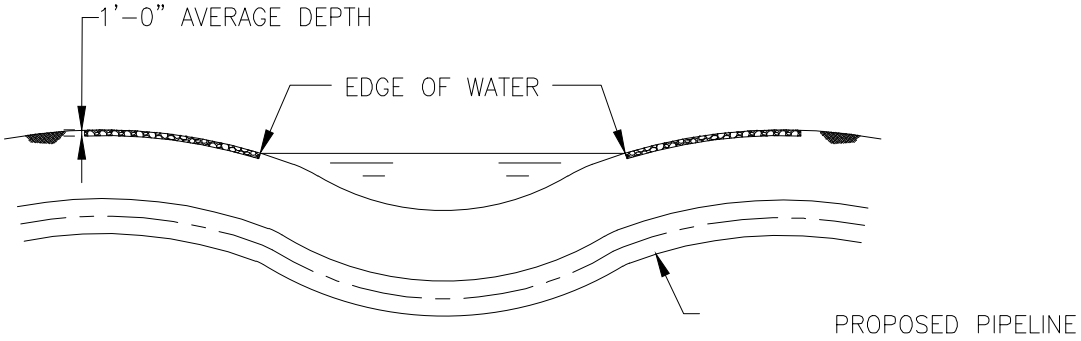
TYPICAL CONSTRUCTION
FLEXIBLE CHANNEL
LINER INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–18	REV A



PLAN VIEW

N.T.S.



CROSS-SECTION

N.T.S.

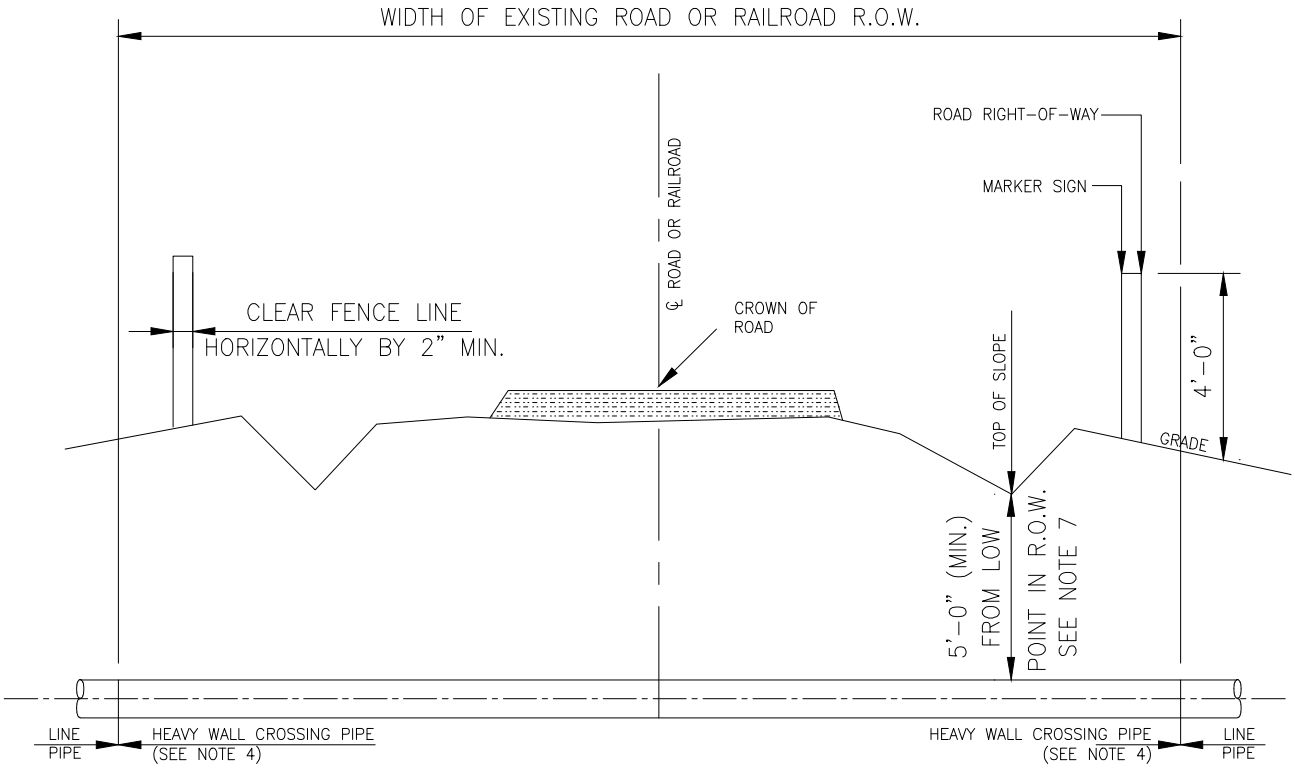
NOTES:

1. RIP-RAP IS LESS THAN 500 FEET IN LENGTH.
2. RIP-RAP WILL NOT EXCEED AN AVERAGE OF ONE (1) CUBIC YARD PER RUNNING FOOT.
3. RIP-RAP INSTALLATION SHALL BE IN COMPLIANCE WITH ALL APPLICABLE PERMITS.

BakkenLink

TYPICAL CONSTRUCTION
RIP-RAP PLACEMENT

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-19	REV A



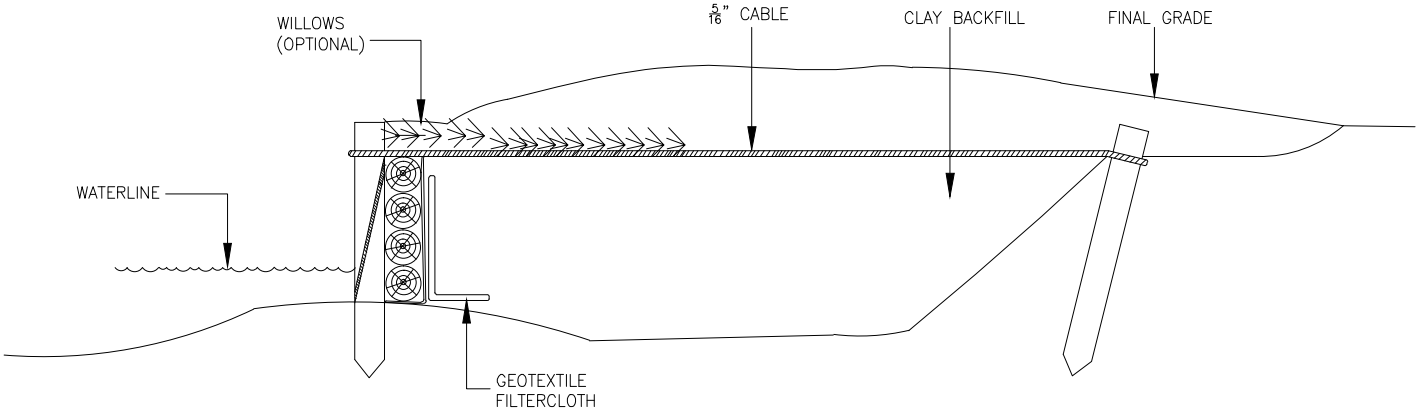
NOTES:

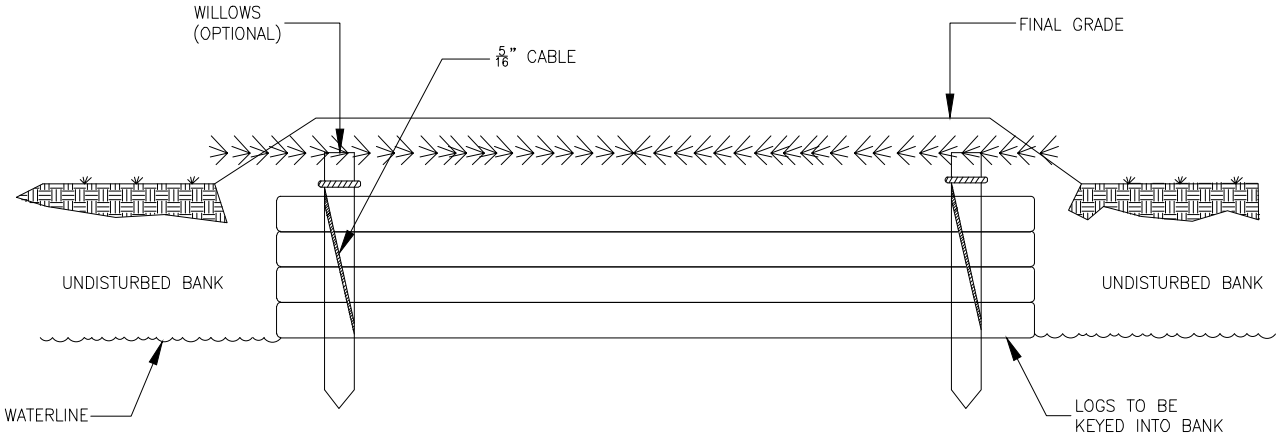
1. CROSSINGS SHALL BE IN ACCORDANCE WITH APPLICABLE PERMIT.
2. ROAD CROSSING PIPE SHALL EXTEND AT MINIMUM TO RIGHT-OF-WAY LINE UNLESS OTHERWISE SPECIFIED.
3. THE TYPE AND MINIMUM REQUIRED LENGTH OF PIPE FOR CROSSINGS OF ROADS SHALL BE AS SPECIFIED ON ALIGNMENT SHEETS.
4. PIPE FOR BORED CROSSINGS TO INCLUDE ABRASION-RESISTANT (ARB) COATING.
5. PIPELINE MARKER AND TEST STATIONS TO BE INSTALLED ON RIGHT-OF-WAY LINE NEXT TO FENCE IF POSSIBLE.
6. THE CROSSING PIPE SHALL BE STRAIGHT WITH NO VERTICAL OR HORIZONTAL BENDS WITHIN ROAD RIGHT-OF-WAY.
7. MINIMUM PIPELINE COVER IN DRAINAGE DITCHES AT PUBLIC ROADS IS 60 INCHES, 36 INCHES IN CONSOLIDATED ROCK.

BakkenLink

TYPICAL CONSTRUCTION
UNCASED ROAD/RAILROAD
CROSSING BORE PROFILE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-20	REV A





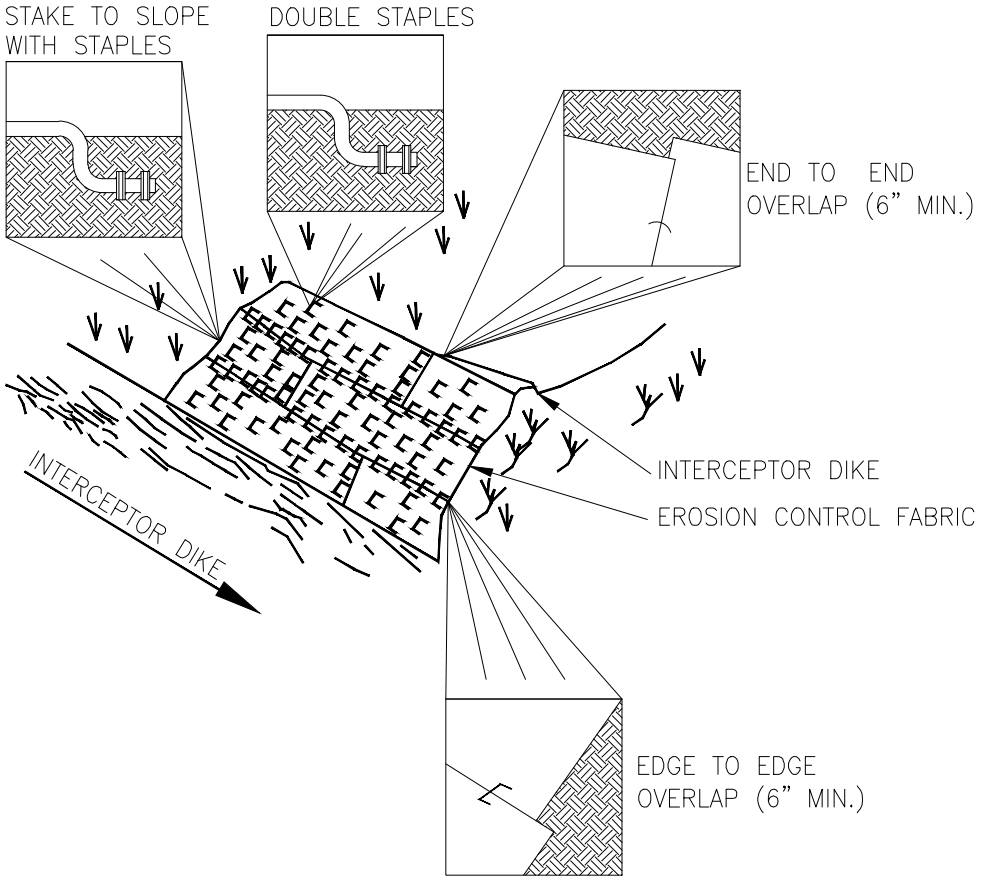
NOTES:

1. LOG WALLS TO BE CONSTRUCTED USING CONIFEROUS MATERIAL.
2. NATURE BACKFILL OR LOOSE GRADE MATERIAL SHOULD BE USED AS FILL MATERIAL.
3. ANCHOR PILINGS OR DEADMAN ANCHORS TO BE USED TO SECURE CABLE IN BANK.
4. NON-WOVEN FILTER CLOTH (NYLEX C34 OR EQUIVALENT) TO BE USED TO LINE LOG WALL.
5. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SITE CONDITIONS.

BakkenLink

TYPICAL CONSTRUCTION
STREAM BANK RECLAMATION
LOG WALL

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-21	REV A



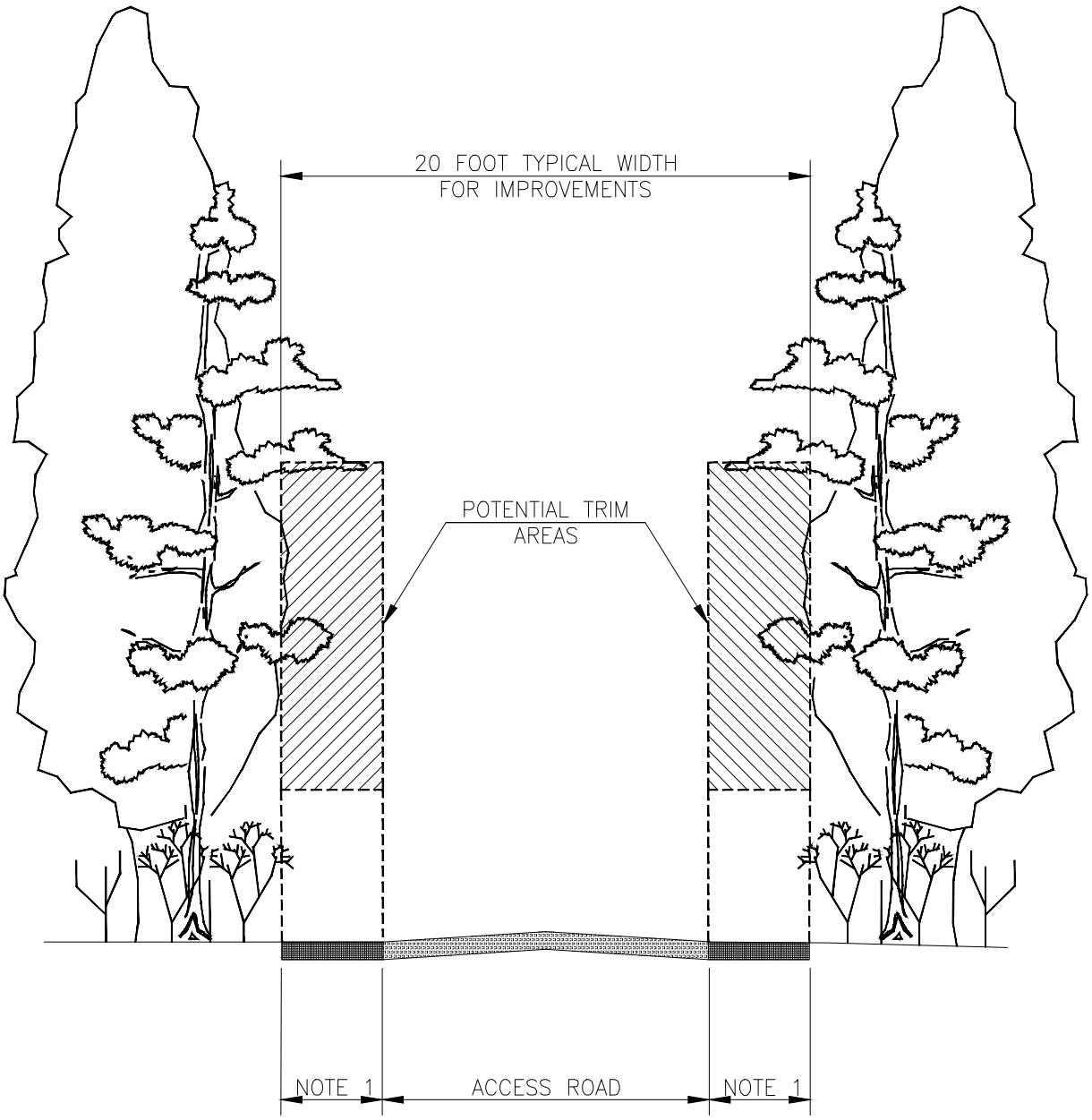
NOTES:

1. EROSION CONTROL MATTING SHALL BE PLACED ON THE BANKS OF FLOWING STREAMS WHERE VEGETATION HAS BEEN REMOVED OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
2. EROSION CONTROL MATTING SHALL MEET THE REQUIREMENTS SPECIFIED IN THE PLAN AND/OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
3. STAPLES SHALL BE MADE OF 11 GAUGE WIRE, U-SHAPED WITH SIX (6) INCH LEGS AND A ONE (1) INCH CROWN. STAPLES SHALL BE DRIVEN INTO THE GROUND FOR THE FULL LENGTH OF THE STAPLE LEGS.
4. MATTING SHALL BE INSTALLED ACCORDING TO MANUFACTURER SPECIFICATIONS OR AS STATED BELOW:
   - EXTEND TOP OF BLANKET THREE (2) FEET PAST THE UPPER EDGE OF THE HIGH WATER MARK. IF AN INTERCEPTOR DIKE IS PRESENT ON THE APPROACH SLOPE, BEGIN THE BLANKET ON THE UPHILL SIDE OF THE INTERCEPTOR DIKE.
   - INSTALL BLANKET(S) ACROSS THE SLOPE IN THE DIRECTION OF THE WATER FLOW.
   - ANCHOR ("KEY") THE UPSTREAM EDGE OF THE BLANKET(S) INTO THE SLOPE USING A SIX (6) INCH DEEP TRENCH. DOUBLE STAPLE EVERY 12" BEFORE BACKFILLING AND COMPACTING TRENCH.
   - ANCHOR ("KEY") THE UPPER EDGE OF THE BLANKET(S) INTO THE SLOPE USING A SIX (6) INCH DEEP TRENCH. DOUBLE STAPLE EVERY 12" BEFORE BACKFILLING AND COMPACTING TRENCH.
   - TRENCH AND ROLL THE BLANKET DOWN THE HILL. DOUBLE STAPLE EVERY 12" BEFORE BACKFILLING AND COMPACTING TRENCH.
   - OVERLAP THE EDGES OF PARALLEL BLANKETS A MINIMUM OF SIX (6) INCHES. PLACE THE UPPER BLANKET OVER THE LOWER BLANKET (SHINGLE STYLE) AND STAPLE EVERY 12" ALONG THE LENGTH OF THE EDGE.
   - WHEN BLANKET ENDS ARE ADJOINED, PLACE THE UPSTREAM BLANKET OVER THE DOWNSTREAM BLANKET (SHIGLE STYLE) WITH APPROXIMATELY (6) INCH OF OVERLAP AND STAPLE THROUGH THE OVERLAPPED AREA EVERY 12".
   - STAPLE DOWN THE CENTER OF THE BLANKET(S), THREE(3) STAPLES IN EVERY SQUARE YARD.
5. IN LIVESTOCK AREAS WHERE EROSION CONTROL MATTING IS APPLIED TO THE SLOPES, FENCING WILL BE USED IF NECESSARY TO EXCLUDE LIVESTOCK, WITH PERMISSION OF THE LANDOWNER.
6. MONITOR WASHOUTS, STAPLE INTEGRITY OR MAT MOVEMENT. REPLACE OR REPAIR AS NECESSARY.

BakkenLink

TYPICAL CONSTRUCTION
MATTING OF STREAM BANKS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-22	REV A



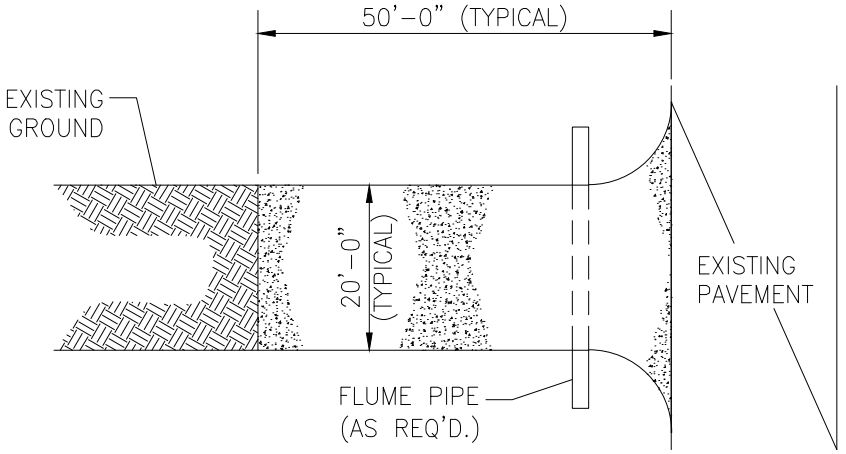
NOTE:

1. POTENTIAL WIDENING OF EXISTING ROADS WITH BASE MATERIAL (IF NEEDED).

BakkenLink

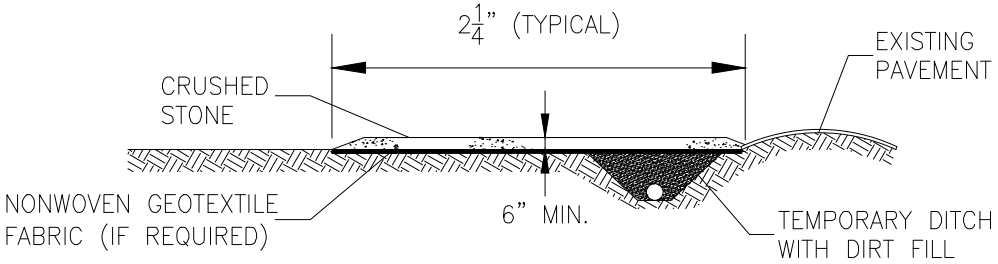
TYPICAL CONSTRUCTION
ACCESS ROAD CROSS SECTION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 23	REV A



PLAN VIEW

NOT TO SCALE



CROSS SECTION

NOT TO SCALE

CONSTRUCTION SPECIFICATIONS:

1. STONE SIZE = 4"-6" (AVG.) CRUSHED STONE.

2. ALL STONE MUST BE PLACED ON NON-WOVEN GEOTEXTILE FABRIC IF USED IN RESIDENTIAL OR ACTIVE AGRICULTURAL AREAS.

3. LENGTH: FIFTY (50) FEET TYPICAL (IF SITE CONDITIONS ALLOW).
   WIDTH: TWENTY (20) FEET TYPICAL.
   THICKNESS: SIX (6) INCHES MINIMUM.

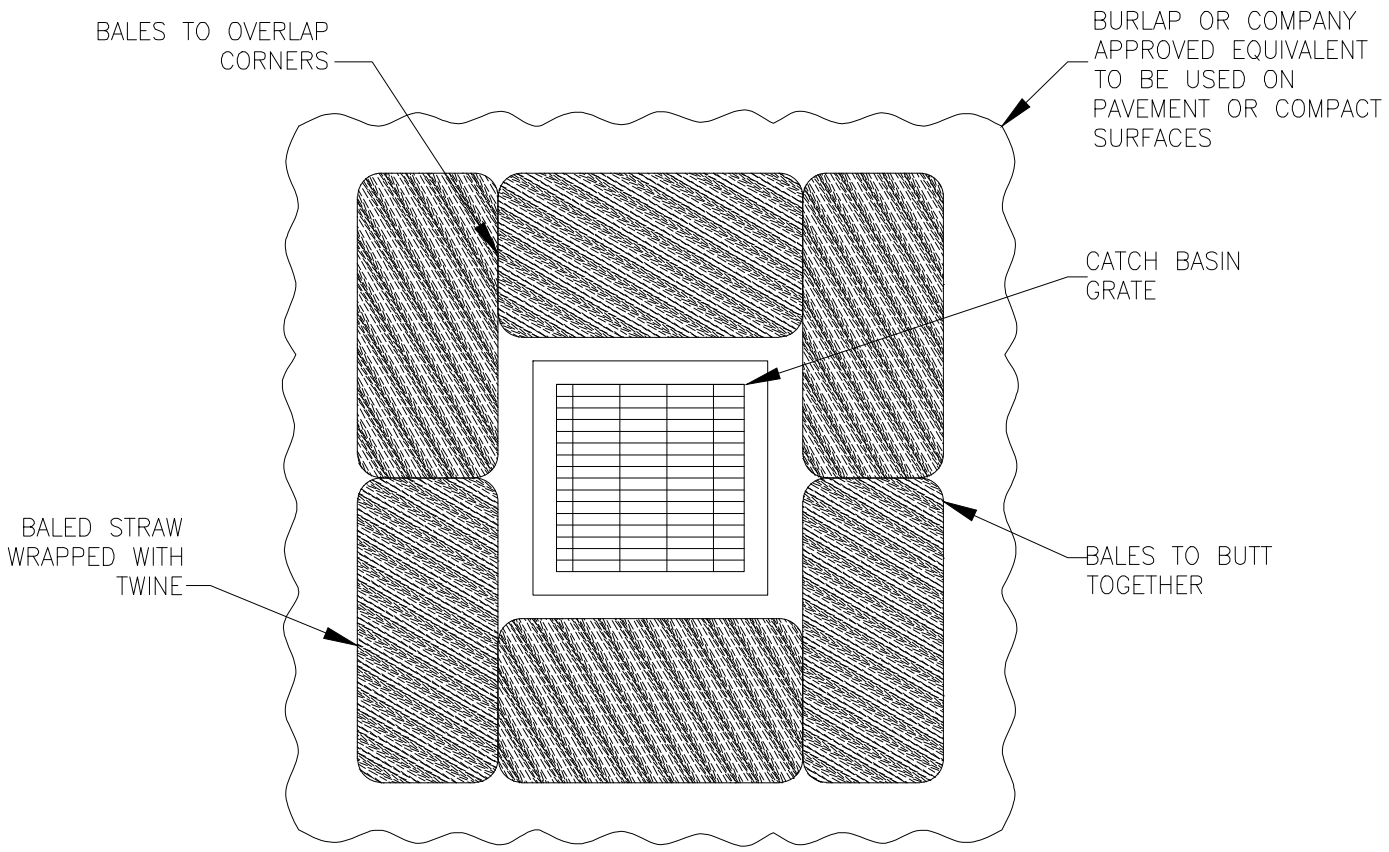
4. ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A DRIVABLE BERM OR OTHER TEMPORARY EROSION CONTROL DEVICE CAN BE USED.

5. THE ENTRANCE SHALL BE PERIODICALLY INSPECTED AND MAINTAINED IN A CONDITION THAT MINIMIZES TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. MAINTENANCE MAY INCLUDE PERIODIC TOP DRESSING WITH AN ADDITIONAL STONE OR THE REPAIR/CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ANY SEDIMENT THAT IS SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED AS SOON AS PRACTICAL.

BakkenLink

TYPICAL CONSTRUCTION ROCK ACCESS PAD

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 24	REV A



STORM DRAIN INLET PROTECTION

NOT TO SCALE

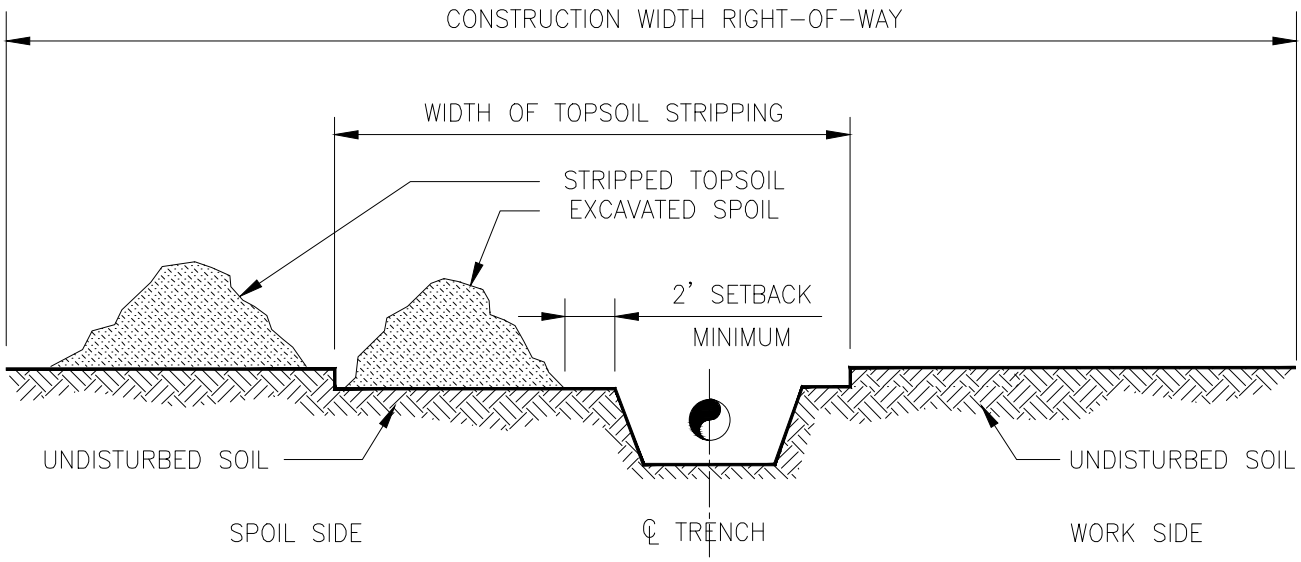
NOTES:

1. SURROUND STREET DRAINAGE STRUCTURE INLET WITH BALES PRIOR TO CONSTRUCTION AND MAINTAIN UNTIL CONSTRUCTION IS COMPLETED.
2. FOR BALES PLACED ON PAVEMENT (OR COMPACT SURFACES), PLACE BURLAP OR COMPANY APPROVED EQUIVALENT BETWEEN PAVEMENT AND BALE.
3. REMOVE ACCUMULATED SEDIMENT.

BakkenLink

TYPICAL CONSTRUCTION
STORM DRAIN INLET PROTECTION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 25	REV A



TRENCH & SPOIL SIDE TOPSOIL STRIPPING

NOT TO SCALE

NOTES:

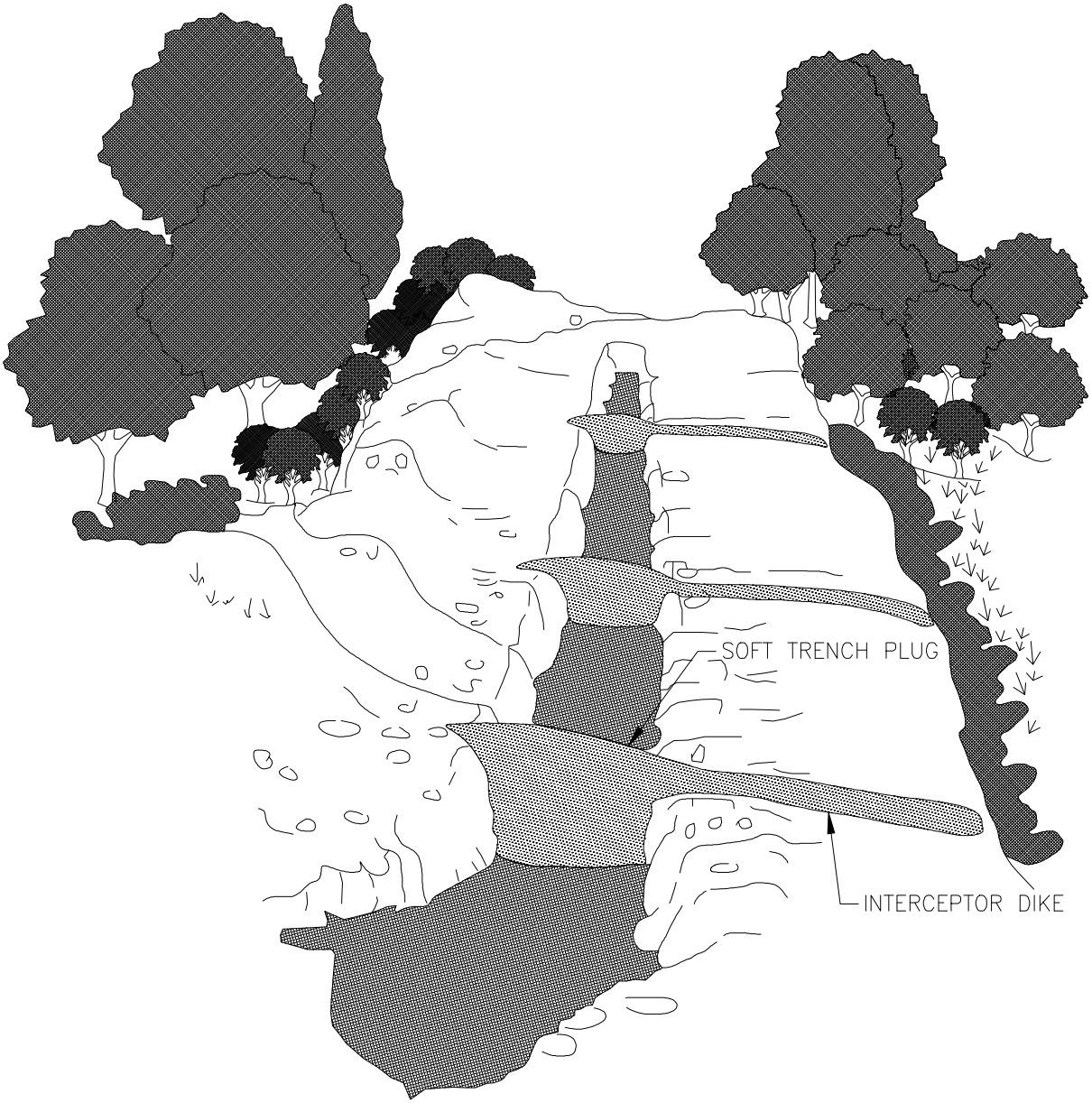
1. TOPSOIL MAY BE STORED IN LOCATIONS AS SHOWN ABOVE, OR AT OTHER COMPANY APPROVED LOCATIONS WITHIN THE CONSTRUCTION RIGHT-OF-WAY.

2. LEAVE GAPS IN SPOIL PILES FOR WATER RUN-OFF.

BakkenLink

TYPICAL CONSTRUCTION
TOPSOIL SEGREGATION TECHNIQUES

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 26	REV A



NOTES:

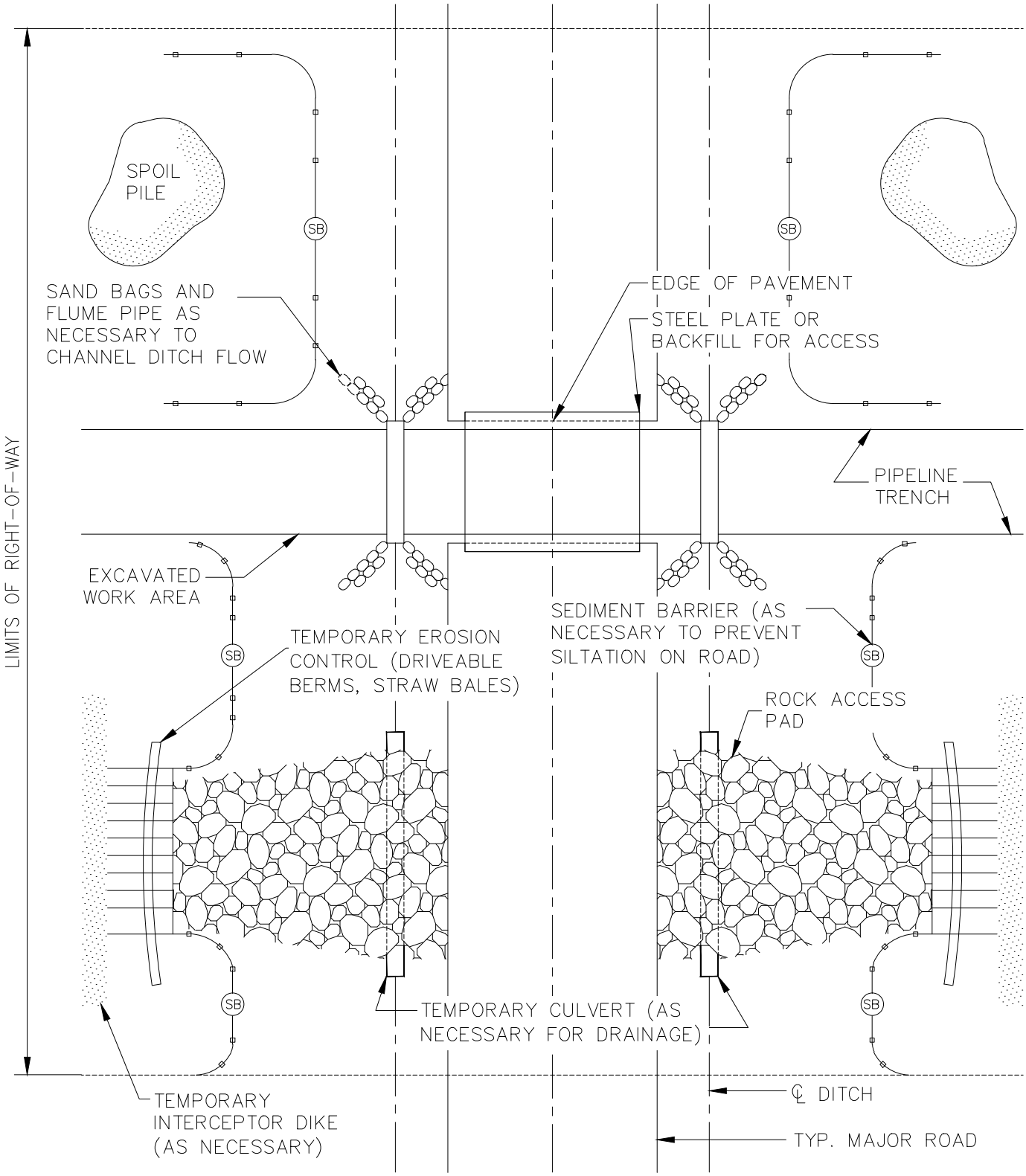
1. TEMPORARY TRENCH PLUGS MAY BE USED IN CONJUNCTION WITH INTERCEPTOR DIKES TO PREVENT WATER FROM OVERFLOWING INTO SENSITIVE RESOURCE AREAS.

2. DIVERT TRENCH OVERFLOW TO A WELL-VEGETATED OFF-RIGHT-OF-WAY LOCATION, OR INSTALL AN APPROPRIATE ENERGY DISSIPATING DEVICE.

BakkenLink

TYPICAL CONSTRUCTION
TEMPORARY TRENCH PLUGS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 27	REV A



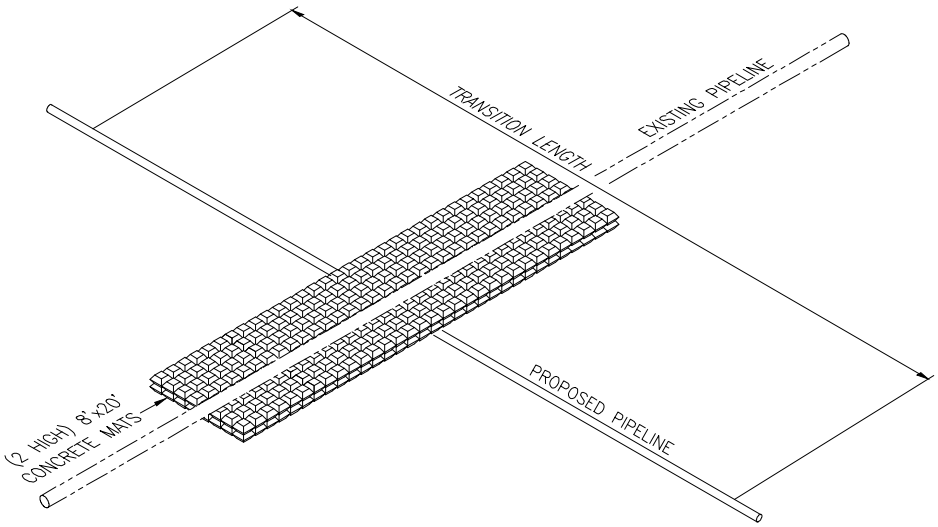
(SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES.

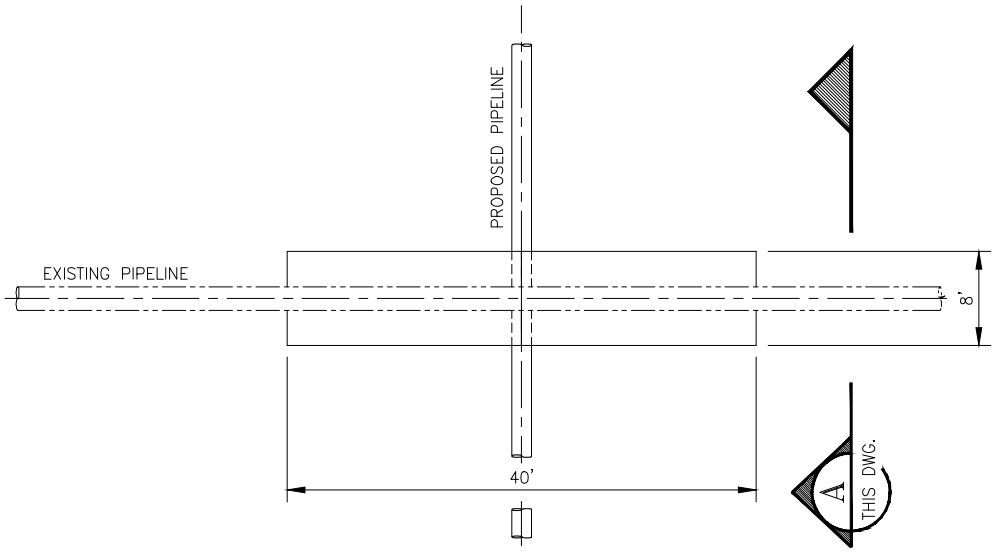
BakkenLink

TYPICAL CONSTRUCTION
PAVED ROAD CROSSING (OPEN CUT)

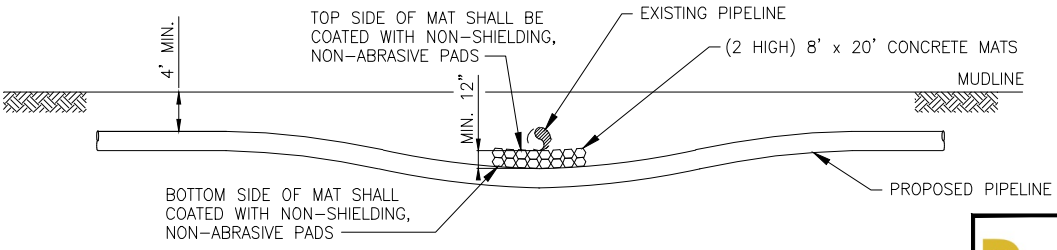
DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 28	REV A

TYP. PIPELINE CROSSING UNDER EXISTING PIPELINE





PLAN



SECTION A

SCALE: N.T.S.

THIS DWG.

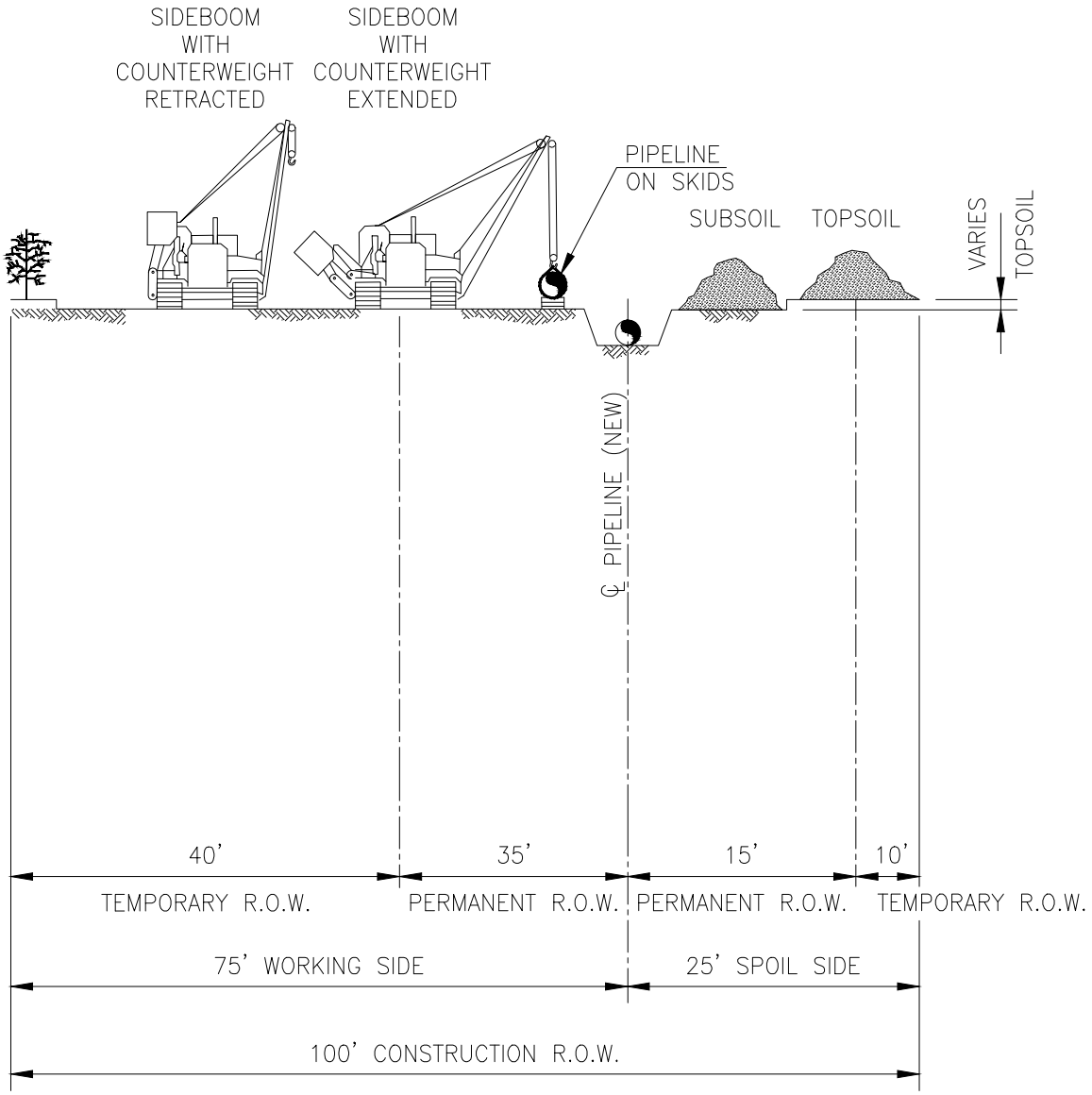
NOTES:

1. SAND/CEMENT BAGS MAY BE USED SEPARATELY OR IN COMBINATION WITH CONCRETE MATS TO ACHIEVE 18 INCH SEPARATION BETWEEN PIPELINES.
2. EDGES OF CONCRETE MATS SHALL BE BURIED BELOW MUDLINE.

BakkenLink

TYPICAL CONSTRUCTION
CROSSING UNDER EXISTING PIPELINE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 29	REV A



NOTES:

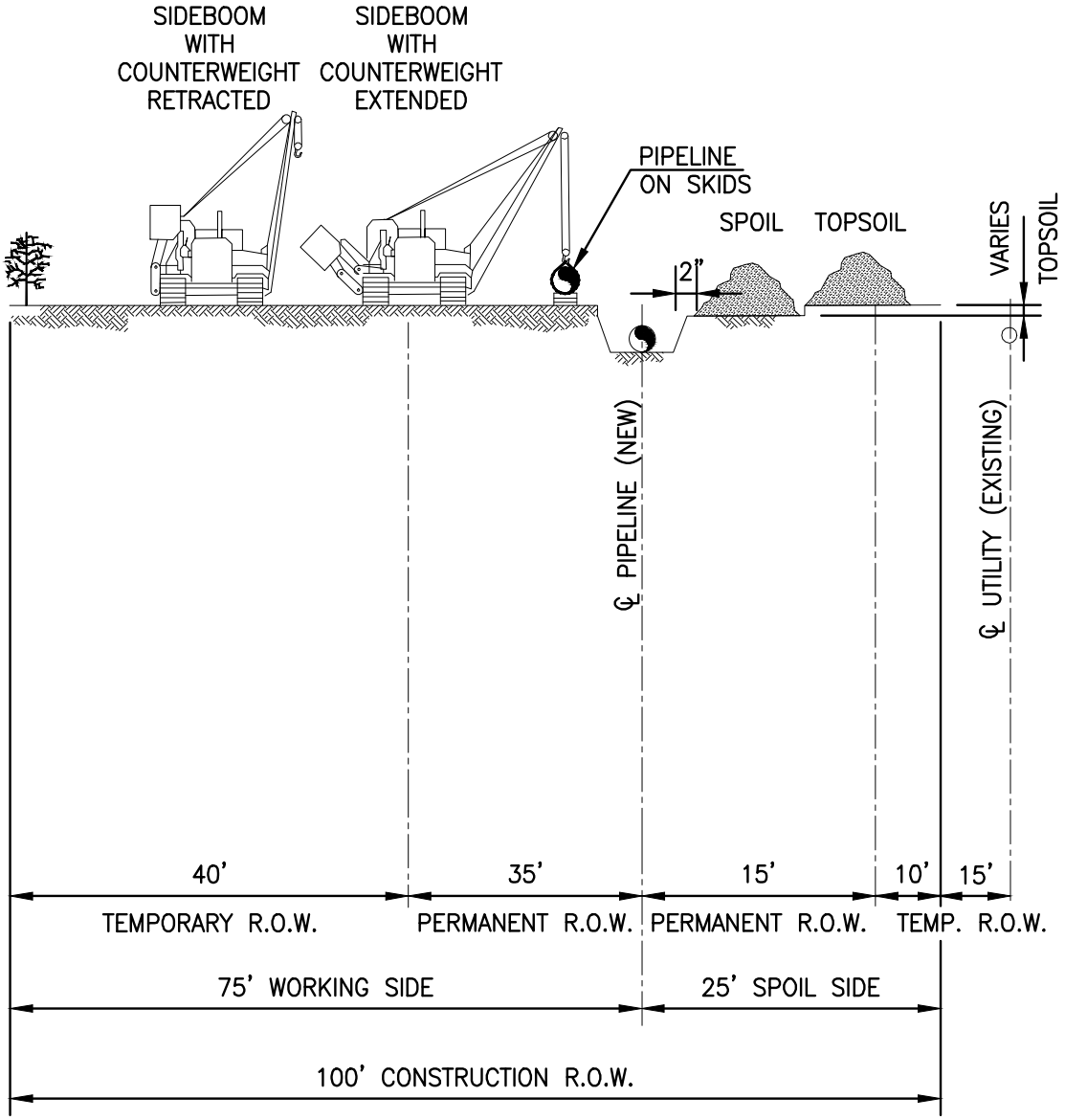
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 30	REV A



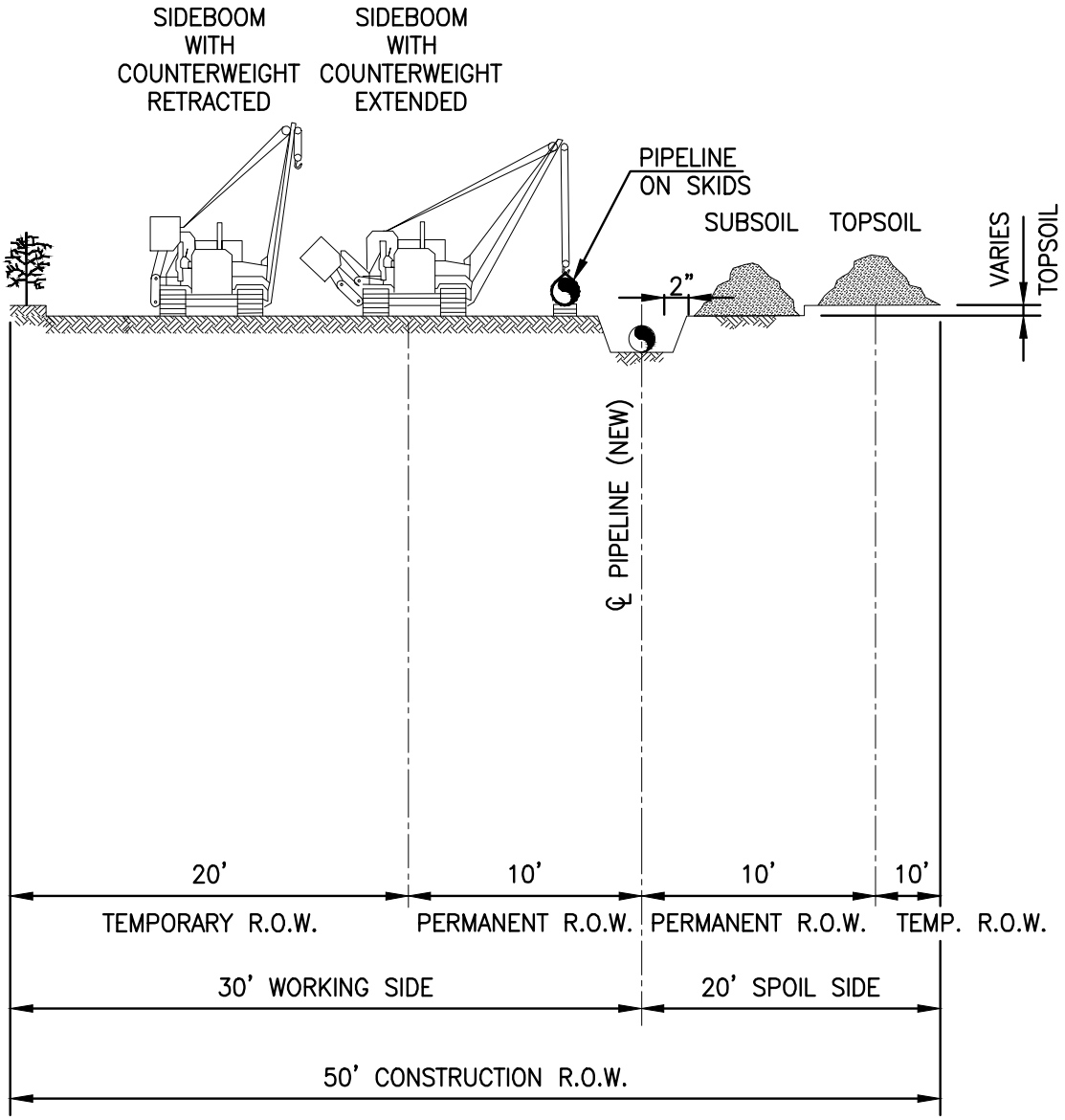
NOTES:

1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.
2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
RIGHT-OF-WAY
PARALLEL TO EXISTING UTILITIES

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 31	REV A



NOTES:

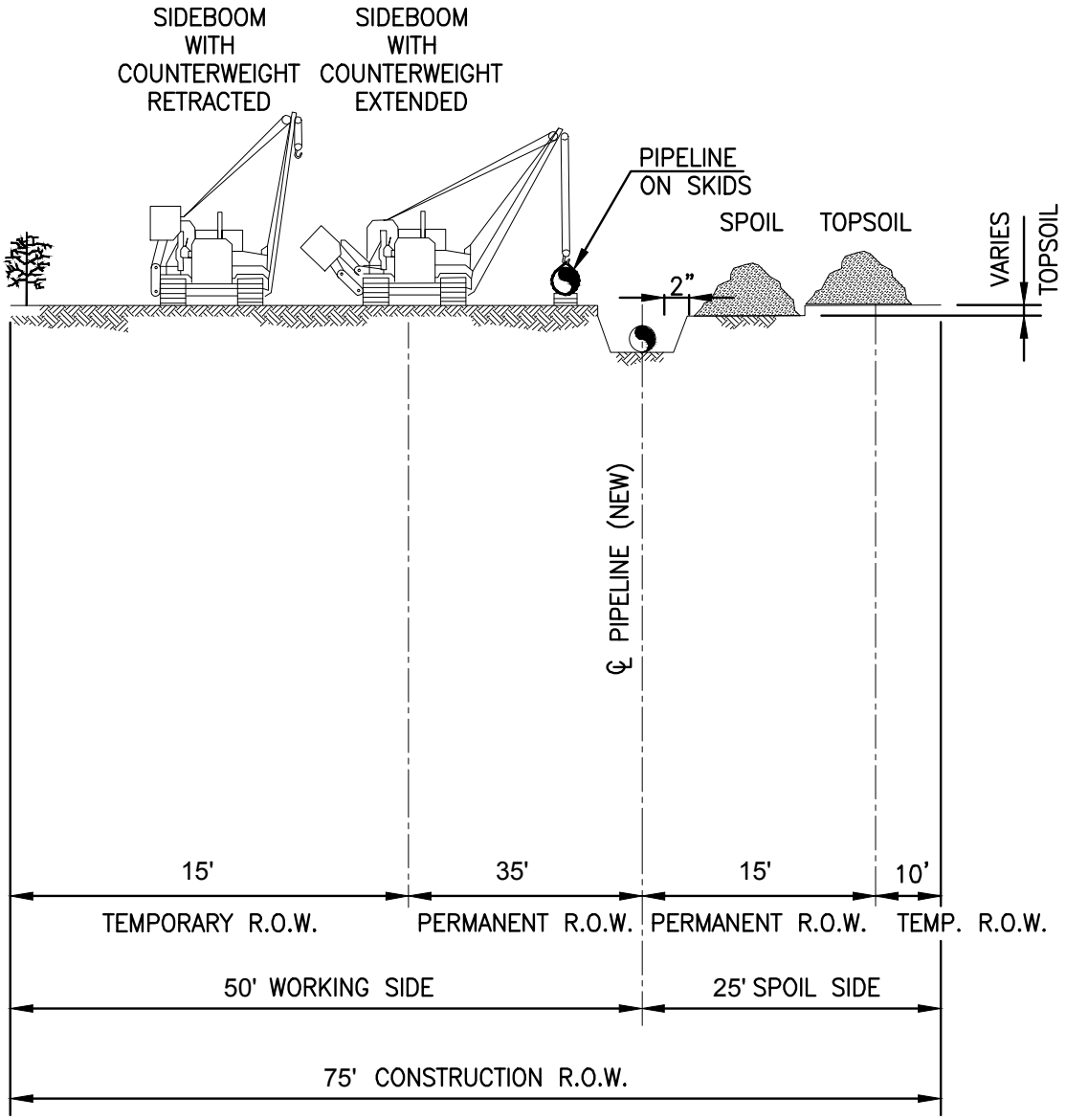
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE ENTIRE 50 FOOT R.O.W. (TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
RIGHT-OF-WAY
WITHIN FOREST SERVICE LANDS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 32	REV A



NOTES:

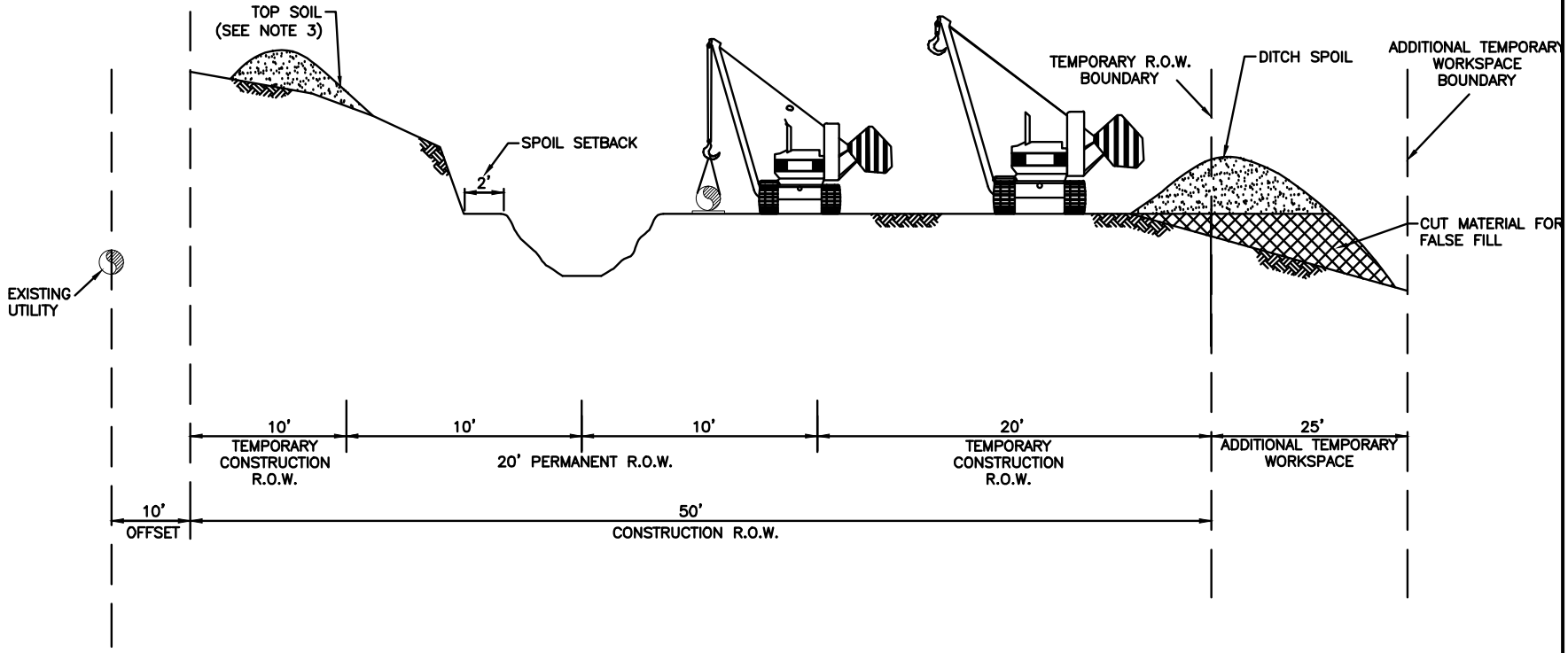
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY WITHIN WETLANDS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 33	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

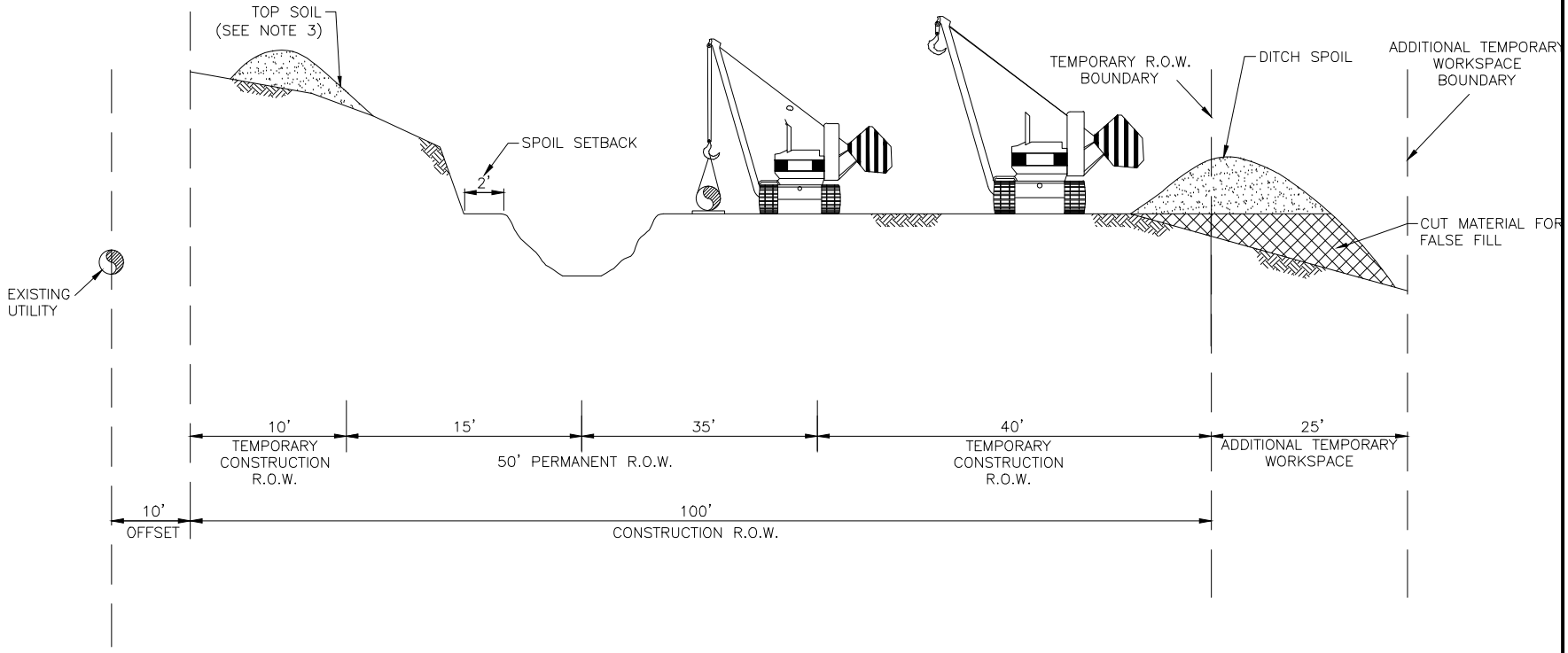
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 20 FEET OF PERMANENT EASEMENT, 30 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL SHALL BE STRIPPED AND SEGREGATED FROM THE ENTIRE 75 FOOT R.O.W.(TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
DOWNWARD SIDE SLOPE
WORKSPACE WITHIN FOREST SERVICE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 34	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

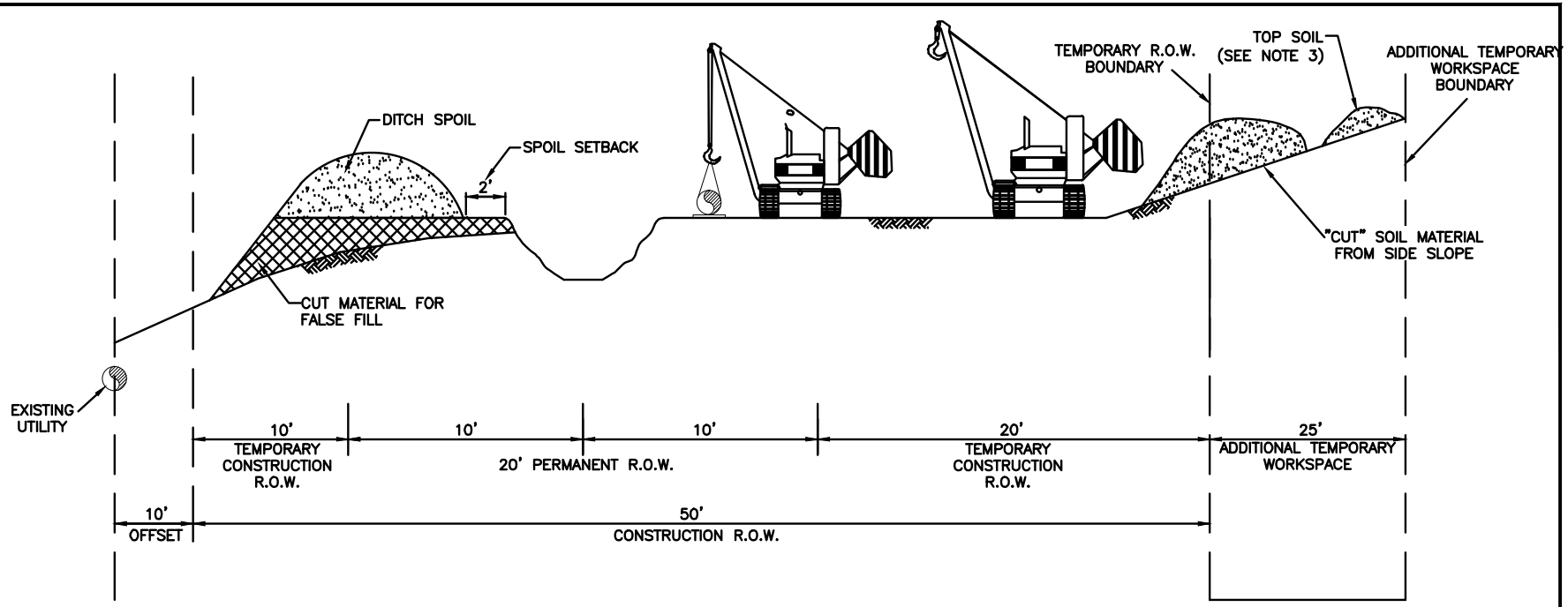
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 125 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT, 50 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
DOWNWARD SIDE SLOPE WORKSPACE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 35	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

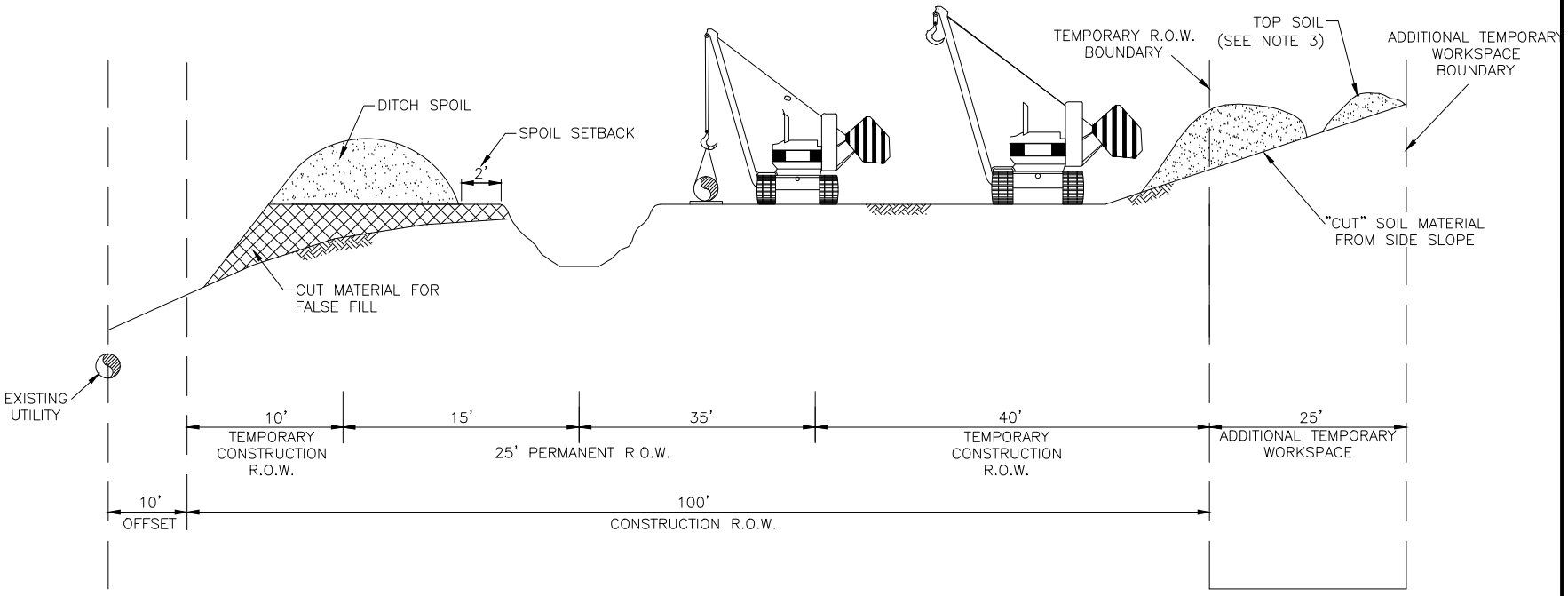
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 20 FEET OF PERMANENT EASEMENT, 30 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOL SHALL BE STRIPPED AND SEGREGATED FROM THE ENTIRE 75 FOOT R.O.W. (TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
UPWARD SIDE SLOPE WORKSPACE
WITHIN FOREST SERVICE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 36	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

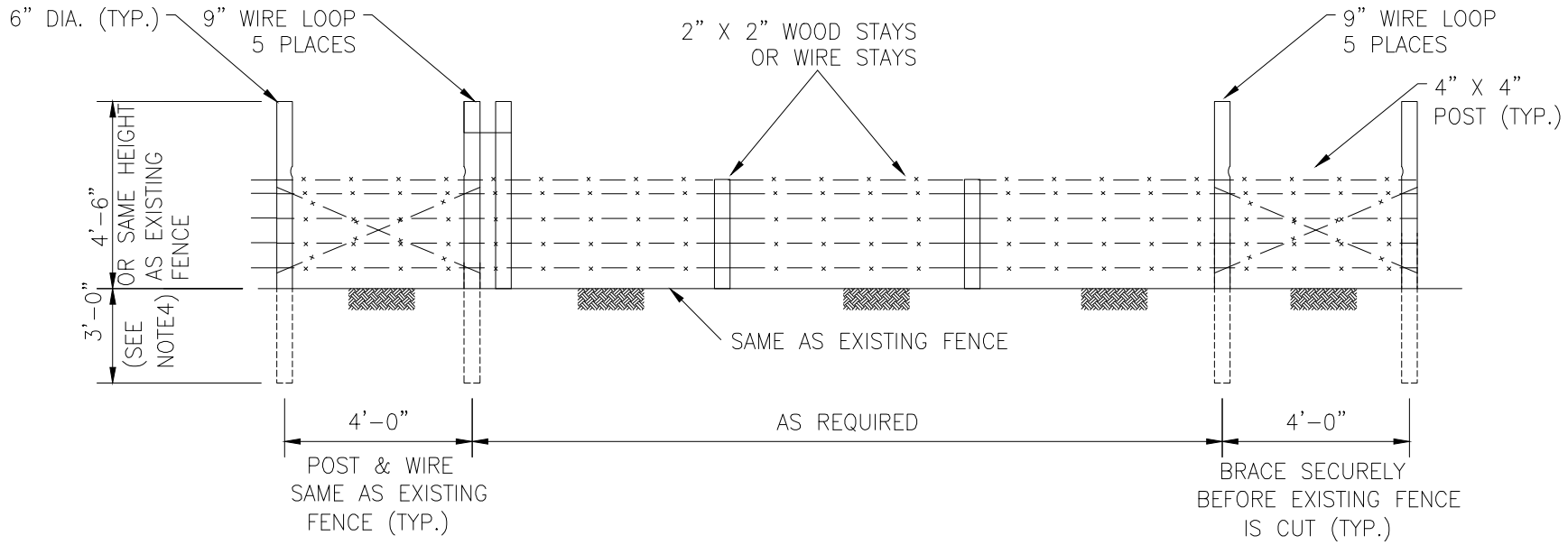
NOTES:

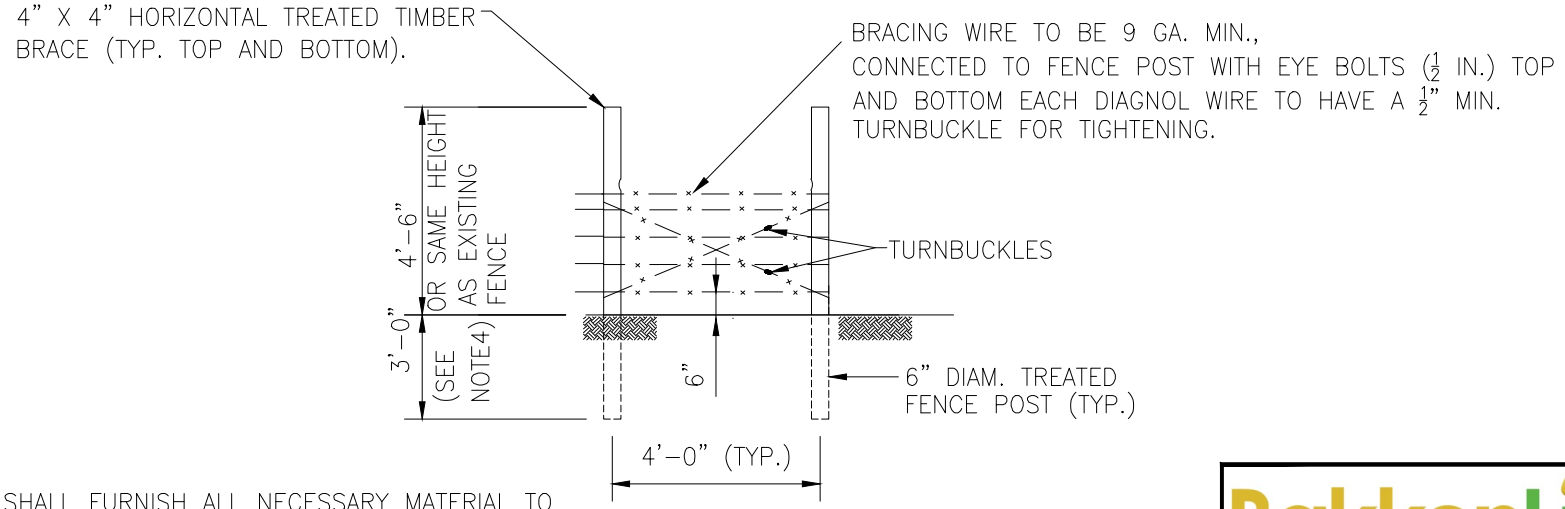
1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 125 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT, 50 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
UPWARD SIDE SLOPE WORKSPACE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 37	REV A





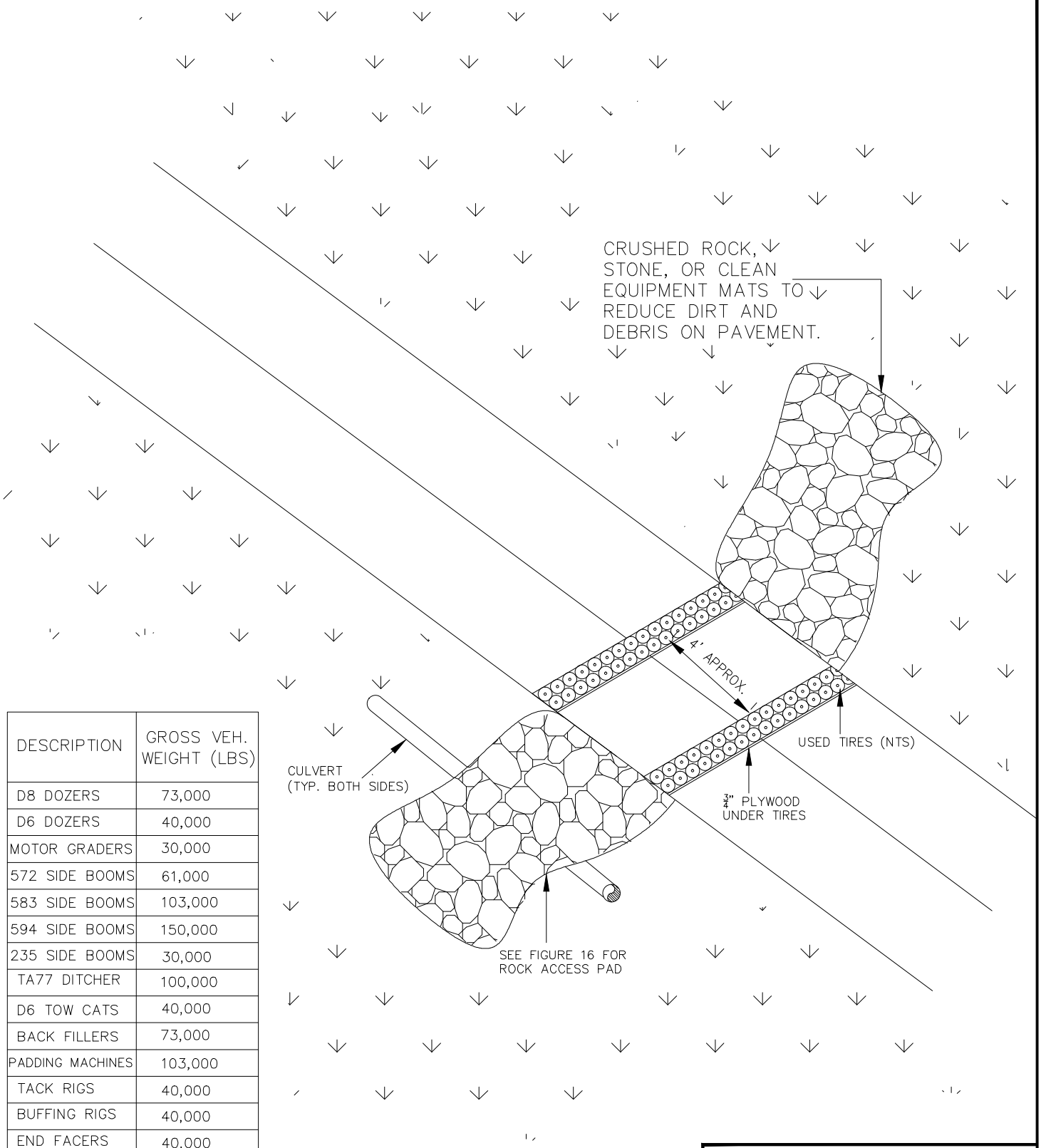
NOTES:

1. CONTRACTOR SHALL FURNISH ALL NECESSARY MATERIAL TO CONSTRUCT FENCE GATE TO MATCH EXISTING FENCE.
2. POSTS, WIRE AND OTHER MATERIAL SHALL BE SAME AS OR EQUIVALENT MATERIAL TO MATCH EXISTING.
3. BRACE SPAN TO BE CONSTRUCTED ON EACH SIDE OF PIPELINE RIGHT-OF-WAY, PRIOR TO INITIAL DISMANTLING OF FENCE.
4. ACTUAL DEPTH REQUIRED TO BE SET BY WHAT IS REQUIRED TO ACHIEVE A STABLE SUPPORT POST.
5. OFFSET METHOD TO BE USED FOR GATE AT CUTS.

BakkenLink

TYPICAL CONSTRUCTION
FENCE WITH TEMPORARY GATE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 38	REV A



DESCRIPTION	GROSS VEH. WEIGHT (LBS)
D8 DOZERS	73,000
D6 DOZERS	40,000
MOTOR GRADERS	30,000
572 SIDE BOOMS	61,000
583 SIDE BOOMS	103,000
594 SIDE BOOMS	150,000
235 SIDE BOOMS	30,000
TA77 DITCHER	100,000
D6 TOW CATS	40,000
BACK FILLERS	73,000
PADDING MACHINES	103,000
TACK RIGS	40,000
BUFFING RIGS	40,000
END FACERS	40,000

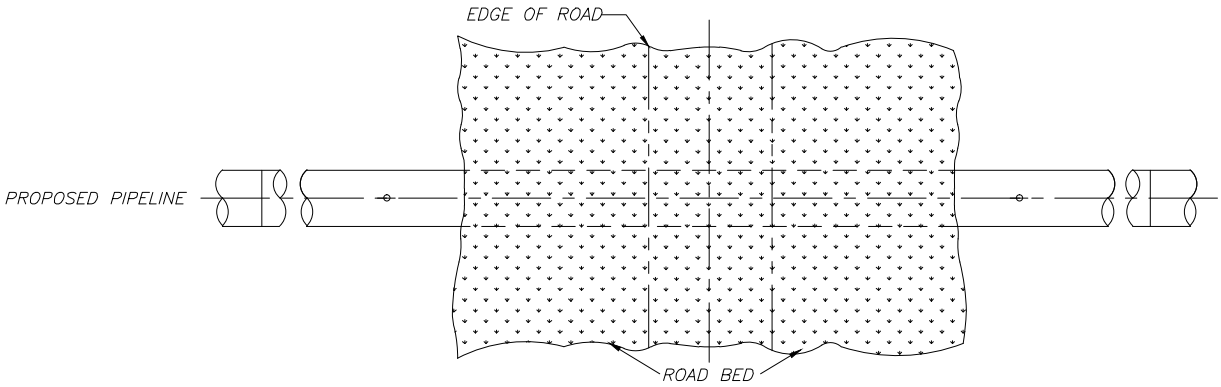
NOTES:

1. ACCESS PADS (ROCK) OR EQUIPMENT MATS MUST BE KEPT FREE OF DIRT AND DEBRIS TO KEEP ROADWAY CLEAN.
2. MATS, ROCK, PLYWOOD AND TIRES MUST BE COMPLETELY REMOVED AND SITE COMPLETELY RESTORED AFTER COMPLETION OF CONSTRUCTION ACTIVITY.
3. REMOVE TIRES AND PLYWOOD BETWEEN EQUIPMENT CROSSINGS ACROSS ROAD ONLY.

BakkenLink

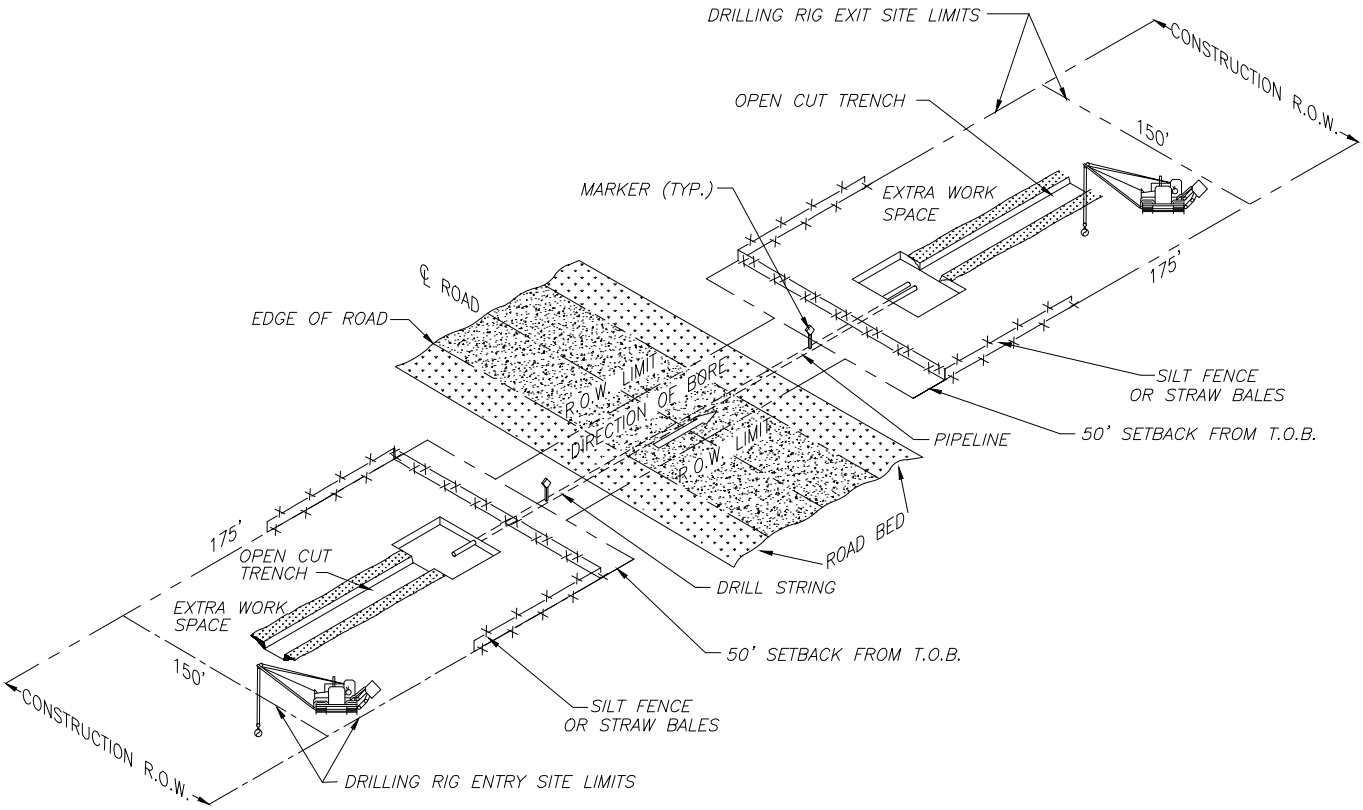
TYPICAL CONSTRUCTION TRACKED VEHICLE ROAD CROSSING TECHNIQUE AND PROCEDURE DETAILS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 39	REV A



PLAN VIEW

NOT TO SCALE



PLAN VIEW 'A'

NOT TO SCALE

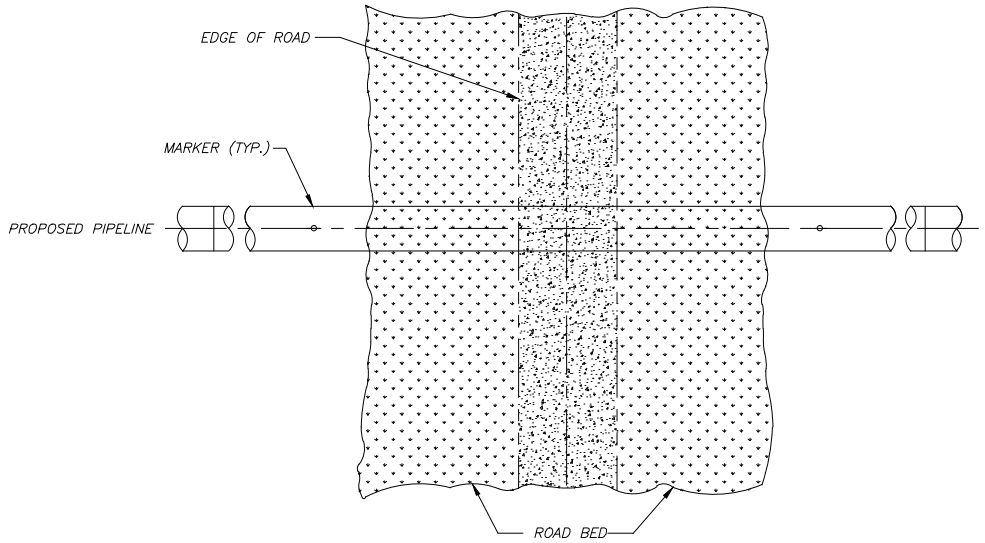
NOTES:

1. EXTRA WORK SPACE NOT LOCATED IN WETLAND WHEN POSSIBLE AND PRACTICAL.
2. RIGHT-OF-WAY LIMITS FOR WETLAND AND UPLAND ARE 100' AND 120' RESPECTIVELY.
3. WORK AREA WILL BE TEMPORARILY MATTED FOR MARSH AREAS.

BakkenLink

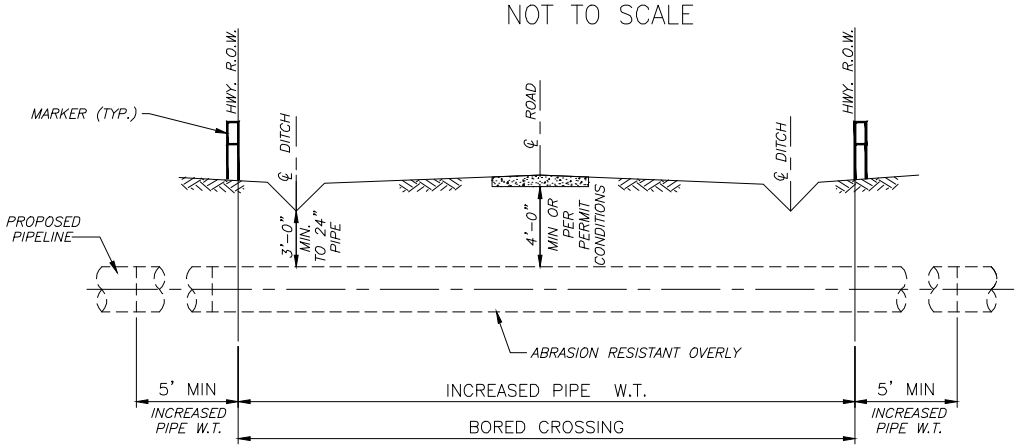
TYPICAL CONSTRUCTION
BORED ROAD CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 40-A	REV A



PLAN VIEW

NOT TO SCALE



PROFILE

NOT TO SCALE

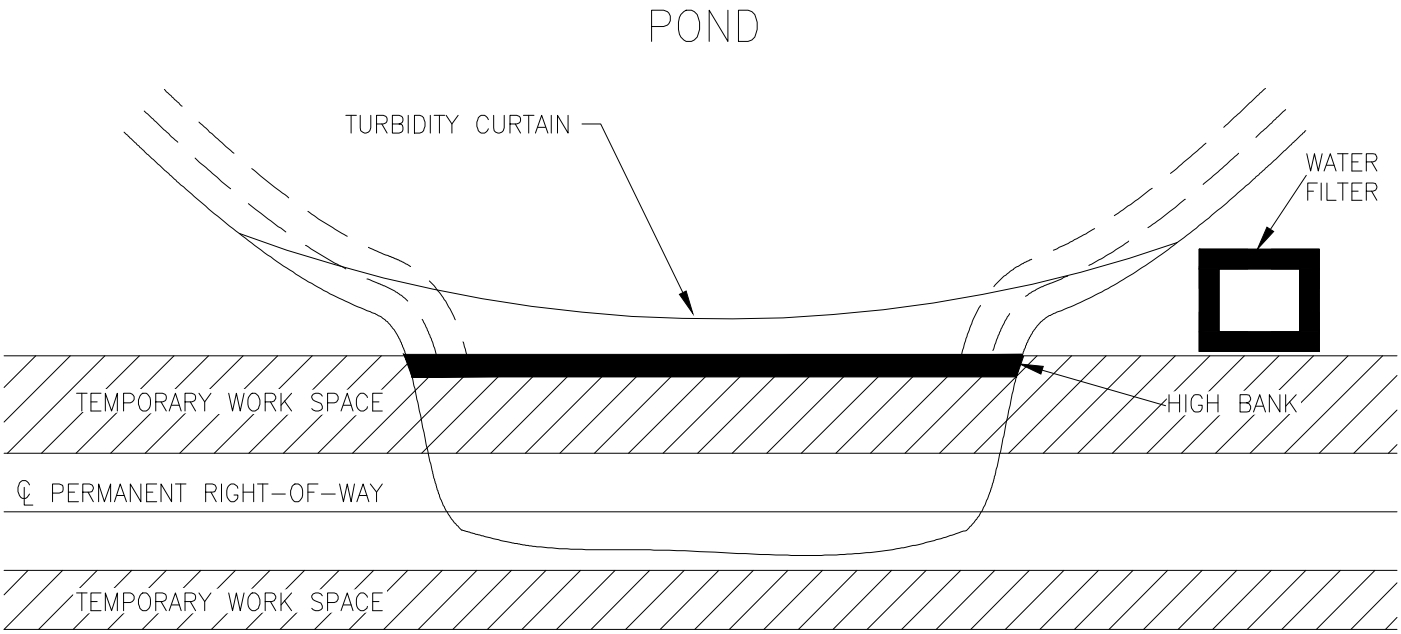
NOTES:

1. CROSSING INSTALLATION SHALL BE IN ACCORDANCE WITH APPLICABLE PERMIT.
2. BORED CROSSINGS SHALL BE ACCOMPLISHED VIA SLICK, HAMMER OR AUGER METHODS.
3. ALL CARRIER PIPE SHALL BE ERW, CARBON STEEL PIPE, EXTERNALLY COATED WITH FUSION BONDED EPOXY AND ABRASION RESISTANT OVERLAY.
4. ALL GIRTH WELDS SHALL BE INSPECTED PER API–1104 SPECIFICATIONS.
5. ALL LONGITUDINAL SEAMS SHALL BE MILL INSPECTED PER API–5L SPECIFICATIONS.
6. CARRIER PIPE DIAMETER, WALL THICKNESS, AND GRADE SHALL BE SPECIFIED ON THE ALIGNMENT SHEET DRAWINGS.
7. COMPANY SUPPLIED WARNING SIGNS SHALL BE INSTALLED.
8. USE OF BORE OR HDD CROSSING WILL BE DETERMINED UPON COMPLETION OF DETAIL SURVEY.

BakkenLink

TYPICAL CONSTRUCTION
BORED ROAD CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 40–B	REV A



PLAN

THE INITIAL APPROACH TO ANY POND CROSSING WILL BE ATTEMPT TO OBTAIN PERMISSION FROM THE LAND OWNER AND TO HAVE THE LAND OWNER LOWER THE POND WATER TABLE TO AN ELEVATION BELOW THE CONSTRUCTION WORK SPACE SO NORMAL PIPE LAY CAN BE CONDUCTED THROUGH THE AREA. IF AN AGREEMENT CANNOT BE REACHED. THE FOLLOWING METHOD WILL BE USED:

TYPICAL POND CROSSING WILL CONSIST OF THE INSTALLATION OF AN EARTH DAM OR PORTABLE WATER DAM TO BE INSTALLED FROM HIGH BANK TO HIGH BANK. A TURBIDITY CURTAIN WILL BE USED TO PREVENT SEDIMENTATION FROM SPREADING THROUGHOUT THE POND AREA. THE WATER WITHIN THE CONSTRUCTION WORK AREA WILL BE PUMPED OVER INTO A WATER FILTER STRUCTURE AND ALLOW TO FLOW NATURALLY BACK INTO POND. THE WATER TABLE WITHIN THE WORK AREA WILL BE LOWERED TO A SAFE WORKING ELEVATION. ONCE PIPELINE INSTALLATION IS COMPLETE, ALL DAM MATERIAL WILL BE REMOVED AND POND RESTORED TO ITS PREVIOUS WATER TABLE ELEVATION AND CONDITIONS.

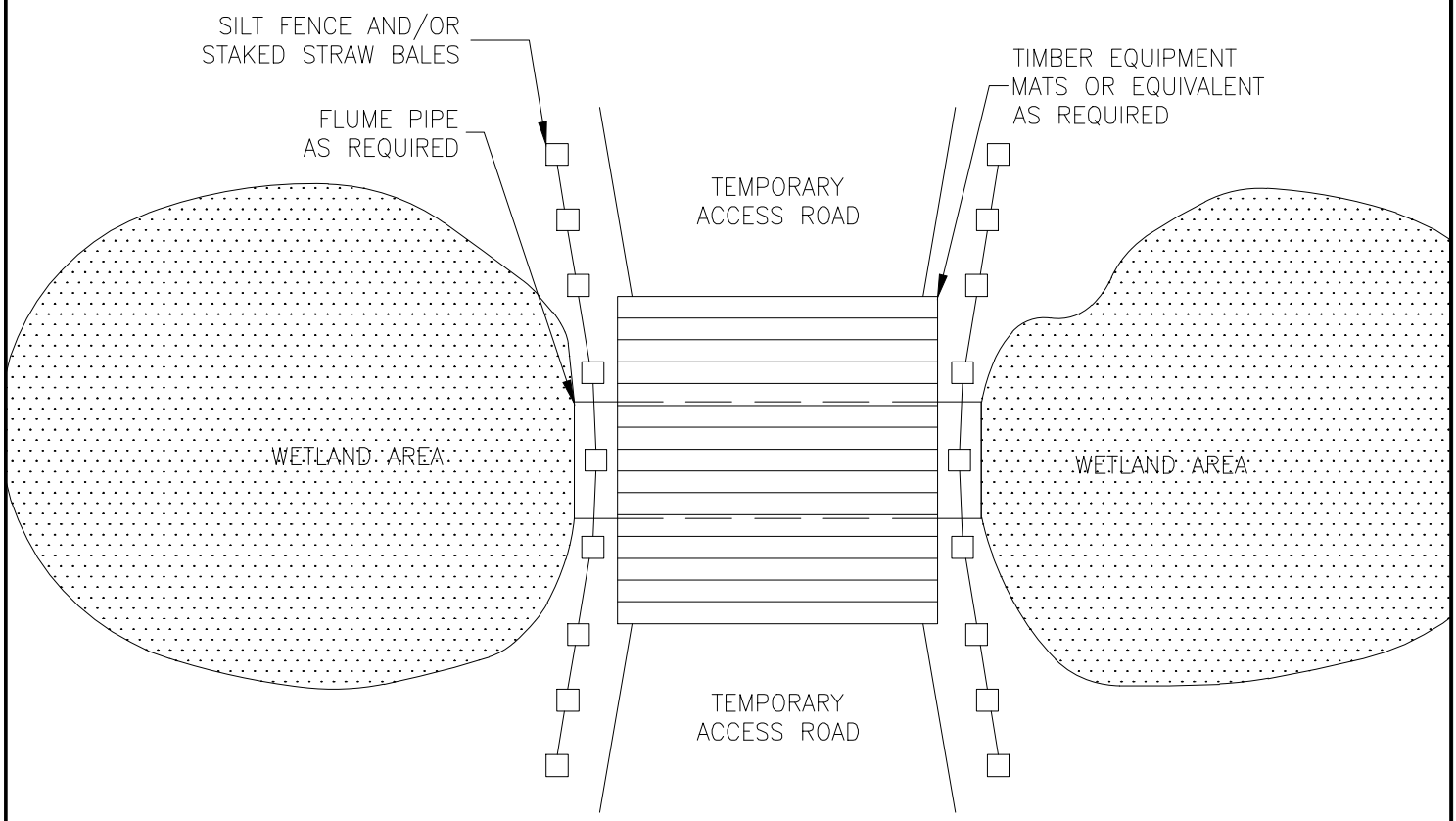
NOTES:

1. CONSTRUCT EARTH OR PORTABLE WATER DAM.
2. INSTALL TURBIDITY CURTAIN.
3. PUMP WATER OUT OF WORKSPACE INTO WATER FILTER STRUCTURE.
4. TURBIDITY CURTAIN AND WATER FILTER AREA WILL BE AGREED UPON BY LANDOWNER.

BakkenLink

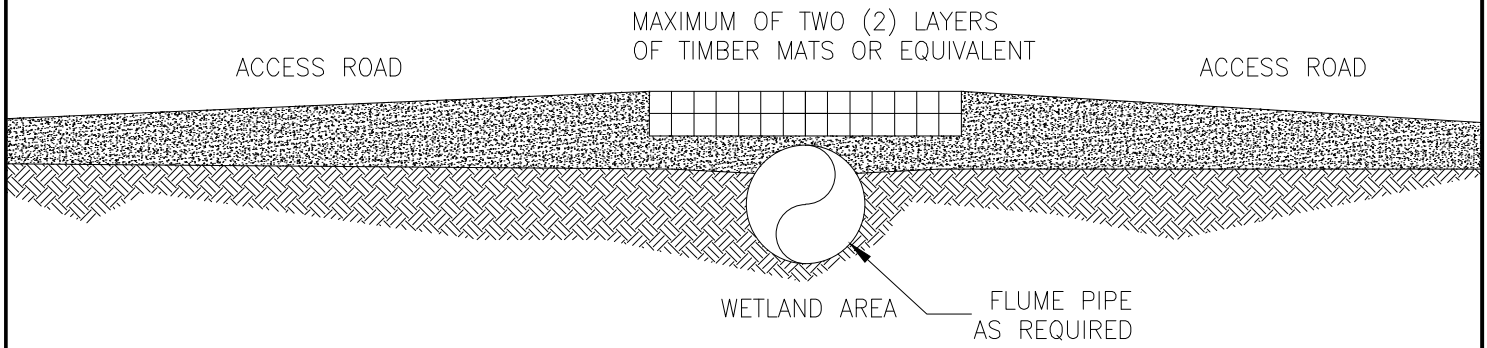
TYPICAL CONSTRUCTION FOR POND ENCROACHMENT

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 41	REV A



PLAN VIEW

NOT TO SCALE



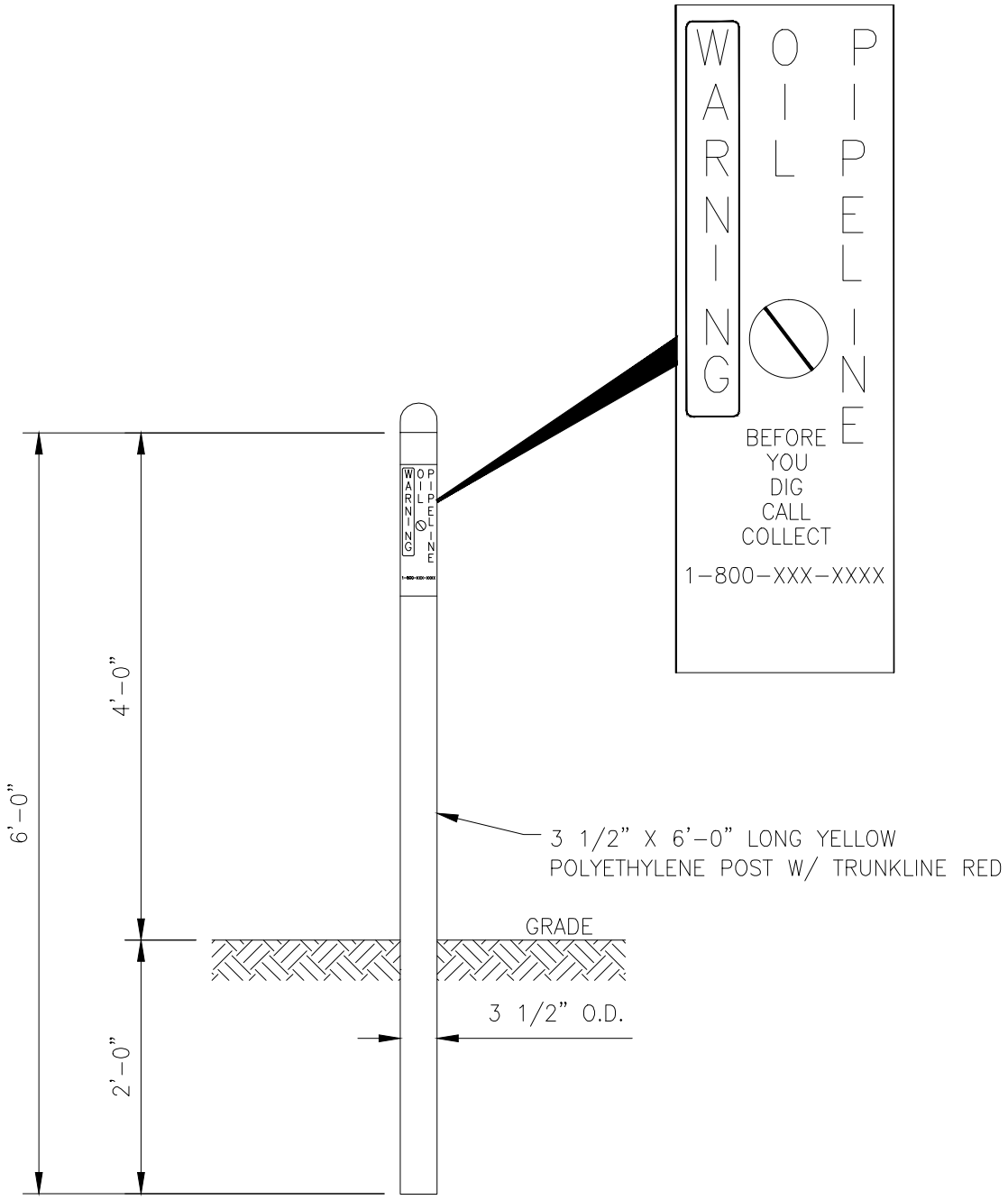
CROSS SECTION

NOT TO SCALE

BakkenLink

TYPICAL CONSTRUCTION
WETLANDS ACCESS ROAD

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 42	REV A



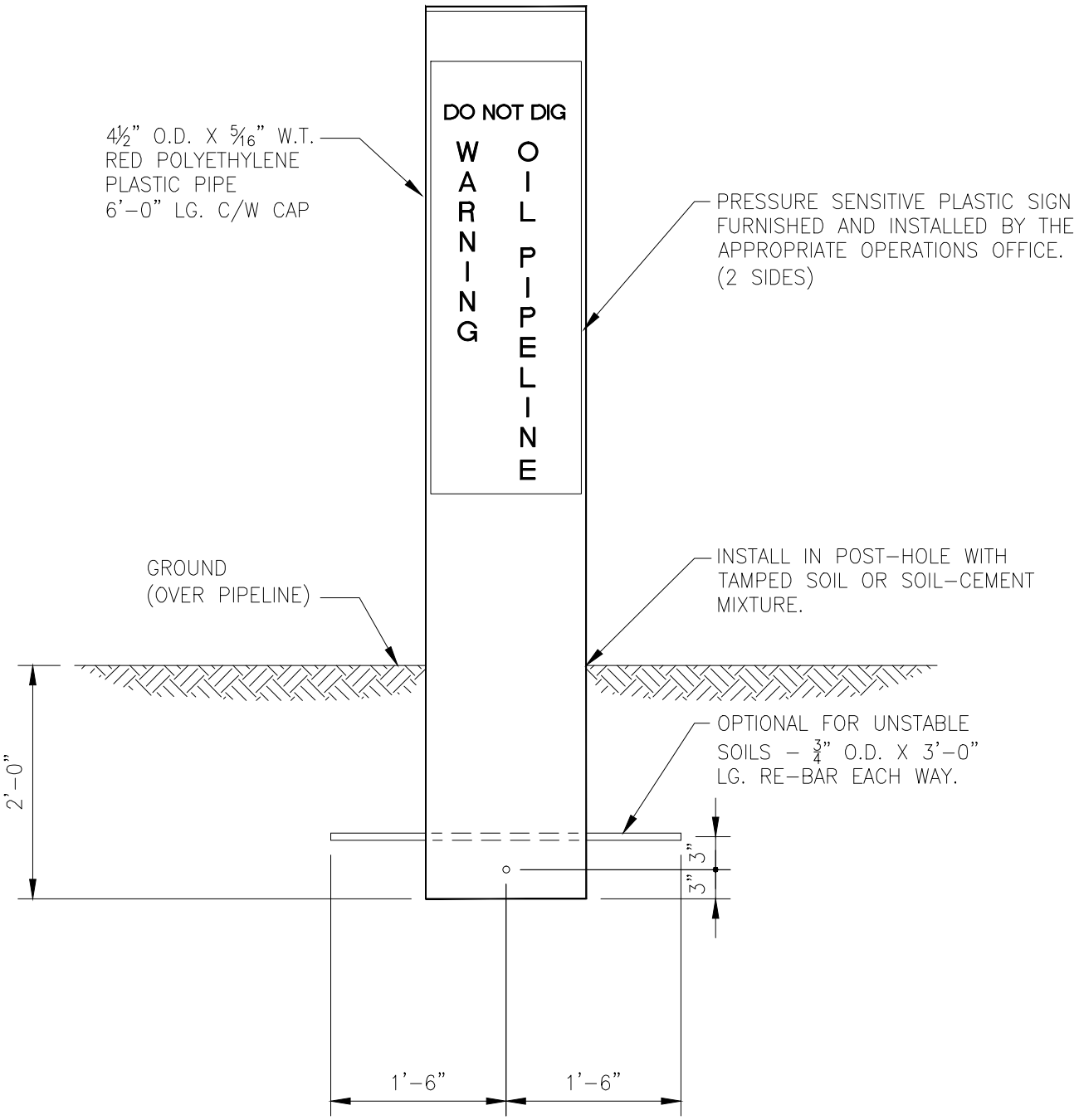
ELEVATION

PIPELINE MARKER TYPE 1

BakkenLink

TYPICAL CONSTRUCTION
PIPELINE MARKER TYPE 1

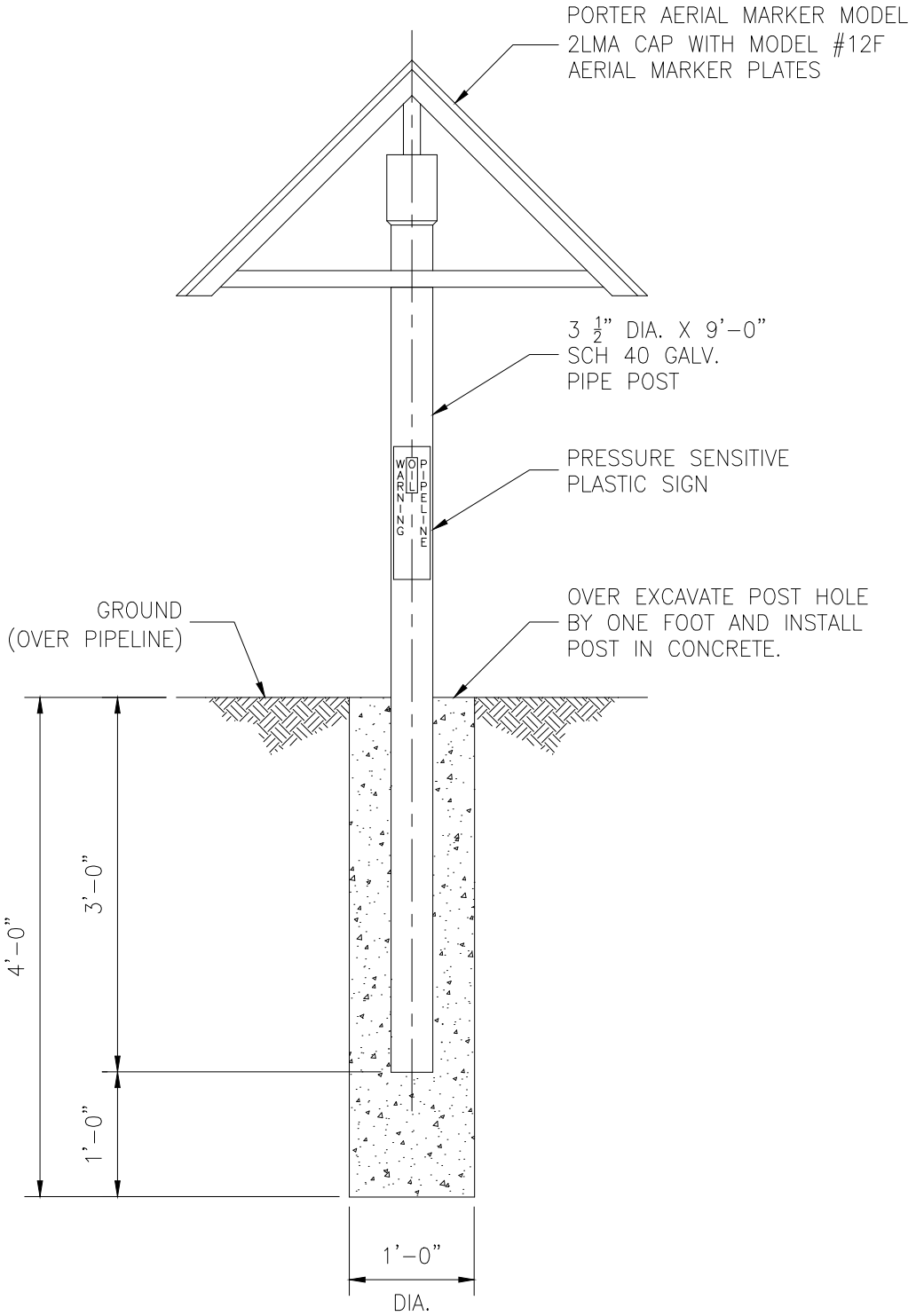
DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 43	REV A



BakkenLink

TYPICAL CONSTRUCTION
PIPELINE MARKER TYPE 2

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 44	REV A



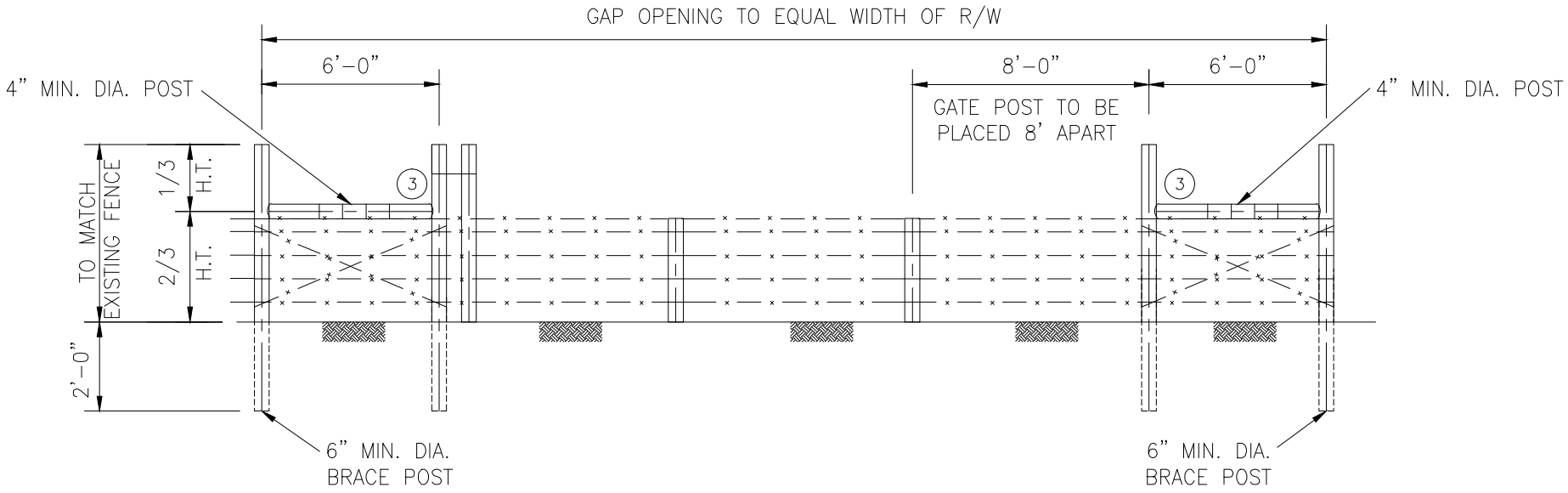
NOTES:

1. AERIAL MARKERS SHALL BE LOCATED AS DIRECTED BY INSPECTOR.

BakkenLink

TYPICAL CONSTRUCTION
PIPELINE AERIAL MARKER

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 45	REV A



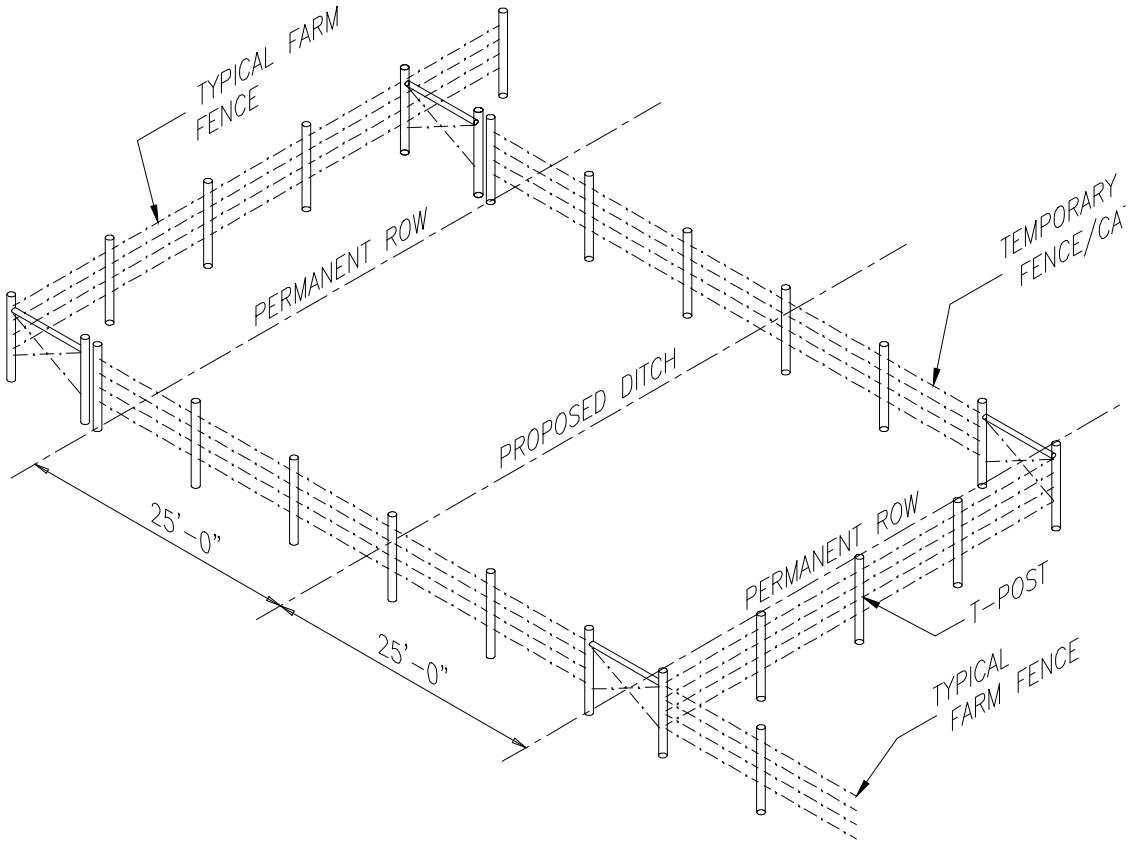
NOTES:

1. INSTALL BRACE POSTS AND SECURE FENCE BEFORE CUTTING EXISTING WIRES. REPLACEMENT FENCE TO BE EQUAL OR BETTER THAN EXISTING FENCE. ALL POST AND WIRE TO BE FURNISHED AND INSTALLED BY CONTRACTOR.
2. ALL POST TO BE ROUND WOODEN POSTS, CUT AND MANUFACTURED FROM LIVE, SOUND, AND GROWING TREES AND SHALL BE SOUTHERN YELLOW PINE, RED (NORWAY) PINE, WHITE PINE, OR JACK PINE, PRESSURE TREATED WITH PENTACHLOROPHENOL PRESERVATIVE. UNTREATED CEDAR POSTS MAY BE USED.
3. CATCH OFF OF FENCE STRETCHER TO BE PLACED THIS SIDE OF BRACE POST BEFORE CUTTING FENCE WIRE. CUT WIRE TO BE SECURED TO BRACE POST BY WRAPPING AROUND POST.

BakkenLink

TYPICAL CONSTRUCTION
FENCE BRACE POST DETAIL

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 46	REV A



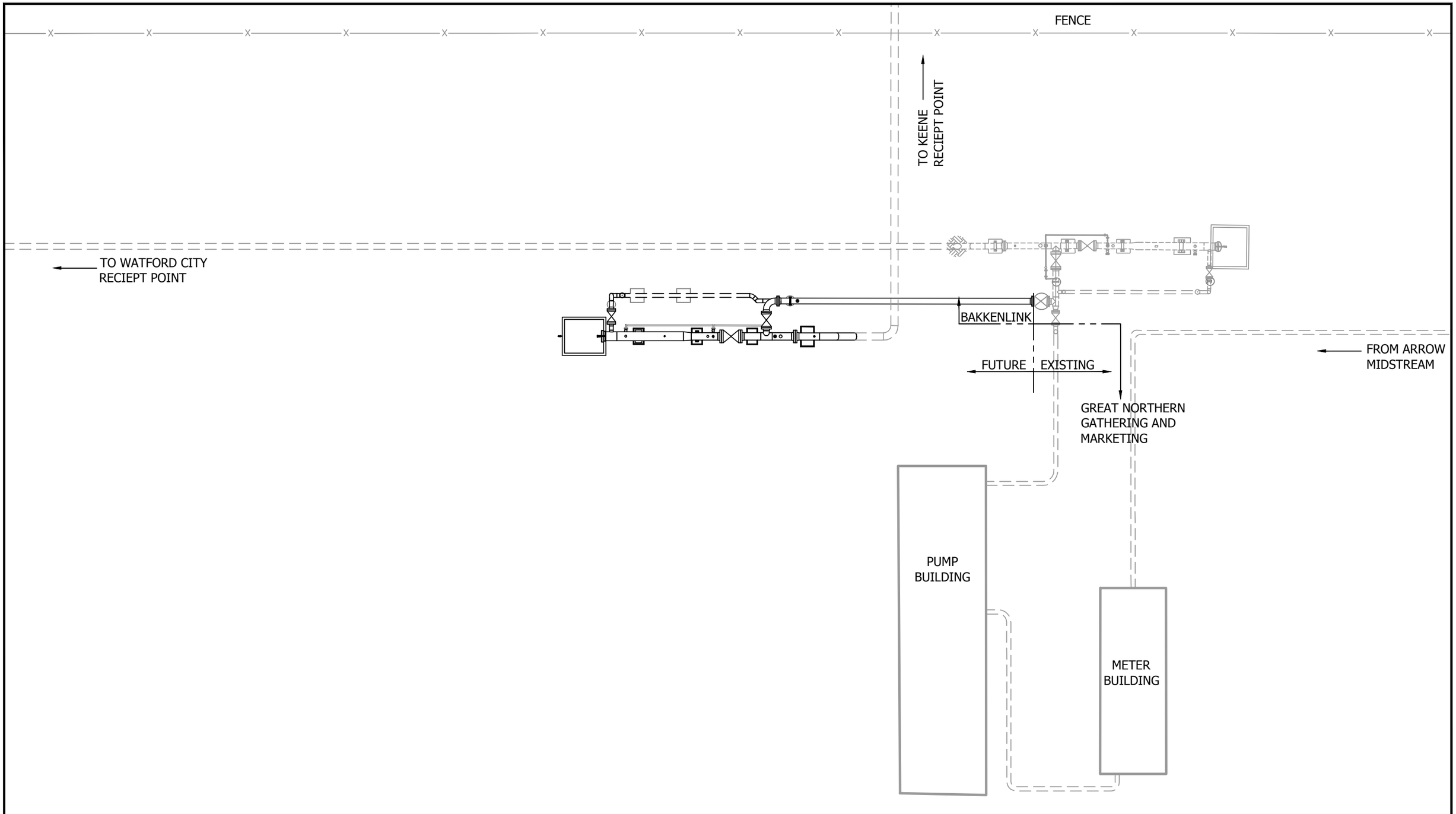
BakkenLink

TYPICAL CONSTRUCTION
TEMPORARY FENCE ALONG R.O.W.

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 47	REV A

Appendix IV

Dry Creek Terminal Connect Detail



#	DATE	REVISIONS	BY

GREAT NORTHERN GATHERING AND MARKETING

DRY CREEK INTERCONNECT SITE PLAN

BARTLETT & WEST
3456 E CENTURY AVENUE • BISMARCK ND 58503
PHONE 701.258.1110 • FAX 701.258.1111
WWW.BARTWEST.COM

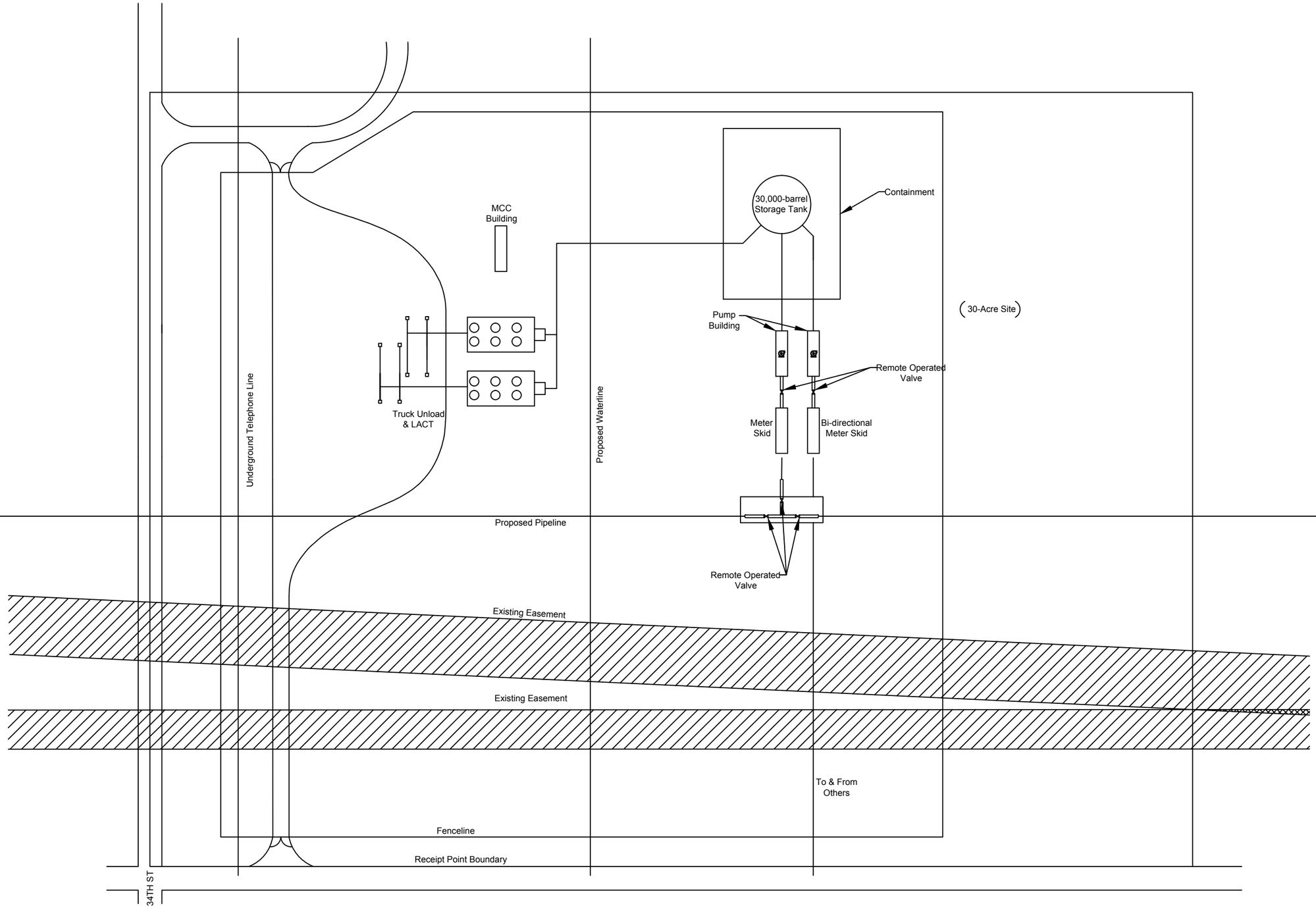
DESIGNED BY: .	PROJ NO: 16853.001
DRAWN BY: .	CONST PROJ: SITE PLAN
CHECKED BY: .	SCALE:
PROJECT ENGR: .	DATE: 2/7/2014

DRAWING NO: .

SHEET NO: XX OF XX

Appendix V

Keene Receipt Point Connect Detail



REVISIONS			
NO.	DATE	BY	DESCRIPTION

DRWN. BY: DJC
CHK'D BY:
PROJECT NO.: 016853.200
DATE: 05/27/2014

Scale Ratio 1:1500
0 25' 50' 100'

Keene Receipt Point
Portion of the SE 1/4 of the SE 1/4 of
S 12, T 151 N, R 96 W
McKenzie County, ND

SHEET NO.: 1 of 1

BakkenLink

BakkenLink Pipeline, LLC
2101 46th Ave SE, Suite 2
Mandan, ND 58503

BILL OF MATERIALS

ITEM		QTY.

NOTES
1. THIS IS NOT A SURVEY DOCUMENT. SURVEY DATA PROVIDED BY BARTLETT & WEST, INC.

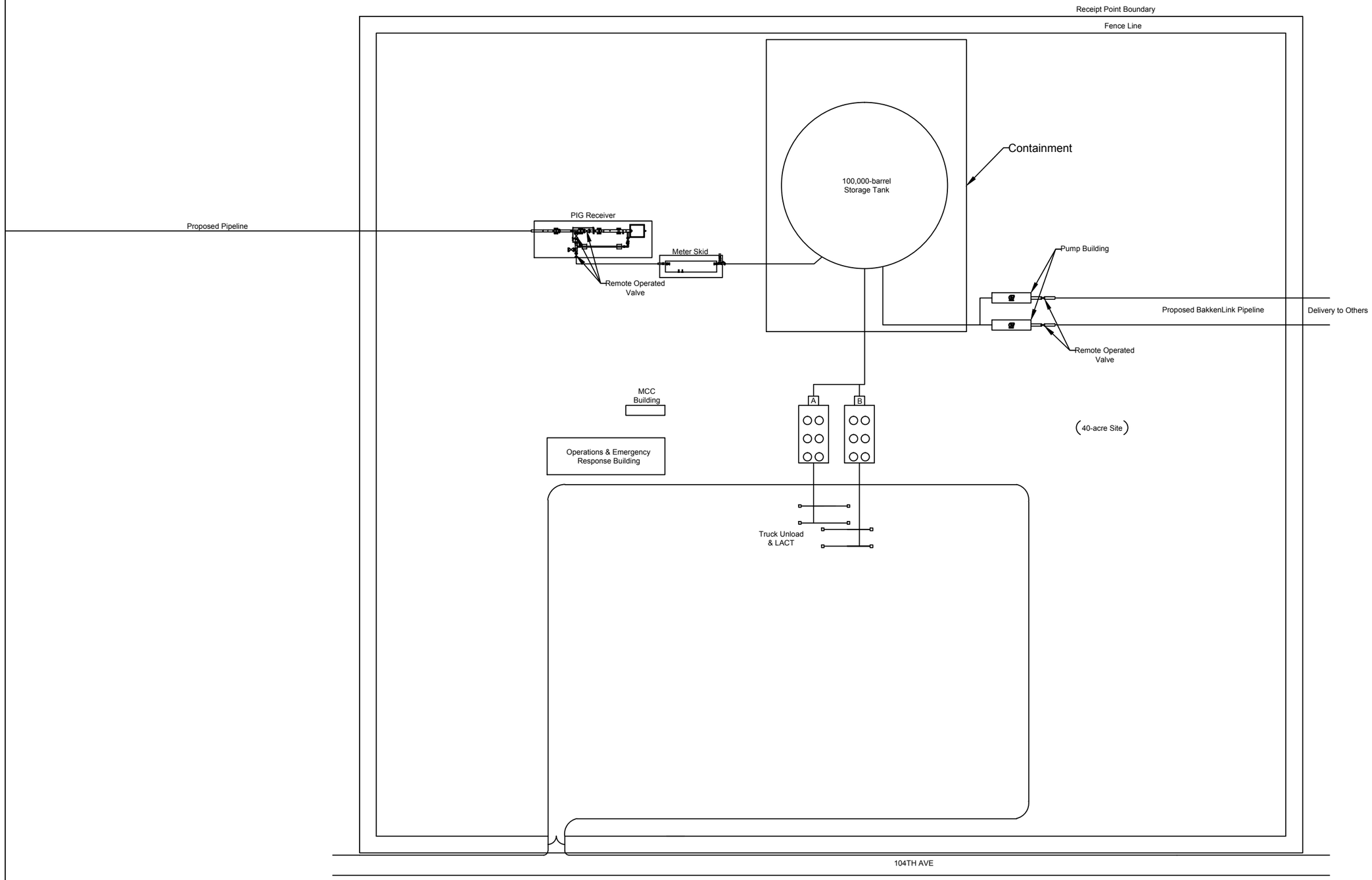
LEGEND

BARTLETT & WEST

3456 Century Ave.
Bismarck, ND 58503

Appendix VI

Beaver Lodge Connect Detail



REVISIONS			
NO.	DATE	BY	DESCRIPTION

DRWN. BY: DJC
CHK'D BY:
PROJECT NO.: 016853.200
DATE: 05/27/2014

Scale Ratio 1:1750
0 25' 50' 100'

Beaver Lodge Receipt Point
SE 1/4 of the NE 1/4 of S 31,
T 156 N, R 95 W
Williams County, ND

SHEET NO.: 1 of 1

BakkenLink

BakkenLink Pipeline, LLC
2101 46th Ave SE, Suite 2
Mandan, ND 58503

BILL OF MATERIALS

ITEM	QTY

NOTES

1. THIS IS NOT A SURVEY DOCUMENT. SURVEY DATA PROVIDED BY BARTLETT & WEST, INC.

LEGEND

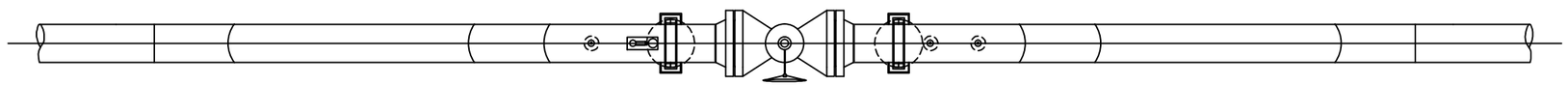
BARTLETT & WEST

3456 Century Ave.
Bismarck, ND 58503

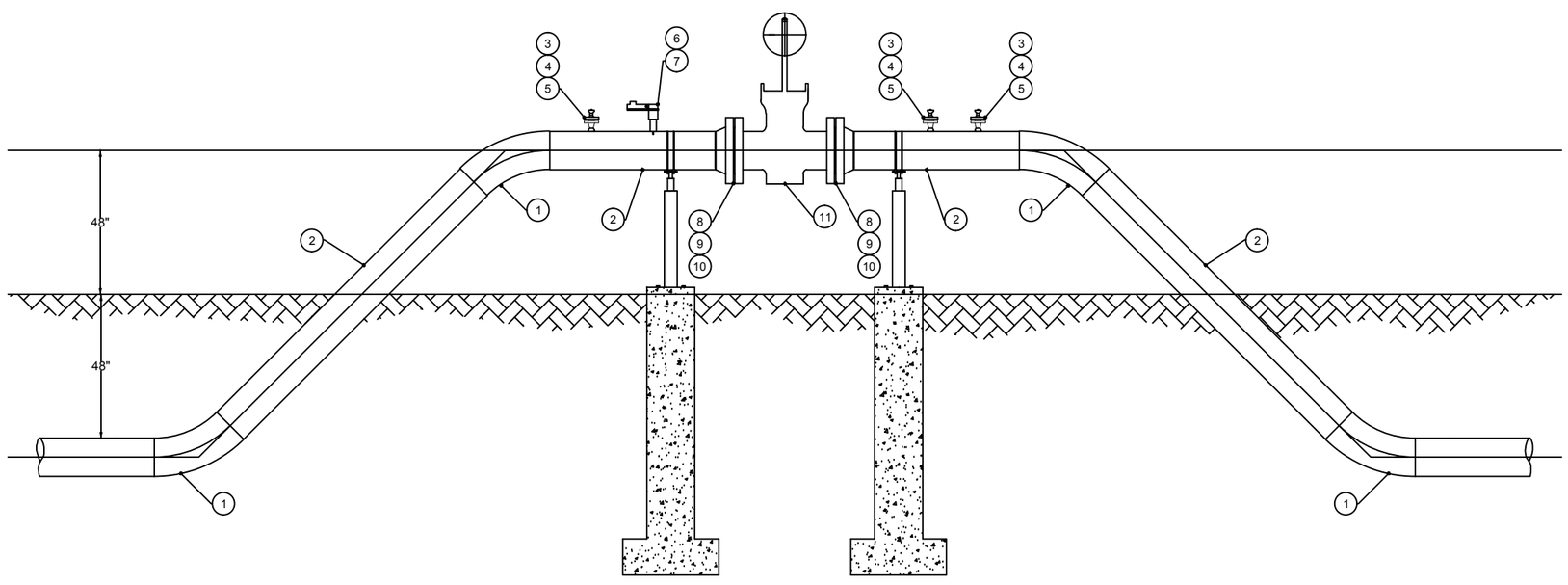
Appendix VII

Mainline Valve Typical Site

PLAN



PROFILE



REVISIONS			
NO.	DATE	BY	DESCRIPTION

DRWN. BY: DJC

CHK'D BY:

PROJECT NO.: 016853.300

DATE: 00/00/0000

Scale $\frac{1}{4}$" = 1'

Typical Main Line Valve Site

SHEET NO.: 1 of 1

BakkenLink

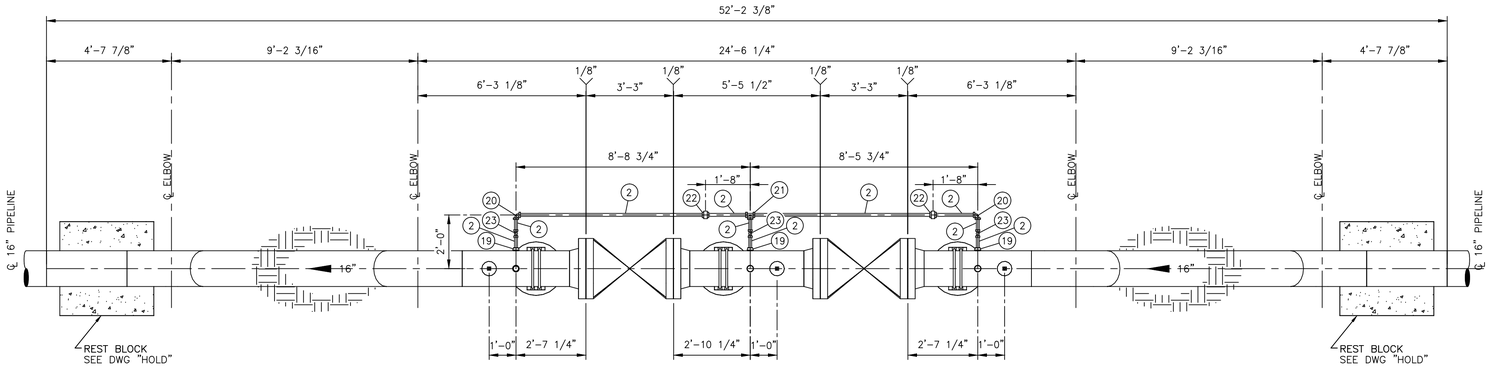
BakkenLink Pipeline, LLC
2101 46th Ave SE, Suite 2
Mandan, ND 58503

NOTES

LEGEND

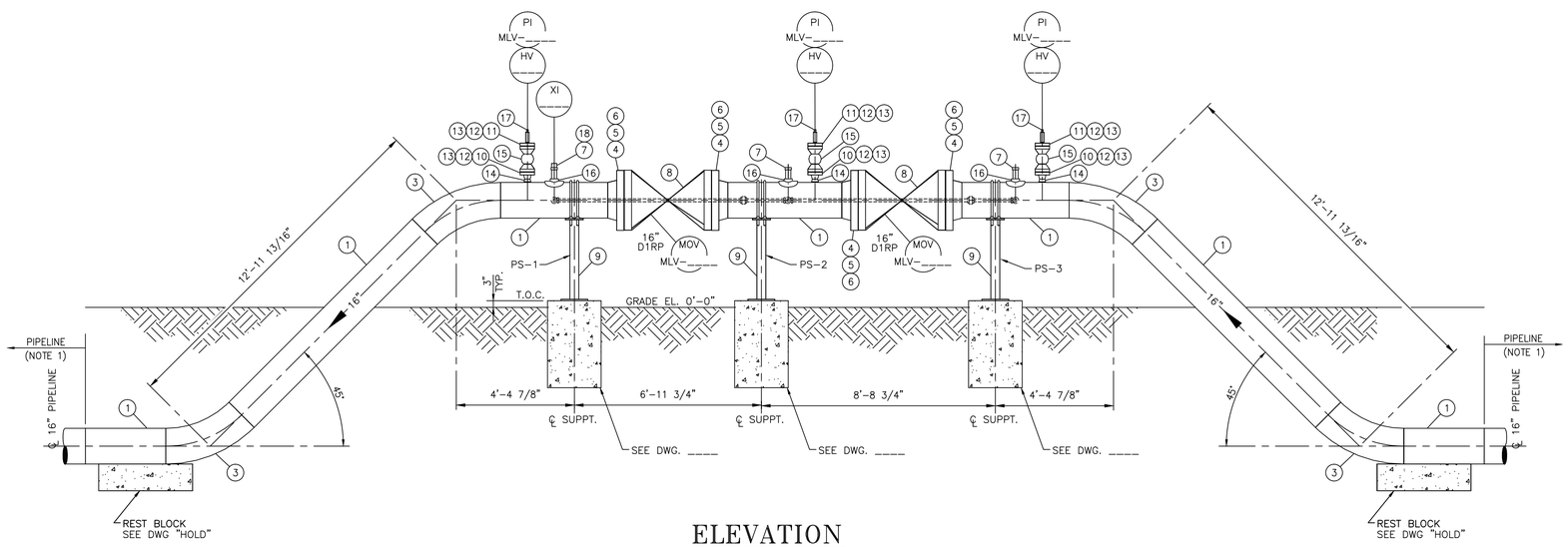
BARTLETT & WEST

3456 Century Ave.
Bismarck, ND 58503



PLAN

SCALE: 3/8" =1'-0"



ELEVATION

SCALE: 3/8" =1'-0"

BILL OF MATERIALS

ITEM	QTY	UNITS	DESCRIPTION
1	38	LF	PIPE, 16.000" O.D. X 0.500" W.T., API 5L X-60
2	20	LF	PIPE, 1.315" O.D. X 0.250" W.T., ASTM A-106
3	4	LF	ELBOW, WELD, 16.00" O.D. X 0.500" W.T., 45 DEGREE, 3R, MSS SP-75 WPHY-60
4	4	LF	FLANGE, 16", ANSI 600, RFWN, BORE TO MATCH 0.500" W.T. PIPE, MSS SP-44 F60
5	80	EA	STUD BOLT ASSEMBLY-1 1/2" DIA X A 10" LG, ASTM A-193, GR. B7 ALLOY STEEL STUD BOLT W/ 2 HEX NUTS EA.,ASTM A194, GR 2 H CARBON STEEL, FLOUROCARBON COATED (16" ANSI 600 FLANGE BOLTS - 20 BOLTS PER)
6	4	EA	GASKET, SPIRAL WOUND TEFLON-16", ANSI 600 RF, FLEXITALLIC STYLE CGI OR EQUAL, 304 SS WINDINGS WITH FLEXICARB FILLER, CS INNER & OUTER RINGS, 1/8" THICK, ASME B16.20
7	3	EA	THREAD-O-RING, 2" TDW PART 2" -0000-0001-00
8	2	EA	VALVE, EXPANDING GATE, 16" ANSI 600, RF X RF, NACE TRIM, API 6D
9	3	EA	SUPPORT, PIPE, DIMENSION D = 1218-F I/R, I-ROD W/UBOLTS, "BASE PL W/HLS, 16" PIPE, EZ-LINE.
10	3	EA	FLANGE, 2", ANSI 600, RFWN, BORE TO MATCH 0.218" W.T. PIPE, ASTM A105, ANSI B16.5
11	3	EA	FLANGE, BLIND, 2", ANSI 600, RF, ASTM A105, ANSI B16.5, CENTER DRILL AND TAP 3/4"
12	48	EA	BOLTS, STUD, 5/8" X 4 1/4"LG, ASTM A193 GRADE B7 W/2 A194 GRADE 2H HH NUTS EACH, FLUOROCARBON COATED, (FOR 2", ANSI 600, 8 PER SET)
13	6	EA	GASKET, 2", ANSI 600, RF, 1/8" THK, SPIRAL WOUND TEFLON, FLEXITALLIC, 304 STAINLESS STEEL, GRAPHITE FILLER, STYLE CGI, ASME B16.20
14	3	EA	WELDOLET, 2.375" O.D. X 0.154" W.T. BRANCH X 16.00" O.D. X 0.500" W.T. RUN, MSS SP-97
15	3	EA	VALVE, BALL, 2", ANSI 600 CLASS, RF X RF, FULL OPEN, NACE TRIM, API 6D, LEVER OPERATED
16	3	EA	SADDLE, WELD, 2.375" O.D. ON 16.00" O.D. W/ VENT HOLE, MSS SP-75 WPHY-60
17	3	EA	VALVE, GAUGE, 3/4" MNPT X (2) 1/2" FNPT, 6000 LB, 316 STAINLESS STEEL
18	1	EA	TDW PIG SIG V, ELECTRIC/INDICATOR PART NO. 04-3800-1001-51
19	3	EA	THREADOLET, 1.315" O.D. X 0.250" W.T. BRANCH X 16.00" O.D. X 0.500" W.T. RUN, MSS SP-97
20	2	EA	ELBOW, 1", 90°, THREADED, 3000LB, FS, ASME B16.11
21	1	EA	TEE, STRAIGHT, 1", THREADED, 3000LB, FS, ASME B16.11
22	2	EA	UNION, 1", THREADED, 3000LB, FS, ASME B16.11
23	3	EA	VALVE, 1", BALL, THREADED, BALL, ASME B16.34
24			

PRELIMINARY
NOT FOR CONSTRUCTION

REFERENCE DRAWINGS

BakkenLink®
BAKKENLINK PIPELINE LLC.

NO.	DATE	DESCRIPTION	DRAWN	CHK'D.	APPRV'D.
A	08/20/12	ISSUED FOR REVIEW	WRA	MRI	MRI

REVISIONS

BAKKENLINK PIPELINE
MAINLINE VALVE DOUBLE BLOCK
PLAN AND ELEVATION

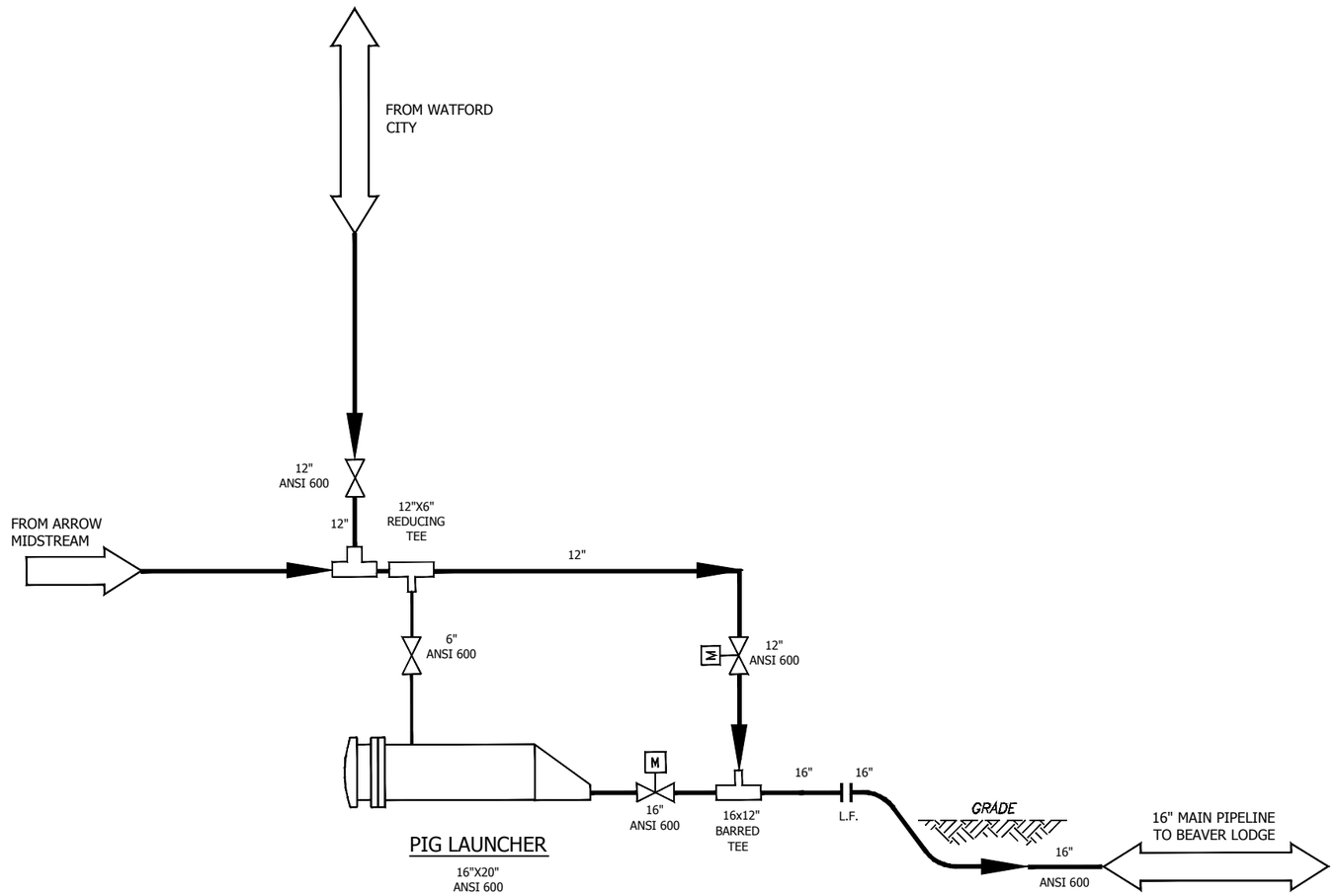
DRAWN BY:	WRA	APPROVED BY:	MRI
SCALE:		PROJ. ENGR.:	MRI
DATE:	08/15/14	PROJ. MGR.:	JD
CHECKED BY:	MRI	SHEET:	1 OF 1

DWG. NO.BL-ME-DBB REV. A

08-19-14 13:06 14003 03 WRA p:\bakkenlink\14003\working\mech\bl-me-dbb.dwg

Appendix VIII

Facility Typical and Preliminary Process Flow Diagram Schematics



DRY CREEK TERMINAL

PRELIMINARY
NOT FOR
CONSTRUCTION

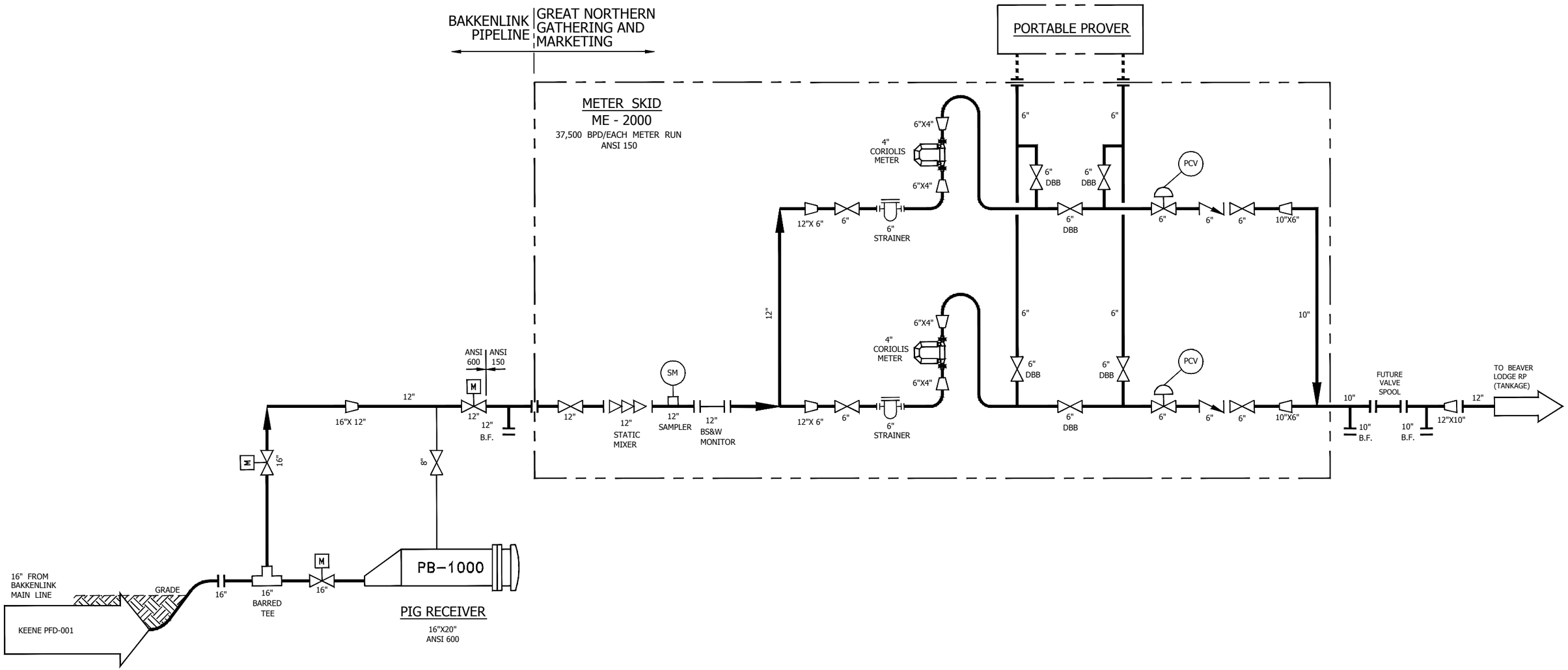
#	DATE	REVISIONS	BY

GREAT NORTHERN GATHERING AND MARKETING

PROCESS FLOW DIAGRAM DRY CREEK TERMINAL RECEIPT POINT AND INTERCONNECT

BARTLETT & WEST
3456 E CENTURY AVENUE - BISMARCK ND 58503
PHONE 701.258.1110 - FAX 701.258.1111
WWW.BARTWEST.COM

DESIGNED BY: .	PROJ NO: 16853.001	DRAWING NO: 1
DRAWN BY: .	CONST PROJ: ARROW MIDSTREAM PFD-001	
CHECKED BY: .	SCALE: AS NOTED	SHEET NO: XX OF XX
PROJECT ENGR: .	DATE: 2/7/2014	



PRELIMINARY
NOT FOR
CONSTRUCTION

#	DATE	REVISIONS	BY

GREAT NORTHERN GATHERING AND MARKETING

PROCESS FLOW DIAGRAM BEAVER LODGE RECEIPT POINT

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DESIGNED BY: .	PROJ NO: 16853.001	DRAWING NO: 2	
DRAWN BY: .	CONST PROJ: BEAVER LODGE-PFD-0001		
CHECKED BY: .	SCALE: AS NOTED	SHEET NO: XX OF XX	
PROJECT ENGR: .	DATE: 2/7/2014		

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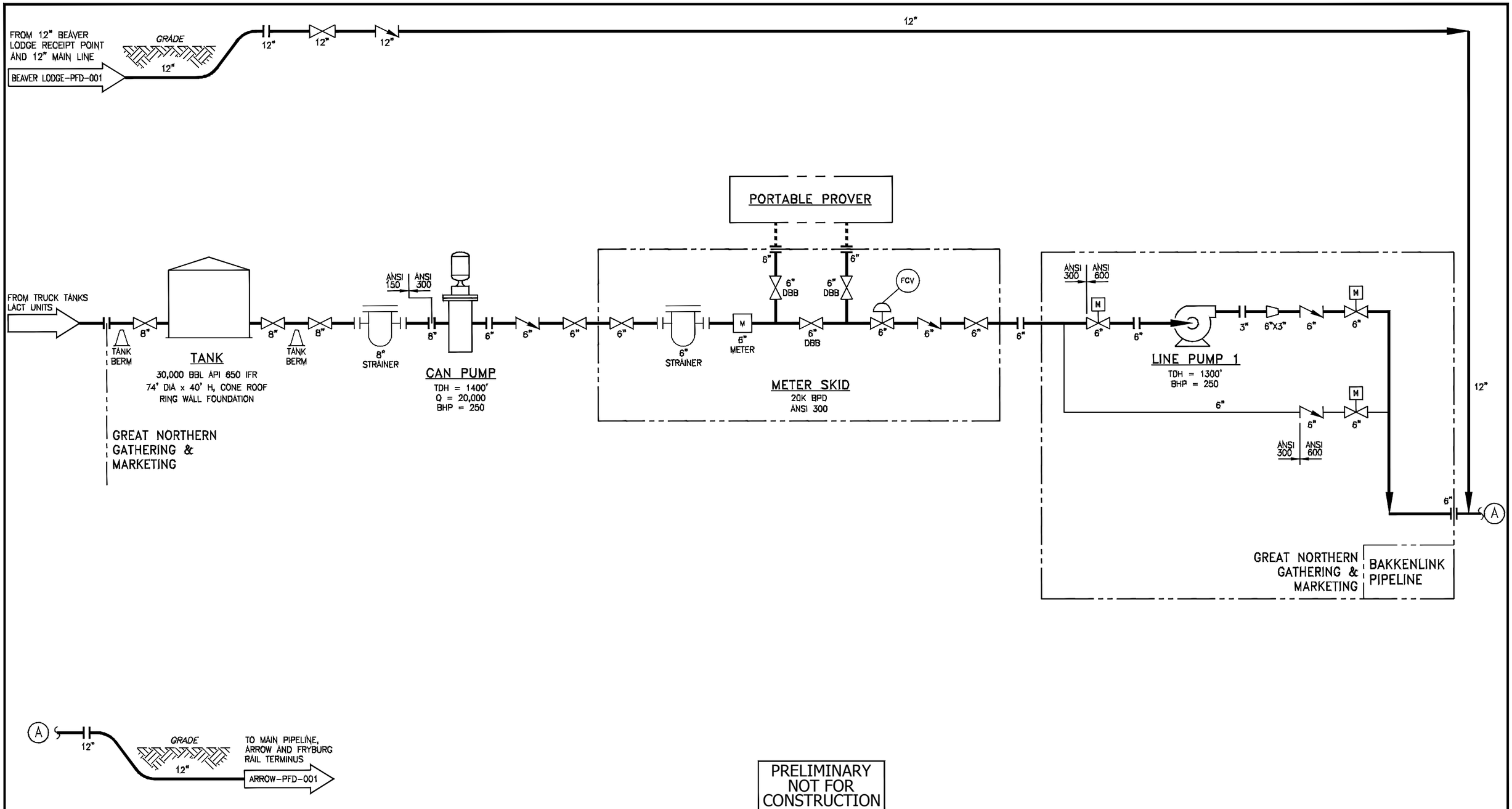

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NOT FOR
CONSTRUCTION

#	DATE	REVISIONS	BY

GREAT NORTHERN GATHERING AND MARKETING

PROCESS FLOW DIAGRAM KEENE RECEIPT POINT

BARTLETT & WEST
3456 E CENTURY AVENUE - BISMARCK ND 58503
PHONE 701.258.1110 - FAX 701.258.1111
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DESIGNED BY: .	PROJ NO: 16853.001	DRAWING NO: 3
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Appendix IX

Waterbody Crossings

Appendix IX. Waterbody Crossings

STREAM CROSSINGS									
Waterbody ID	County	Waterbody Name	Type[1]	Length[2]	Section	TWP	RNG	Crossing Method	Approx. MP
Mainline									
18150095-wb1	McKenzie	Unnamed tributary to Dry Creek	I	0	18	150	96	NA	0.1
18150095-wb1	McKenzie	Unnamed tributary to Dry Creek	I	80	18	150	96	HDD	0.2
12150096-wb1	McKenzie	Unnamed tributary to Dry Creek	I	30	12	150	96	Open Cut	1.2
01150096-wb1	McKenzie	Unnamed tributary to Dry Creek (stock dam)	I	210	1	150	96	HDD	2.6
01150096-wb2	McKenzie	Unnamed tributary to Dry Creek	I	120	1	150	96	Open Cut	3.0
36151096-wb1	McKenzie	Unnamed tributary to Dry Creek	I	0	36	151	96	NA	3.9
36151096-wb1	McKenzie	Unnamed tributary to Dry Creek	I	0	36	151	96	NA	3.8
12151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	55	12	151	96	Open Cut	8.4
01151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	185	1	151	96	Open Cut	8.7
01151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	170	1	151	96	Open Cut	8.9
01151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	170	1	151	96	Open Cut	9.0
01151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	230	1	151	96	Open Cut	9.1
36152096-wb2	McKenzie	North Branch Clear Creek	I	20	36	152	96	Open Cut	10.4
25152096-wb1	McKenzie	Unnamed tributary to Clear Creek (stock dam)	I	175	25	152	96	HDD	11.4
13152096-wb1	McKenzie	Unnamed tributary to Sand Creek	I	35	13	152	96	Open Cut	13.4
33153095-wb1	McKenzie	Unnamed tributary to Sand Creek	I	0	33	153	95	NA	16.0
33153095-wb2	McKenzie	Unnamed tributary to Sand Creek	I	45	33	153	95	Open Cut	16.5
33153095-wb3	McKenzie	Sand Creek	I	0	33	153	95	NA	16.7
28153095-wb1	McKenzie	Sand Creek	I	114	28	153	95	HDD	16.8
09153095-wb1	McKenzie	Unnamed Tributary to Lake Sakakawea	I	10	9	153	95	HDD	20.9
	Mckenzie, Williams	Missouri River/Lake Sakakawea	P	12,100	21,27, 28, 34	154	95	Trench/ Pull	23.2
09154095-wb1	Williams	Unnamed tributary to Dry Fork Creek	I	35	9	154	95	HDD	27.2
04154095-wb1	Williams	Unnamed tributary to Dry Fork Creek	I	80	4	154	95	Open Cut	28.2

STREAM CROSSINGS									
Waterbody ID	County	Waterbody Name	Type[1]	Length[2]	Section	TWP	RNG	Crossing Method	Approx. MP
21155095-wb1	Williams	Dry Fork Creek	I	30	21	155	95	Open Cut	32.1
20155095-wb2	Williams	Unnamed tributary to Dry Fork Creek	I	20	20	155	95	HDD	32.7
17155095-wb2	Williams	Unnamed tributary to Dry Fork Creek	I	172	17	155	95	HDD	33.7
17155095-wb1	Williams	Unnamed tributary to Dry Fork Creek	I	190	17	155	95	HDD	34.3
31156095-wb1	Williams	Unnamed tributary to Dry Fork Creek	I	60	31	156	95	HDD	36.8
Access Roads									
36152096-wb3	McKenzie	Unnamed tributary to North Branch Clear Creek	I	25	36	152	96	Mat	
36152096-wb4	McKenzie	North Branch Clear Creek	I	20	36	152	96	Mat	
27155095-wb1	Williams	Unnamed tributary to Alkali Creek	I	30	27	155	95	Mat	

[1]Where I is Intermittent and P is perennial
[2]Where Length is in feet

WETLAND CROSSINGS								
Wetland ID	County	National Wetland Inventory Classification Code	Acres	Section	TWP	RNG	Crossing Method	Approx. MP
Mainline								
25151096-w1	McKenzie	NA	0.14	25	151	96	HDD	5.4
13151096-w1	McKenzie	NA	0.19	13	151	96	Open Cut	7.4
36152096-w1	McKenzie	NA	0.10	36	152	96	NA	10.2
12152096-w1	McKenzie	PEMA	0.16	12	152	96	Open Cut	14.1
12152096-w2	McKenzie	PEMA	1.17	12	152	96	Open Cut	14.4
01152096-w1	McKenzie	PEMAd	0.06	1	152	96	Open Cut	14.9
28153095-w1	McKenzie	PEMA	1.89	28	153	95	HDD	17.0
28153095-w1	McKenzie	PEMA	1.89	28	153	95	Open Cut	17.0
28153095-w2	McKenzie	NA	0.39	28	153	95	Open Cut	17.6
22153095-w1	McKenzie	PEMC	1.40	22	153	95	HDD	18.7
22153095-w2	McKenzie	PEMC	0.16	22	153	95	NA	19.1
15153095-w1	McKenzie	PEMA	0.29	15	153	95	Open Cut	19.5
04153095-w1	McKenzie	PEMC	0.02	4	153	95	Open Cut	21.9
04153095-w2	McKenzie	PEMC	0.05	4	153	95	NA	21.9
16154095-w1	Williams	PEMC	1.30	16	154	95	Open Cut	26.6
09154095-w1	Williams	PEMC	0.07	9	154	95	Open Cut	27.5
20155095-w1	Williams	NA	0.02	20	155	95	NA	33.0

WETLAND CROSSINGS								
Wetland ID	County	National Wetland Inventory Classification Code	Acres	Section	TWP	RNG	Crossing Method	Approx. MP
17155095-w2	Williams	NA	0.27	17	155	95	HDD	33.7
17155095-w1	Williams	NA	0.52	17	155	95	HDD	34.3
Beaver Lodge Receipt Point								
31156095-w1	Williams	NA	0.06	31	156	95	NA	

Appendix X

Lake Sakakawea Crossing

A) Lake Sakakawea Crossing - Report, Methodology, Maps, Soil Report, CWC Protection, Equipment Lowering (Sections A-F)

B) Lake Sakakawea Crossing - HDD Crossing Report

C) Lake Sakakawea Crossing – Addendum to Phase I Report

BakkenLink

Addendum to Lake Sakakawea Crossing Reports:

"Lake Sakakawea Pipeline Crossing Report – BakkenLink Pipeline Project Western North Dakota" Revision 2 – November 14, 2011

"Lake Sakakawea Pipeline Crossing Report - Construction Methodology Evaluation Horizontal Directional Drilling" – March 1, 2012

Summary of Addendum:

The United States Bureau of Land Management (BLM) prepared an Environmental Assessment (EA) that analyzed the environmental effects of the BakkenLink Pipeline. Phase I of the BakkenLink pipeline project (from the Johnson's Corner area to the Fryburg Rail Terminal exclusive of the Lake Sakakawea crossing) was issued a Finding of No Significant Impact (FONSI) by the BLM on October 22, 2012. A crossing of Lake Sakakawea was not included as part of the FONSI. BakkenLink now wishes to pursue approval of that portion of the Project.

The crossing of Lake Sakakawea is an integral part of the Project as it will provide Bakken oil producers in portions of McKenzie and Williams Counties, North Dakota, with pipeline access to additional export options both north and south of the lake. The pipeline will reduce the amount of crude being transported by trucks on both sides of the lake. As detailed in the Lake Sakakawea Crossing Report dated November 14, 2011, and submitted with the Environmental Assessment's Plan of Development, BakkenLink is proposing to cross the Lake employing a conventional pipe pull method.

BakkenLink has sought consultation with the relevant federal agencies over the past years to collaborate on the preferred crossing location and methodology of Lake Sakakawea.

As part of the NEPA process during agency consultation, BakkenLink was requested to provide a detailed feasibility report of the Horizontal Directional Drill (HDD) method of crossing Lake Sakakawea, supported by empirical geotechnical data. Subsequent to this request, BakkenLink engaged Braun Intertec Corporation (Braun) to conduct a geotechnical evaluation consisting of nine (9) bore hole locations with depths up to 300 feet. The cores were strategically located to investigate the subsurface conditions of Lake Sakakawea and provide sufficient data to evaluate the feasibility of the HDD installation. BakkenLink also contracted Laney Directional Drilling (Laney) to analyze the geotechnical data and professionally evaluate the feasibility of an HDD crossing of Lake Sakakawea. Laney has 24 years of experience and has successfully constructed HDD installation of steel pipelines with diameters from 4 to 54 –inches, and lengths ranging from 300 to 11,000 feet. Laney is considered experts in the field of HDD concept, engineering, design and installation.

The Lake Sakakawea HDD Feasibility Report (Report) produced by Laney describes the findings from the geotechnical acquisition program conducted in the Fall of 2012 and its relevance to the feasibility of crossing Lake Sakakawea utilizing the HDD method. The Report analyses the expected crossing using the geotechnical report and more specifically the detailed laboratory evaluations of the nine (9) cores acquired by the geotechnical engineer Braun. The Report reviews various HDD installation options and in all cases finds that a HDD crossing solution is not technically feasible. The factors negatively impacting feasibility include subsurface conditions that do not support a drilling operation combined with the challenges associated with the length of the crossing. Additionally, the terrain on either side of the proposed HDD location prevents fabrication of a single pipe string for pulling through the completed HDD hole. Laney concludes that there is less than a 10% chance of a successful HDD installation across Lake Sakakawea. Laney follows this assessment with a recommendation for BakkenLink to develop an alternative crossing construction methodology.

Based on the determination and findings of the Laney Report, BakkenLink proposes the more conventional and proven pipe pull method that was previously detailed in the Lake Sakakawea Crossing Report dated November 14, 2011 submission. The pipe pull method is the most reasonable method of crossing the Lake with implementable mitigation measures to address regulatory agencies' concerns. BakkenLink would like to consult with the agencies to determine the recommended mitigation measures that will be developed, engineered, and employed during the installation of the pipeline using the pipe pull method.

The scope of the project for which the Supplemental Environmental Assessment is being performed has been revised as follows:

BakkenLink Pipeline LLC (BakkenLink) is planning to build a new crude oil pipeline (Project) consisting of approximately 34 miles of 16-inch steel crude oil pipeline extending from the Beaver Lodge receipt point in Williams County, North Dakota to the Dry Creek Terminal in McKenzie County, North Dakota. The interconnect to the Dry Creek Terminal will establish a connection with the existing BakkenLink Pipeline that is transporting crude oil to a rail facility operated by Great Northern Midstream LLC at Fryburg, North Dakota. BakkenLink is developing and intends to construct, own, and operate the Project.

The Project will address anticipated regional pipeline and outlet constraints due to increased development of the Bakken formation. With outlets via the Fryburg Rail Facility and Beaver Lodge, BakkenLink will immediately reduce crude oil truck hauling distances. Over the longer term, the strategic position of the Project will encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

The proposed project is designed to initially carry up to 100,000 barrels per day (BPD) and would transport crude oil from three proposed receipt points, including one existing and two new proposed crude oil truck receipt locations and pipeline gathering receipt stations.

The Project will consist of the following assets:

- Approximately 34 miles of bi-directional 16-inch steel pipeline that would transport crude oil between Beaver Lodge Receipt Point on the north end of the system and the Dry Creek Terminal on the south end.
- There are three receipt points associated with the Project:
    - Beaver Lodge Receipt Point, Williams County (Proposed)
    - Keene Receipt Point, McKenzie County (Proposed)
    - Dry Creek Terminal, McKenzie County (Existing)

BakkenLink anticipates receiving necessary pre-construction permits and approvals, acquiring the necessary right-of-way (ROW), and finalizing other agreements no later than July 2014. The commencement of construction activities is dependent upon permitting, ROW acquisition, and other development activities. The anticipated in-service date for the Lake Sakakawea portion of the Project is November 2014. The anticipated in-service date for the Dry Creek Terminal to Beaver Lodge portion of the Project is September 2015. BakkenLink proposes to develop the Project on the following schedule:

Project Milestone	Completion Date
Engineering and Design (Lake Sakakawea)	November 2011
Construction Complete Phase 1 (Fryburg to Dry Creek Terminal)	August 2013
Commissioning Phase 1 (Fryburg to Dry Creek Terminal)	September 2013
In-Service Phase 1 (Fryburg to Dry Creek Terminal)	September 2013
Engineering and Design Phase 2 (Dry Creek Terminal to Beaver Lodge)	March 2014
Construction/Environmental Permitting Phase 2 (Dry Creek Terminal to Beaver Lodge)	July 2014
ROW Land Acquisition Phase 2 (Dry Creek Terminal to Beaver Lodge)	July 2014
Start Construction (Lake Sakakawea)	September 2014
Construction Complete (Lake Sakakawea)	November 2014
Start Construction Phase 2 (Dry Creek Terminal to Beaver Lodge)	May 2015
Construction Complete Phase 2 (Dry Creek Terminal to Beaver Lodge)	September 2015
Commissioning Phase 2 (Dry Creek Terminal to Beaver Lodge)	October 2015
In-Service Phase 2	November 2015

The findings of the subject reports issued relative to the Lake Sakakawea Crossing are still relevant for the revised scope as described above.

Additionally, several additional agency consultations have occurred since the previously documented meetings in the "Lake Sakakawea Pipeline Crossing Report – BakkenLink Pipeline Project Western North Dakota" Revision 2 – November 14, 2011.

- March 22, 2013 – USACE Riverdale interagency meeting – Meeting held in the USACE office in Riverdale; Agencies represented: USFWS, USACE, BLM, North Dakota Department of Health, and North Dakota Game and Fish
    - Presentation of the geotechnical evaluation of the soil borings taken across Lake Sakakawea and the Horizontal Directional Drilling evaluation.
    - The Geotechnical evaluation of the subsurface conditions along the proposed route across the Lake does not support a successful HDD across the Lake Sakakawea.

- November 7, 2013 – USACE-Omaha interagency meeting – Meeting held in the USACE office in Omaha:
    - Follow up with USACE Engineering division with findings of Geotechnical evaluation discussed in March 22nd interagency meeting and the resulting HDD Feasibility report.
    - Findings were discussed with USACE Subject Matter Experts.
    - USACE included as consulting agency for Supplemental Environmental Assessment for Phase 2 of the Project.

- January 15, 2014 – USFWS-Bismarck interagency meeting – Meeting held in the USFWS office in Bismarck
    - Discussed Supplemental Environmental Assessment status of Phase 2 of the Project with USFWS, USACE, and BLM

LAKE SAKAKAWEA PIPELINE CROSSING REPORT

BakkenLink Pipeline Project
Western North Dakota

BakkenLink Pipeline, LLC

REGISTERED PROFESSIONAL ENGINEER
MICHAEL R. ISTRE
PE-6807
DATE 11/15/11
NORTH DAKOTA

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1. Project Description

BakkenLink Pipeline LLC (BakkenLink) is planning to build a new crude oil pipeline (Project) to provide much-needed capacity to transport the increasing supplies of crude oil produced from the Bakken oil play. The pipeline will consist of approximately 144 miles of 8-inch and 12-inch steel crude oil pipeline extending from Beaver Lodge, North Dakota to a proposed crude oil rail loading facility located near Fryburg, North Dakota (Rail Facility). Additional initial outlets being considered include third party interconnects in the Beaver Lodge/Ramburg area south of Tioga, North Dakota

The Project will address anticipated regional pipeline and outlet constraints due to increased development of the Bakken formation. With the initial outlets via the Rail Facility and Beaver Lodge, BakkenLink will immediately reduce crude oil truck hauling distances. Over the longer term, the strategic position of the Project will encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

The crossing of Lake Sakakawea is an integral part of the Project as it will provide Bakken oil producers in portions of Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota, with pipeline access to additional export options both north and south of the lake. It will reduce the amount of crude being transported by trucks on both sides of the lake.

Several meetings have been held with the relevant federal agencies over the past eleven months to collaborate on the preferred crossing location.

This report describes selection of the selected crossing location, the studies performed to date at the site, and the evaluation of various construction methodologies. Also the report includes case study discussion and relevant marine experience of the engineering and construction contractor.

2. Description of Proposed Project

The proposed Project is a crude oil pipeline system consisting of approximately 144 miles of 8-inch and 12-inch steel crude oil pipeline extending from multiple receipt points in Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota, to an interconnect with a new Rail Facility at Fryburg, North Dakota. The trunkline will have bi-directional capability, and will be able to transport crude oil to/from the Rail Facility and Beaver Lodge. BakkenLink is developing and intends to construct, own and operate the pipeline. Another entity is developing the Rail Facility.

The proposed Project will provide much-needed pipeline capacity to transport the increasing supplies of crude oil produced in portions of Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota. The system will only accept for transport light sweet crude, typical of production from Bakken formation in North Dakota.

The Project will be designed, constructed, and operated in compliance with applicable portions of the United States Department of Transportation (USDOT) regulations as set forth in 49 CFR Code of Federal Regulations (CFR) Part 195, Transportation of Hazardous Liquids by Pipeline. These regulations encompass general requirements, accident reporting and safety related condition reporting, design requirements, construction, pressure testing, operation and maintenance, qualification of pipeline personnel, and corrosion control. Relevant industry standards are incorporated into these regulations by

reference, including those of the American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), and the American Standard for Testing and Materials (ASTM) and others.

The proposed trunkline is designed to initially carry up to 65,000 barrels per day (BPD) and will have expansion capabilities.

The Project will consist of the following assets:

- Approximately 122 miles of 12-inch steel trunkline for the transportation of crude oil originating from, initially, up to six proposed receipt points including existing and proposed crude oil truck receipt locations and pipeline gathering receipt stations. This trunkline will be bi-directional and will transport crude oil to/from the Rail Facility and Beaver Lodge.
- Approximately 18 miles of 8-inch steel lateral from the Dunn Receipt Point, which will deliver into the trunk line approximately 30 miles north of Belfield.
- Approximately 4 miles of 8-inch steel lateral from the Belfield Receipt Point, which will deliver into the trunk line just north of Belfield.
- Initially, six receipt points will be constructed for input of product. The receipt points will be located at:
    - Beaver Lodge Receipt Point, Williams County
    - Keene Receipt Point, McKenzie County
    - Arrow Midstream Receipt Point, McKenzie County
    - Watford City Receipt Point, McKenzie County
    - Dunn Receipt Point, Dunn County
    - Belfield Receipt Point, Stark County

The Project will be located in the following North Dakota counties: Billings, Dunn, McKenzie, Stark and Williams. Maps depicting the Project location are provided in Appendix 9.2.

BakkenLink anticipates receiving necessary pre-construction permits and approvals, acquiring the necessary right-of-way (ROW), and finalizing other agreements no later than April 2012. The commencement of construction activities is dependent upon permitting, ROW acquisition, and other development activities. The anticipated in-service date for the Arrow to Belfield portion of the Project is September 2012. The anticipated in-service date for the Beaver Lodge to Arrow portion of the Project is December 2012. BakkenLink proposes to develop the Project on the following schedule:

Project Milestone	Completion Date
Certificate of Corridor Compatibility and Route Permit	November 2011
Engineering and Design	November 2011
Construction/Environmental Permitting	March 2012
ROW Land Acquisition	April 2012
Start Construction	April 2012
Construction Complete (Arrow to Belfield)	September 2012
Commissioning (Arrow to Belfield)	September-October 2012
In Service (Arrow to Belfield)	October 2012
Construction Complete (Beaver Lodge to Belfield)	November 2012
Commissioning (Beaver Lodge to Arrow)	November-December 2012
In Service (Beaver Lodge to Arrow)	December 2012

In the future, additional receipt points may be developed, as well as outlet connections with third party pipelines, including potentially the Enbridge North Dakota pipeline system, the Tesoro High Plains Pipeline system, the Bridger Pipeline system, and if approved and it moves to construction, the Keystone XL Pipeline system. An extension of the Project to an interconnect with TransCanada's Marketlink and Keystone XL Pipeline system projects is currently being assessed by BakkenLink.

3. Need for Facility

The Project will address anticipated regional pipeline and outlet constraints as development of the Bakken formation continues. With the initial outlets via the Rail Facility and Beaver Lodge, BakkenLink will provide a number of producers in western North Dakota with a much needed alternative means of transporting their crude oil. Additionally, the strategic position of the Project will encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

Over the last five years, development of the middle Bakken and upper Three Forks formations has steadily increased in North Dakota. Technological advancements in horizontal drilling and fracture stimulation have made recovering the oil in these formations economically feasible. Favorable oil prices have further accelerated this development.

An initial study by the United States Geological Survey (USGS) released in 2008 claimed stated that the middle Bakken had 4 billion barrels of recoverable oil in the Williston Basin. The latest official estimate from the North Dakota Industrial Commission (NDIC) is that up to 11 billion barrels may be recoverable from the middle Bakken and upper Three Forks formation in North Dakota. Continental Resources, Inc., a leading Bakken producer, has indicated that at current economics and with current technology the Bakken and Three Forks has 24 billion barrels of recoverable oil. As technological advances continue, even these higher estimates may be exceeded.

Production is forecasted to grow in North Dakota from a record 444,000 BPD in August 2011 to up to and in excess of 1,000,000 BPD over the next five years. During August 2011, there were approximately 192 rigs drilling for oil in North Dakota. According to the NDIC, over 95% of drilling is targeting the middle Bakken and upper Three Forks formations. It is expected that the rig count could rise above 200 rigs during 2012.

This Project will provide an environmentally sensitive method of transporting crude oil from the heart of the Bakken play, greatly benefiting producers, landowners, citizens in the State of North Dakota, local municipalities, and mineral interest owners.

4. Lake Crossing Information

4.1. Routing Selection Process

BakkenLink evaluated several options for the proposed Project route. Each option was considered with respect to regional access to markets, economics, engineering design, construction feasibility, and environmental impacts. Efforts were coordinated with the regional US Army Corps of Engineers (USACE), Bureau of Land Management (BLM), US Forest Service (USFS), and US Fish & Wildlife Service (USFWS) offices. The location of the proposed route was selected to have minimal effects on resources and residents while maintaining a strong positive impact for the region.

The route design for the Project will provide multiple origination points (Receipt Points) in the most prolific

and active parts of the middle Bakken and upper Three Forks development in addition to opening up new areas that are not currently accessible to pipeline service, especially between Johnson's Corner and Watford City and between Watford City and Belfield. The planned 12-inch trunkline allows for economic expansion opportunities that are supported by the proprietary catchment study, including the original oil in place estimates.

Key routing considerations included:

- Location and number of receipt points in relation to existing and proposed oil field production facilities;
- The crossing of the Missouri River at Lake Sakakawea;
- The pipeline route across the Little Missouri National Grasslands (LMNG).

The Lake Sakakawea crossing is a key logistical consideration. Several crossing locations were evaluated during preliminary design and planning of the Project. The proposed route is a crossing north of Keene, ND. Another location given consideration, east of Williston, was approximately 10 miles west of the proposed location and provided a more favorable approach to the lake shoreline. The total crossing length would have been reduced by nearly 4,000 feet compared to the proposed route; making the use of HDD technology more feasible. Two other crossing locations were evaluated – at the Four Bears Bridge near New Town and another route near Williston. BakkenLink presented the different crossing location options for discussion at meetings with federal agencies on October 5, and December 9, 2010, and on February 8, 2011. In these meetings, the USACE identified the current crossing location as their preferred route due to the presence of existing pipelines at that location. Other entities in the region reportedly have also been exploring the same river crossing location and certain advantages exist for locating their pipeline adjacent to this route.

As a result of the aforementioned meetings, all other crossing locations were abandoned in favor of the proposed route north of Keene. A summary of the meeting minutes concerning lake crossing locations and methods is below in Section 4.3. Further information and meeting minutes can be provided upon request.

4.2. Pipelines and Facilities in the Vicinity

In the evaluation of the Lake Sakakawea approach, the following pipelines have been identified in the vicinity of the proposed BakkenLink Pipeline crossing:

Pipeline Owner	Outer Diameter of Pipe	Number of Pipelines	Construction Method	Product
Amerada Hess	8"	3	Open cut – 1950s	Gas
Amerada Hess	16"	1	Open cut – 1950s	Gas
Dakota Gassification Company		1	Open cut	Carbon Dioxide

During interagency discussions, the USACE noted that Amerada Hess has three 8" and one 16" lines across the Lake that that were installed in the 1950's. These pipelines predate the lake and were installed utilizing open cut trenching methods. The Dakota Gassification Company (DGC) pipeline, also installed using open cut techniques, was constructed when the lake water level was only 10 feet in the center of the Missouri River Thalweg (old river channel). The alignment of the proposed pipeline is approximately 200 feet away from the existing DGC pipeline.

4.3. Summary of Agency Meetings for Lake Crossing Site

- October 5, 2010 -- USACE/USFWS – Meeting held in USACE office in Riverdale
  - Notified by USACE-Riverdale that water depth at time of construction would be +/- 48 ft. Advised the agencies the water depth increase would change the recommended construction methodology.

- December 9, 2010 – USACE-Bismarck interagency meeting – Meeting held in USACE office in Bismarck
  - Presentation of crossing methodology at the proposed location. Assumed maximum water depth was +/- 20 ft. Proposed methodology was pre-trenching using backhoe/excavator on a floating platform. Jetting was discussed and expressed as not feasible due to limited water depth and desire to minimize turbidity.
  - USACE advised that Enbridge indicated findings that an HDD would be possible at a depth of 300 feet below surface due to pressure and soil conditions. BakkenLink related that HDD crossing of the lake would require a world record 14,000 LF drill using a "hand-shake" method, where the drill begins on both banks and meets in the middle. The USACE asked if another location would be more favorable and received the response that no locations within a reasonable distance would reduce the HDD length and risk. The proposed location was recommended because the existing corridor at this location would be favorable for the alternative trenching-based installation method.
  - Bucket dredging and jetting techniques were discussed but not ideal because of turbidity issues

- February 8, 2011 -- USACE-Bismarck, United States Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), US Forest Service (USFS) – Meeting held in USFWS office in Watford City
  - Discussed Lake Sakakawea pipeline crossing in general terms. Alternative crossing locations were discussed. USFS preference was western alternative to move the route off of Forest Service lands. After BakkenLink confirmed that other locations would not produce more favorable HDD conditions, USACE's preference was the current proposed location. USACE maintained its preference of an HDD crossing but was open to discussing alternative methods.
  - Construction methodology options were discussed including discussion of the favorability of the proposed location due to knowledge of the existing soil conditions in the corridor.

- September 20, 2011 -- North Dakota Department of Health Water Quality Division – Teleconference
  - Presentation of Push/Pull Crossing method of Lake. Discussions of turbidity control during construction operations. ND Dept. of Health communicated comfort level with proposed construction method and turbidity control relative to resuspension of soils and elutriate testing

4.4. Schedule Restrictions for this Area

As part of the project development the regulatory agencies have been consulted regarding temporal construction restrictions around Lake Sakakawea. The species of concern in and around the lake are Pallid Sturgeon and shoreline birds nesting along the banks of the lake. The USACE advised that the Pallid Sturgeon spawning period ended around June 15. Additionally, the shoreline avian species of concern nesting period ends around July 15. BakkenLink was advised to add a one month temporal buffer to address any concerns related to nesting and spawning activities. Therefore, the commencement of any construction activities around Lake Sakakawea was discouraged prior to August 15.

4.5. Description of Selected Crossing

The crossing location preferred by the USACE (see map, Appendix 9.2) is approximately 12,100 linear feet from shore to shore. At the time of the hydrographic survey, the maximum water depth was approximately 50 feet and the bottom substrate is characterized by one to two foot layer of fine silt and mud. The relic Thalweg of the Missouri River can be seen in the hydrographic survey data

A key aspect in the design of a pipeline is a thorough review of the protection of the asset with reference to operating conditions, potential third party interactions, and other circumstances or events that might impact the safety and operating ability of the pipeline. Each marine pipeline project is unique and requires specific design and construction efforts to ensure that the pipeline is installed and operated in a safe manner based on the location and marine traffic plying the waters in the immediate vicinity. For the Lake Sakakawea crossing, an assessment of the marine traffic determined that the weight of mooring systems is less than 40 pounds and will not damage or impact a bare, uncoated steel pipeline. Appendix 9.4 expands on this premise and refers to the results of a previous field test for a project crossing an active seaway. For the test, large anchors were deliberately dropped on a series of pipe joints (40 feet sections) ranging from bare pipe to pipe with 3 or more inches of concrete weight coating.

The conclusion that was reached after review of these test results was that the crossing pipeline was safe from damage in its original bare pipe state however, as additional protection, it was decided to increase the steel wall thickness by 20% and to apply a 2 to 3 inch concrete weight coating outer sheath for pipeline stabilization purposes as well as for additional protection. Burial of the pipeline will further serve the purposes of added protection and stabilization. The proposed burial depth is 3 feet to the top of the pipe for the lake crossing, as required by 49 CFR Part 195 regulations.

Based on these conditions, PCS is satisfied that with the pipeline, as designed and lowered with the top of pipe below the natural lake bed, will be adequately protected and safe for operation.

4.6. Studies

4.6.1. Hydrographic Surveys

The hydrographic and geophysical survey was performed by Chris Ransome and Associates (CRA) during the period May 18 to June 8, 2011. Prior to the mobilization of the CRA survey crew, the onshore survey team established the crossing centerline alignment on both sides of the lake and installed bench marks to ensure compatibility between the onshore and marine surveys (see figures on following pages).

The purpose of the high-resolution survey was to:

- Acquire bathymetric data
- Identify and map lake bed hazards to construction and debris
- Identify and locate adjacent existing foreign pipelines and identify and map possible environmental and cultural resources within the proposed pipeline corridor.

The survey scope of work included bathymetric, side scan sonar, shallow penetration sub-bottom profiler and magnetometer survey lines run along 50 foot spaced lines parallel to and along the proposed pipeline route and extending 250 feet to each side giving a total corridor width of 500 feet. Tie-lines surveyed perpendicular to the pipeline were run in both directions every 500 feet. Supplemental survey lines were also run in areas of special interest or geological complexity.

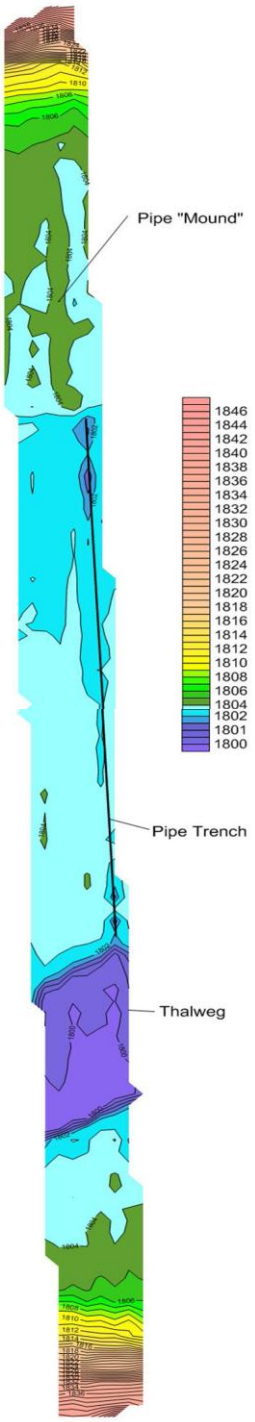
The results of the magnetometer and side-scan surveys did not reveal any significant objects on the lake bottom that could be a hazard to the construction of the proposed pipeline (see crossing bottom contours). The spoil side cast during the trenching of the adjacent Dakota Gasification (DGC) pipeline (when the depth of the lake was less than 20 feet) is evident on the northern side of the crossing but has naturally returned to the trench on the southern side of the lake. There is a 1 to 2 feet thick layer of fine silt and mud over most of the crossing deepening to over 2 feet in the Thalweg. The longitudinal profiles indicated that the original ground level is below this thin layer and contains a stiffer and more consolidated material than the first layer.

Bottom Contours

The lake bottom contours, based on the high frequency data, and produced in the program “Surfer”, are shown in diagrammatic form in the graphic to the right. Overall, after the initial slopes from the current shoreline (elev. 1853.8 feet), the majority of the lake is extremely flat with elevations of between 1802 and 1804 feet. A slight change of slope appears about 500 feet from the northern shoreline, but the most prominent topographic feature is the Missouri River Thalweg, denoting the original river route prior to the flooding and creation of the lake. In the work area, the Thalweg runs in a southwest to northeast direction with respect to the shorelines, with bank elevations of 1803 feet and a bottom elevation approximately 3 feet deeper to 1800 feet. It is centered approximately 3300 feet from the southern shoreline.

Other features to note include the trench from the existing DGC pipeline on the east side of the proposed corridor, and, in some areas, the small mound which runs parallel to the pipeline trench and which has been interpreted as the material excavated from the lake bottom during past trenching. In each case where these features could be identified on the cross-lines, a central coordinate was picked to be plotted on the final plan view drawing as further evidence of the location of the existing pipeline. In addition, these cross-lines over the existing pipe show the depth of the trench, and, in many sections, the amount of infilling material now over the pipe (typically about 1.5 feet of very soft unconsolidated sediment).

Finally, when the images from the depth sounder records were imported into the CAD drawings, the reflectors beneath the lake bed revealed by the lower operational frequency were examined and compared with the same results from the sub-bottom profiler.

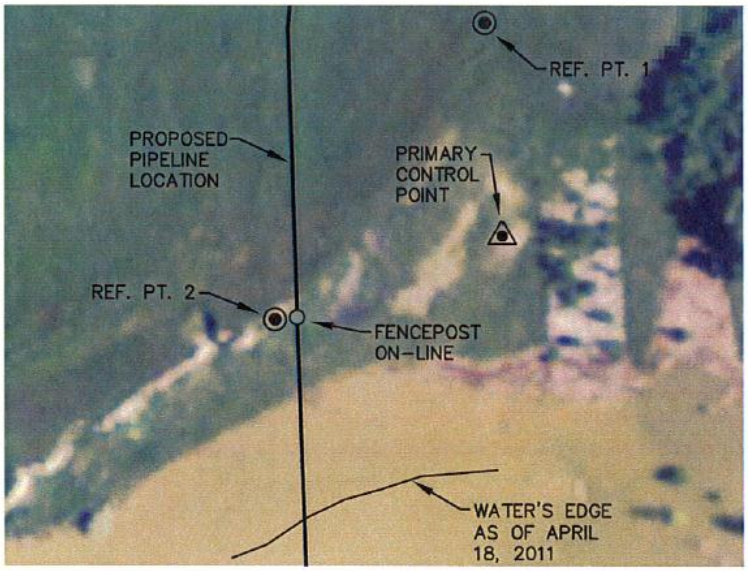


Bottom Contours

SURVEY MARKER FOR BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA CROSSING (NORTH SIDE)

SITE PHOTO

VICINITY MAP
NO SCALE



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E 1,384,273.98
EL 1860.34

REF. POINT 1
N 429,214.90
E 1,384,262.83
EL 1876.27

REF. POINT 2
N 429,024.26
E 1,384,127.15
EL 1875.25

FENCEPOST ON-LINE
N 429,025.62
E 1,384,141.43

GRAPHIC SCALE

100 0 50 100

(IN FEET)
1 inch = 100 ft.

COORDINATE DATUM

The horizontal coordinates shown hereon are based on the North Dakota State Plane Coordinate System, North Zone (NAD83). The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88) using Geoid 09.

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Bruce P. Zelmer L.S. #3756 — Date 5-6-11

BRUCE P. ZELMER
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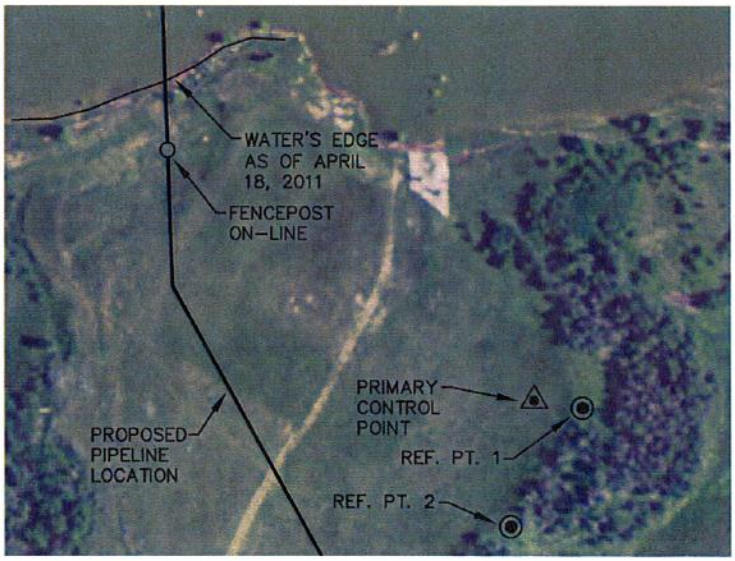
NORTH DAKOTA

SURVEY MARKER FOR BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA CROSSING (SOUTH SIDE)

SITE PHOTO

VICINITY MAP
NO SCALE



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EL 1858.26

REF. POINT 1
N 416,221.40
E 1,385,137.50
EL 1858.03

REF. POINT 2
N 416,066.04
E 1,385,043.35
EL 1862.62

FENCEPOST ON-LINE
N 416,558.72
E 1,384,594.75

GRAPHIC SCALE

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(IN FEET)
1 inch = 200 ft.

COORDINATE DATUM

The horizontal coordinates shown hereon are based on the North Dakota State Plane Coordinate System, North Zone (NAD83). The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88) using Geoid 09.

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4.6.2. Soil Investigation

Soil boring sites and spacing were determined in consultation with North Dakota Department of Health (NDDH). Six bores locations were chosen and were evenly spaced across the crossing location. Standard penetration test borings were performed from July 25 - 27, 2011, with a trailer mounted core and auger drill equipped with 3 1/4-inch, inside diameter hollow-stem auger to a depth of 10-feet below the lake bottom. Sampling for the borings was conducted in general accordance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils." The boreholes were advanced with the hollow-stem auger to the desired test depths. A 140-pound hammer falling 30 inches was then used to drive the standard 2-inch split-barrel sampler a total penetration of 2 feet below the tip of the hollow-stem auger. The blows for the middle foot of penetration were recorded and are an index of soil strength characteristics. Samples were taken at 2 foot vertical intervals down to the termination depths of the borings. A representative portion of each sample was then sealed in a glass jar.

The general soil profile consisted of lake sediment overlying alluvial soils. The lake sediment was encountered in four of the six borings and appeared to consist of 1-foot of sediment classified as fat clay; however, the moisture content of the sediment was higher than the soils liquid limit. Therefore, this sediment was acting more as a fluid. Below the deposited sediment layer, alluvial soils were encountered having textures matching that of lean clay, silty sand, and poorly graded sand with silt and gravel. These alluvial soils are the native soils that were at this site prior to flooding of the lake. The cohesive portions of these soils generally were very soft to rather soft in consistency, and the granular portions were very loose to medium dense soils. The soils below the lake sediment were determined to adequately support the lowered pipeline or any supporting structure.

Additional information regarding the soils investigation and boring logs can be found in Appendix 9.3.

4.6.3. Water Quality Standards

The North Dakota Department of Health is a cooperating agency with the USACE to certify federal licenses and permits in accordance with Section 401 of the Federal Clean Water Act. Specifically, the NDDH will make a determination if the proposed construction will violate applicable standards of water quality (Standards of Quality for Waters of the State - North Dakota Administrative Code Section 33-16-02.1). The certification, if issued, will express the NDDH's opinion that the project will not result in a violation of applicable water quality standards. Although water quality certification is a prerequisite for issuance of a USACE permit, certification alone does not guarantee a permit will be issued for the project.

Consultation with the NDDH and USACE directed BakkenLink to perform analytical testing of lake sediments for certain parameters in order to characterize the chemistry of the soil relative to maintaining water quality during construction activities. Sediments normally contain constituents that exist in various chemical forms and in various concentrations in several locations within the sediment. These include: Nitrogen, Phosphorous, and metals.

Composite samples of sediment were obtained at the locations and as described in Section 4.6.2 above. Samples were composites of sediments obtained during the soil testing. Samples were obtained at two depth ranges: 0-4' and 6-10'. These depth ranges were selected to represent typical pipeline installation depths.

An elutriate test may be used to predict the effect on water quality due to release of contaminants from the sediment to the water column. The results of the analysis are reported as 4:1 elutriate results (table below) for sediment from the proposed crossing, and the values are reported as comparisons against the North Dakota surface water quality criteria. Presumably, the intent is to show a "worst case" water quality if sediment is suspended in/near the trench.

Constituent	ND Surface Water Quality Standards Acute/Chronic	Sample 4, Boring 1, 0-4'	Sample 4, Boring 2, 0-4'	Sample 4, Boring 3, 0-4'	Sample 4, Boring 4, 0-4'	Sample 4, Boring 5, 0-4'	Sample 4, Boring 6, 0-4'	Sample 7, Boring B-1, 6-10'	Sample 7, Boring 2, 6-10'	Sample 7, Boring 3, 6-10'	Sample 7, Boring 4, 6-10'	Sample 7, Boring 5, 6-10'	Sample 7, Boring 6, 6-10'
	All Measurement in mg/L (ppm)												
Organic Nitrogen		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5.19	< 5	6.02
Ammonia-Nitrogen as N		2.93	6.01	4.23	4.43	1.82	3.25	5.87	0.21	0.42	0.41	0.99	0.28
Phosphorus as P - Total	0.02	0.12	0.11	0.51	0.57	< 0.1	< 0.13	< 0.78	< 0.1	< 0.34	1.13	< 0.52	1.37
Total Kjeldahl Nitrogen		< 5	< 7.1	< 5	< 6.9	< 5	< 5	8.1	< 5	< 5	5.6	< 5	6.3
Mercury - Total	0.0017/0.00012	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0002	< 0.0002	0.0006
Chromium - Total	*	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.11	0.07	0.25
Copper - Total	0.014/0.093	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.16	0.07	0.37
Nickel - Total	0.47/0.052	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.09	0.04	0.22
Zinc - Total	0.12/0.12	0.06	0.11	0.16	0.12	0.05	0.11	0.12	< 0.05	< 0.12	0.45	0.21	0.92
Arsenic - Total	0.34/0.15	0.003	0.002	0.004	0.0137	0.0032	0.0029	0.0068	< 0.002	< 0.0151	0.0458	0.0239	0.1058
Cadmium - Total	0.0021/.00027	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.00132	< 0.001	< 0.001	< 0.001	0.00166	0.00115	0.0054
Lead - Total	0.082/0.0032	< 0.002	< 0.002	0.0049	0.0237	0.0026	0.0031	0.0088	< 0.002	< 0.0238	0.0712	0.043	0.1862
Selenium - Total	0.020/0.0005	< 0.002	< 0.002	< 0.002	0.0029	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.0042	0.0027	0.0093

Results are reported in volume(s) of mg/L or parts per million (ppm). Generally, the results show that the parameters meet or exceed Water Quality Standards except for three samples:

- Sample 7, Boring-4
- Sample 7, Boring-5; and
- Sample 7, Boring-6

These three samples indicate levels of zinc that exceed the Water Quality Standards. In addition, cadmium and lead in Sample 7, Boring-6 also exceeds Water Quality Standards. Zinc as reported in Sample 4, Boring-3 is within statistical error analysis when considering levels of ppm.

The proposed pipeline will be installed with approximately three feet of cover to the top of the pipe (four feet total depth) with approaches near the shorelines installed at deeper depths. These results indicate that constituents within the sediments across the majority of the crossing – at the installation depth – meet or exceed the Water Quality Standards.
Results should also be evaluated in light of the volume and rate of the intended discharge, the type of discharge, the hydrodynamic regime at the site, and other information relevant to the impact on water quality. The mixing zone should also be considered when evaluating water column effects. In addition, the reporting levels are based on tenths (or hundreds) of ppm. Other considerations include:

- The criteria for several metals are hardness related. The ND Water Quality Standards are based on an assumed hardness of 100 mg/L. To derive a hardness adjusted value, it would be necessary to get a value for lake hardness. A higher lake hardness would result in higher criteria standards for these metals.
- The criterion for most metals is based on dissolved metals. The data here is reported as total metals.
- Nutrients (phosphorus and nitrogen) are not toxicity concerns. The values listed are related to possible eutrophication increase from liberation of nutrients. This increase would be temporary, and of little immediate consequence if it occurs outside the growing season.
- The phosphorus is reported as total phosphorus. The listed criterion is a guidance value for lake management based on phosphate phosphorus. The criterion is not toxicity based, but based on eutrophication. Free phosphate phosphorus is only a small portion of the total phosphorus in the system. There is no total phosphorus criterion.
- The Water Quality Standards present an eutrophication guidance value for NO3-N of 0.25 mg/L, but the data were reported for three types of nitrogen: organic, Kjeldahl, and ammonia nitrogen,

but not for nitrate N. Each stream or lake has unique characteristics which determine the concentration of this constituent that will cause excessive plant growth.

- The disturbance from trenching would be on a relatively short term basis, and therefore the higher (acute) value is a better indicator of potential toxicity than the lower (chronic) value.
- The nature of the trenching disturbance will generate fairly localized suspension of sediments, silting and turbidity. However, these also can be controlled.

In summary, the contamination investigation provides evidence that metals should not be an issue for this site. However, turbidity and silting might be a larger concern, in terms of narrative water quality.

5. Construction Methodology Evaluation

5.1. General

Discussed below are several possible crossing options evaluated during the project development of the proposed 12" OD crude line across Lake Sakakawea in North Dakota. The options considered include:

- Horizontal Directional Drill (HDD) across the entire lake crossing from a single onshore location
- HDD from both sides of the crossing to a midpoint in the crossing and then an intermediate tie-in operation.
- HDD from the center of the crossing to each onshore location and then an intermediate tie-in operation.
- Trench and conventional lay of the entire pipeline from a marine barge accompanied by separate shore crossing operations at each end.
- Trench and perform a push-pull operation with a buoyant pipeline constructed on an offshore barge positioned midstream and then push-pull the line toward each shore line in sequence. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the intermediate tie-in operation from the vessel.
- Trench and perform a push-pull operation with the pipeline made up along one shoreline and then push-pull the line across the water. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the tie-in operations from each shoreline.
- Trench and perform a push-pull operation with the pipeline made up in sections within a pre-constructed onshore trench and then pulled across the water. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the tie-in operations from each shoreline.

5.2. Horizontal Direction Drill (HDD)

Because of the length of the crossing of 2.3 miles, a single HDD operation across the entire lake crossing is not feasible for the pipeline diameter required for this Project. Although such a lengthy HDD operation could be technically feasible, there are many risks involved, which no construction contractor consulted would consider undertaking. The risks include loss of pipe due to sticking, buckling of the pipe during the push operation, large surface units and space requirements for the operation, etc. In addition, the success of an HDD depends on the soil characteristics. In this area, the undisclosed soil investigations anecdotally indicated the plausibility of such an HDD; however, the exact conditions will require further investigation to confirm this method.

A more feasible and less risk adverse approach using HDD technology was discussed using two drills instead of the single drill.

The first dual HDD option was to drill from both the north and south banks and join the pipeline in the middle of the lake. The length for each drill would be approximately 6000 feet leaving a 650 feet length of pipe for each section (a total of 1300 feet length) in the middle of the lake to make the connection. This section would then to be lowered and protected. This option requires extensive dredging activities to dig the two exit holes and pipeline break-over areas. The amount of bottom disturbance was considered unacceptable plus the risk of a failed drill in these soils was a serious concern and one without a valid contingency plan or remedial action.

The second dual HDD option consists of drilling from the center of the lake but was not feasible due to the excessive water depth. Additionally, HDD's originating from a marine location would require extensive specialized marine equipment that is limited to a 20 to 30 feet water depth. The proposed crossing has a mid-stream water depth of 50 feet rendering this option invalid.

5.3. Conventional Pipe Lay

A conventional pipe lay operation into a pre-trenched ditch across the waterway was evaluated as an alternative option. The concrete weighted pipeline would be laid across the waterway by constantly changing the position of the lay barge in a similar manner to a conventional offshore pipelay operation. A separate shore approach method involving trenching would be developed at each shoreline. Due to the nature of the bottom topography, some type of jetting or trenching operation along with a pull operation would be required in the near shore marine and terrestrial land areas.

Due to the isolated nature of the lake and the difficulties in mobilizing large, specialized equipment to the area, a small scale pipe lay inland barge system would be mobilized in sections and rigged on site. The barge would consist of a deck length having at least one or two pipe-welding stations, a nondestructive testing station to evaluate welds and a coating station to apply the protective corrosion coating to the welded pipe joints. The individual barge sections would be attached bow to stern and would require a crane and several positioning winches for anchoring operations. With the use of spuds not feasible due to the water depths, an option to conventional anchoring could be the installation of mooring piles at strategic locations along the pipeline route to moor the barge and to progress the barge across the lake as it installs the pipeline.

The lack of local marine equipment and the cost to mobilize, fabricate, and rig-up an extensive marine pipe lay spread, in addition to the mobilization of support vessels and other marine equipment, makes the conventional pipe lay option impractical, inefficient and unworkable.

5.4. Push-Pull Method – Preferred Method

The push-pull method of installation is a highly proven and successful technique used for installing pipelines in water depth ranges similar to that of the lake. Lake Sakakawea is an inland lake with a crossing distance (2.3 miles) that would be suitable for this operation. This technique requires that the concrete coated pipe be welded into one or more strings either on land, along the shore, or off a permanently positioned marine barge on the lake and have temporary buoyancy flotation collars keep the pipe afloat. The floating pipe strings are maneuvered by pushing or pulling operations until in the desired position. Once in position, the floatation collars are sequentially removed and the pipe settles onto the lake bottom.

In order to lower and bury the pipeline beyond the reach of the land-based excavators, a pair of mud/slurry submersible pumps (Toyo brand or equivalent) fitted to a purpose-built lowering sled will be

used. The burial sled will extract soil from beneath the installed pipeline and discharge the resulting slurry into the pipeline ditch astern of the sled. The exact design of the burial sled will be specific for this Project; however, the concept of the dual slurry pumps has been utilized before by several construction groups for pipeline lowering in difficult and environmentally sensitive locations. The ability to trail a turbidity mat over the discharge diffuser is designed to direct the slurry back into the trench to reduce lateral dispersion, provide positive backfill over the lowered pipeline, and reduce the water column turbidity. Further detail about this proposed construction methodology can be found in Appendix 9.1.

The burial operation will be performed immediately after the installed pipeline is flooded and after the installed pipeline elevation is surveyed. The Project Team will deploy turbidity monitoring instrumentation at agreed locations with STOP authority in case of the construction activity exceeding a turbidity level above that observed prior to work commencement (the control measurement). The depth of cover achieved over the pipeline with the lowering sled will be verified real time with divers positioned aft of the jet sled. If the adequate coverage is not being achieved, the lowering sled can be slowed until the pipe is buried to a sufficient depth. The pump employed on the lowering sled is well suited for the classification of substrate on the lake floor.

Although the purpose-built lowering sled will be specific to this project, the USACE Waterways Experiment Stations (WES), as part of their Dredging Research Program (DRP), has tested similar hydraulic excavators. Among the competing vendors, the results found that a Toyo brand slurry pump had the overall best performance. See Appendix 9.3 for full report. In practice, the pumps have been proven effective in multiple projects world-wide where pipeline lowering was required in confined or sensitive areas. One such project involved successfully lowering 7,000 linear feet of 36-inch live gas pipelines in the shallow waters of the Gulf of Mexico. Additional details concerning this burial technique and the engineering firm's experience with this equipment see Appendix 9.5.

6. Code Compliance

The pipeline and pipeline system will be designed in accordance with the Code of Federal Regulations Title 49, Part 195, "Transportation of Hazardous Liquids by Pipeline" (latest edition). Provided all minimum federal safety standards have been met, ASME B31.4-2009 "Pipeline Transportation of Hydrocarbons and Other Liquids" will be used to supplement the requirements of 49 CFR, Part 195. For issues where both of the above publications are silent or additional guidance is required, codes and/or recommended practices from the following organizations are incorporated into the design as applicable (latest edition unless otherwise noted):

Code	Title
ASME B31.8	American Society of Mechanical Engineers: Gas Transmission and Distribution Piping Systems
API Spec. 5L	American Petroleum Institute: Specification for Line Pipe
API RP 1102	American Petroleum Institute: Steel Pipelines Crossing Railroads and Highways
API Std. 1104	American Petroleum Institute: Welding of Pipelines and Related Facilities
API Std. 1130	American Petroleum Institute: Computational Pipeline Modeling for Liquid Pipelines
API RP 5LW	American Petroleum Institute: Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels
NACE SP0169	National Association of Corrosion Engineers: Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE SP0177	National Association of Corrosion Engineers: Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
NACE MR0175 /ISO 15156	National Association of Corrosion Engineers: Control of External Corrosion on Underground or Submerged Metallic Piping Systems
ISO 15589-1	Petroleum and natural gas industries – Cathodic protection of pipeline transportation systems – Part 1: On-land Pipelines
ISO 15589-2	Petroleum and natural gas industries – Cathodic protection of pipeline transportation systems – Part 2: Offshore Pipelines
API Spec. 6D	American Petroleum Institute: Specification for Pipeline Valves (Gate, Plug, Ball and Check Valves)
ASME B16.5	American Society of Mechanical Engineers: Pipe Flanges and Flanged Fittings
ASME B16.9	American Society of Mechanical Engineers: Factory-Made Wrought Steel Butt Welding Fittings
MSS-SP-44	Manufacturers Standardization Society: Steel Pipe Line Flanges
MSS-SP-75	Manufacturers Standardization Society: Specification for High Test Wrought Butt Welding Fittings
MSS-SP-97	Manufacturers Standardization Society: Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Butt Welding Ends
ASME Section IX	American Society of Mechanical Engineers: Boiler and Pressure Vessel Code, Section IX: Welding and Brazing Qualifications

Consultation was sought with PHMSA Central Region regarding the Lake Sakakawea crossing. PHMSA indicated that pipe would need to be lowered to provide the necessary protection of the pipeline. If statutory burial depth could not be achieved, mechanical protection would need to be provided that would provide equivalent protection.

Mainline Valve Assemblies

The mainline valve sites will provide means for isolation of segments of the pipeline and limits release of the product in the unlikely event of a pipeline leak. The valves shall be installed in a location, accessible to authorized employees and protected from damage or tampering **[49 CFR, 195.258(a)].**

All valves will be of a class pressure-temperature rating for the specified design pressure in Section 2.3.1 and meeting the requirements of 49 CFR, Part 195.104. The valves shall meet the requirements and stamped API 6D as well as the following minimum design requirements:

- Compatible with the pipe or fittings to which the valve is attached
- Compatible with the liquid the pipeline may carry
- Both hydrostatically shell and seat tested without leakage per Section 10 of API 6D
- Equipped with a means for clearly indicating open or closed
- Marked on the body or nameplate with the following:
- Manufacturer's name or trademark
- Class designation or maximum working pressure
- Body material
- Nominal size **[49 CFR, 195.116]**

Each mainline valve installation, extending 5 pipe diameters beyond the last fitting, will have 0.60 design factor. Mainline valve sites will be in accordance with the requirements of **49 CFR, Part 195.260**:

- On the suction and discharge of a pump station to permit isolation of the pump station equipment
- On each line entering or leaving a breakout storage tank area that permits isolation of the tank area from other facilities
- Along the mainline at locations that minimize damage or pollution from accidental discharge as appropriate for the terrain in open country or for populated areas
- On each lateral takeoff from a trunk line that permits shutting off the lateral without interrupting the flow in the trunk line
- On each side of a water crossing that is more than 100 feet wide from high-water mark to high-water mark
- On each side of a reservoir holding water for human consumption

Mainline valve sites shall be designed to provide adequate access and work space for operation personnel, vehicles and equipment. Roadways shall be graveled and raised to permit drainage. Sub-surface drainage structures other than culverts under roadways are not anticipated. The area within 1-foot outside a station fence shall be covered with 4-inch of crushed stone, over a geotextile fabric, for weed control. The fencing shall be 6-foot high chain link, topped with three strands of barbed wire. The main entrance gate shall be a double swing gate 12-ft wide. Steel guard posts will be installed as appropriate at each mainline valve to protect the installed facility.

7. Spill Mitigation

BakkenLink has prepared a Spill Prevention, Containment, and Countermeasures (SPCC) Plan to be implemented during construction of the BakkenLink Pipeline Project (Project) in accordance with Section IV.A of the Federal Energy Regulatory Commission Wetland and Waterbody Construction and Mitigation Procedures, January 17, 2003 version. The SPCC Plan describes specific preventive measures to be followed to reduce the likelihood of the accidental release of a hazardous or regulated liquid during construction activities and sets forth procedures and response actions in the event of an actual release.

The goal of the SPCC Plan is to minimize the potential for a spill of these materials, to contain any spillage to the smallest area possible, and to protect areas that are considered environmentally sensitive (e.g. streams, groundwater wells, wetlands, etc.). The policies are outlined in a general way below:

- Preventive measures will be in place that restrict the location of fuel storage, refueling activities, and construction equipment maintenance along the construction right-of-way, staging area and work yards.
- Release of any petroleum product or hazardous liquids in vulnerable aquifer areas will be mitigated by immediate actions dictated in the SPCC. These areas will be treated with the highest levels of sensitivity.
- The response action priorities upon discovery of a spill are to protect the safety of personnel and the public, minimize environmental impacts, and control costs associated with cleanup and restoration.
- BakkenLink will provide spill prevention, response training and safety training to its personnel and contractors. The training program will be designed to improve awareness of safety requirements, pollution control laws, proper operation and maintenance of equipment, and implementation of spill response actions.
- BakkenLink will approve of a Contractor appointed Field Coordinator who will be responsible for reporting spills, coordinating Contractor personnel for spill cleanup, completing subsequent site investigations, and preparing incident reports.
- BakkenLink will prepare Spill Report Forms and notify state and federal agencies as required in the event of a release.
- Further details are to be found in the SPCC.

In addition to the SPCC, BakkenLink will be joining the Sakakawea Area Spill Response team. Six companies with oil interests in the area of Lake Sakakawea are forming a joint company (Sakakawea Area Spill Response, LLC) whose primary purpose is spill response for the area. The joint effort will share the equipment and training costs to handle small-to-medium oil spills, with an initial $300,000 going toward three vessels, two oil skimmers and a boom. This effort is in response to saltwater and oil spills occurring in the spring of 2011, many having been caused by the historic flooding in the area. At least sixteen other companies have shown interest in joining the group effort. BakkenLink intends to pursue agreements to join this response effort.

8. Qualifications of Engineering Firm for the Work

Project Consulting Services, Inc. (PCS) is a company specializing in the design, engineering, and construction management of onshore and offshore pipelines, platforms, and subsea facilities. Since PCS began operations in 1992, it has successfully completed over 2000 projects. Corporate headquarters are located in Metairie, Louisiana, with regional offices in Houston, Texas; Atlanta, Georgia; and Birmingham, Alabama. Internationally, with foreign project offices, PCS has provided services to clients for projects in South America, Russia, Southeast Asia, Canada, Mexico, and West Africa. The company's knowledge of pipeline operations is exceptional, with engineers who have participated in and played a key role in many industry firsts. In addition to its qualifications in the onshore pipeline industry, PCS' personnel have extensive experience in other marine construction projects such as the conceptual and engineering development of Deep Water Ports (DWP) plus offshore platform installation, modification, and salvage. Project responsibilities have included feasibility studies, cost analysis and scheduling, design, permitting, project management for installation of onshore and offshore pipeline project.

Some pipeline projects, having pertinent similarities to the lake crossing, with which PCS has been involved include:

- Denbury Green Pipeline: Galveston Bay Crossing – 320 miles of 24-inch CO_2 pipeline with a shallow water crossing at Galveston Bay, TX
- Creole Trail Pipeline: a 42" natural gas pipeline from Creole Trail LNG Facility, through low lands and shallow water to a transmission system near Carlyss, LA
- Louisiana Offshore Oil Port – Gulf of Mexico deepwater oil port Phase 2 expansion project;
- Main Pass Energy Hub – Gulf of Mexico LNG Terminal (Proposed)
- Northeast Gateway – Boston Harbor DWP
- Broadwater and Islander East proposed installations in Long Island Sound
- Gulfstream Natural Gas System – 744-mile natural gas system, over 430 miles of which are 36-inch-diameter marine pipeline within the coastal areas of Alabama to Tampa, Florida
- Gathering and flowline systems for major producers in and around Mobile Bay, Alabama, to transport natural gas, some of it with corrosive and dangerous properties, to onshore processing facilities

Further information about PCS' experience with this crossing technique is included in Appendix 9.5.

9. Appendix

9.1. Detail Lake Crossing Methodology Document
9.2. Maps
9.3. Soil Boring Report and Logs
9.4. Memo on Concrete Weight Coating of Marine Pipeline Protection
9.5. Memo on Lake Crossing Lowering Equipment, Experience and Planning

LAKE SAKAKAWEA PIPELINE CROSSING REPORT

Appendix 9.1

Detail Lake Crossing Methodology Document

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

REGISTERED PROFESSIONAL ENGINEER
MICHAEL R. ISTRE
PE-6807
DATE 11/7/11
NORTH DAKOTA

Executive Summary

This Proposed Construction Methodology describes the planned work program and sequence of events to install, lower and pre-commission a 12-inch diameter pipeline crossing of Lake Sakakawea as part of the Bakkenlink Pipeline Project.

The planned pipeline installation is based on a conventional pull with strings of pipe welded together in sections on the north shore and then joined into a 13,000 feet (approximate) single pipeline as the pipeline is pulled toward the south shore by a linear winch located on the south shore.

The lowering and protection of the pipeline at the North and South shorelines will be achieved by excavating a trench using long-reach excavators on both banks. The excavators will commence at the shore line and construct a berm adjacent to the pipeline centerline from trench materials and use the berm to walk the excavator out from the shore as determined by site conditions and water depths. After the pipeline is installed, the excavators will reverse the process and transfer the berm material back into the trench and over the pipeline.

Lowering the pipeline beyond the reach of the land-based excavators will be achieved using a pair of Toyo submersible pumps fitted to a purpose-built lowering sled that will extract soil from beneath the installed pipeline and discharge the resulting slurry into the pipeline ditch astern of the sled. The design of the lowering sled will be specific for this project however the concept of the dual Toyo pumps and has been utilized before by several construction groups for pipeline lowering in difficult and environmental sensitive locations. The ability to trail a turbidity mat over the discharge and diffuser is designed to direct the slurry back into the trench to reduce lateral dispersion and provide positive backfill over the lowered pipeline while reducing water column turbidity.

The support equipment for the lowering operation will include a Flexifloat catamaran that will house the power generator for the Toyo pumps. An initial conceptual set of drawings of the lowering system is included in this document and will be supplemented by actual design drawings as the program is developed to fabrication. The operation will include a team, divers vessels, diving equipment, marine and land surveys and instrumentation, an onshore crane, the linear winch and crew, a hold back winch and crew.

The dive team will operate and monitor the lowering operation including pipeline lowering depths and discharge. Both the Flexifloat and the lowering sled will be pulled across the lake by the winch previously used for the pipeline pull. The pull cable will incorporate floatation and will connect to both the water surface pontoon and the sled.

The lowering operation will be performed immediately after the installed pipeline is flooded and after the installed pipeline elevation is surveyed. The Project Team will deploy turbidity monitoring instrumentation at agreed locations with STOP authority in case of the construction activity exceeding an agreed turbidity level above that observed prior to work commencement (the background measurement). Additional lowering passes will be performed until the pipeline reaches the designed depth.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Protection of the pipeline will be achieved based on a fitness for use criteria. A concrete weight coating system will be utilized to protect the pipeline from dropped objects, e.g. anchors, from the expected maximum size marine traffic. The details of the concrete weight coating system are under design.

Construction Plan Summary

1) Shallow Geotechnical Acquisition Study - Completed
2) Detailed pipeline route Hazard Survey - Completed
3) Mobilization and installation of the Pipe Stringing Station at the North Shore
4) Mobilization and installation of the Pipe Pull Station at the South Shore
5) Excavate beach crossings
6) Weld pipe strings on the North Shore
7) Install the pull cable from South Shore to the North Shore
8) Pipe pull operation
9) Flood pipeline section
10) As-Installed Survey
11) Pipeline Lowering
12) As-Lowered Survey
13) Supplemental Pipeline Lowering (Diver Air Lift)
14) As-Built Survey
15) Placement of supplemental protection (as required)
16) Shore Crossing Reinstatement
17) Hydrostatically test the Crossing Section
18) Prepare for tie-in and weld-on valves.

Construction Plan Details

1.0 Shallow Geotechnical Acquisition Study – Completed

2.0 Detailed pipeline route Hazard and Route Selection Survey - Completed

3.0 Mobilization and installation of the Pipe Stringing Station at the North Shore

3.1 Mobilize equipment, plant, materials and personnel to the North Shore work location

3.2 Conduct Job Safety Analysis (JSA) pre-job meeting

3.3 Perform sufficient earth works and placement of work station footings to allow a safe operation to be performed

3.4 Arrange timbers to create a suitable pipe stringing yard for approximately ten (10) strings of pipe each approximately 1300 feet (32 or 33 double random joints/string) adjacent to the pipeline centerline

3.5 Establish a primary welding station on the centerline approximately 200 feet from the lake shoreline

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

4.0 Mobilization and installation of the Pipe Pull Station at the South Shore

4.1 Mobilize equipment, plant, materials and personnel to the South Shore work location

4.2 Conduct Job Safety Analysis (JSA) pre-job meeting

4.3 Construct a suitable land access and level pull site for the placement of the linear line pulling winch (LLPW), wire take-up spools and the Dead Man Anchor (DMA) and hold-back rigging

4.4 Receive and place the LLPW

4.5 Excavate and install the DMA and rigging

4.6 Test pull against the DMA for safety check

5.0 Excavate Beach Crossing (North and South Shorelines)

5.1 After the pulling and welding sites are completed, transfer the excavator and dozer to the respective shore crossing sites

5.2 Excavate a trench from the work sites to the shore line

5.3 Excavate a trench through the shore line and construct a berm wall adjacent to the centerline using the excavated material from the trench and additional material from other locations

5.4 Extend the berm to approximately 100 feet from the shore line

6.0 Welding the pipe strings on the North Shore

6.1 Conduct Job Safety Analysis (JSA) pre-job meeting

6.2 Receive and place the 325 double random joints along the 10 predetermined stringing lines

6.3 Weld and complete NDE of all string sections

6.4 Apply Fusion Bonded Epoxy (FBE) coating to the completed field joints

6.5 Weld a prefabricated pull-head to the first joint

7.0 Installing the pull cable from North Shore to the South Shore

7.1 Conduct Job Safety Analysis (JSA) pre-job meeting

7.2 While the pipe strings are being welded and prepared, float a suitably sized polypropylene rope from the North to the South side of the lake using divers and other marine personnel and equipment

7.3 Attach the polypropylene rope to the wire rope on the South side pulling station and initiate pulling the wire cable to the North Shore (pipe stringing location) using dozers and excavators

7.4 Add floatation to the wire rope to assist progress and reduce pull forces. Meanwhile, divers to ensure that the wire rope alignment is installed under survey control

7.5 Receive the wire cable at the pulling station and attach the wire cable to the pulling head on the leading end of the first pipe string (String #1).

8.0 Pipe pull operation

8.1 Conduct Job Safety Analysis (JSA) pre-job meeting

8.2 Ensure communications between the North and South Shores, the Spotter/Security vessel and the Diving Inspection boat is established and that a redundant system is tested in the event of primary system failure

8.3 The Spotter/Security vessel crew will install markers or buoys during the pull operation to identify a safe boating corridor to cross the pipeline pulling operation. The vessel will provide at-site directions to boaters to ensure the safety of the boating community and will have STOP authority (the pull operation) should a boat inadvertently enter an area that is considered hazardous.

8.4 Attach a hold-back cable to String #1 to ensure that the string does not advance forward in an uncontrolled manner.

8.5 Gradually increase the pull wire tension using the LLPW

8.6 Monitor the movement of the pipe string and maintain detailed open communications with all parties and work sites.

8.7 Pull pipe string until the end of String #1 is at the Line-Up Station.

8.8 Secure the pipe string and slowly lower tension on the LLPW

8.9 Roll String #2 over onto the firing line alignment and line-up with the tail end of String #1

8.10 Complete weld, complete NDE, Inspect and accept NDE

8.11 FBE the complete field joint to provide a continuous protective coating from Sting #1 to String #2

8.12 Jeep the field joint to inspect for holidays in the coating. Repair as necessary.

8.13 When complete and all parties are ready, take up tension on the wire rope again and pull the pipeline until the tail end of String #2 is at the Line-Up Station

8.14 Align String #3 and repeat process of adding strings and pulling

8.15 Between pulls, divers to confirm that the pull head is not digging into the bottom of the trench

8.16 Continue adding strings and pulling until the pull head surfaces at the South shore.

8.17 With assistance from the bull dozer, continue the additional and last pull until the initiation head reaches the target location

9.0 Flood Pipeline Section

9.1 The Pre-Commissioning crew will control flood the lake crossing pipeline section by running a pig train that will include a gauging plate to confirm the pipeline was not damaged during the pull operation.

9.2 The gauging plate will be inspected and accepted by the Chief Inspector

10.0 As-Installed Survey

10.1 Divers will swim the line and perform elevation checks comparing the top of pipe (TOP) to the adjacent natural lake bed.

10.2 Divers will also note the amount of cover (if any) at each survey location

10.3 The Project Engineer will review the results and determine if and where additional lowering is required. The lowering solution will then be initiated based on the results of the diver survey of the flooded pipeline.

11.0 Pipeline Lowering

11.1 Conduct Job Safety Analysis (JSA) pre-job meeting

11.2 Divers will assist the placement (by crane) of the lowering sled (LS) over the installed pipeline on the North side of the lake.

11.3 Divers will partially flood the LS pontoons to stabilize the unit on the bottom.

11.4 Divers will rig-up the Flexifloat Catamaran (FC) and connect the FC to the LS.

11.5 Divers and other marine personnel and equipment will float the polypropylene rope from the North to the South side of the lake

11.6 The polypropylene rope will be attached to the wire rope on the South side pulling station and pulling of the wire cable initiated toward the North Shore using bull dozer and excavators

11.7 Floatation will be added to the wire rope to assist progress and reduce pull forces. Meanwhile, divers will ensure that the wire rope alignment is installed under survey control

11.8 The wire cable will be received at the North Shore and the attached to the yolk connecting both the LS and FC.

11.9 Tension on the pull wire will be increased and the divers will check the LS on bottom alignment and readiness to commence lowering.

11.10 The Toyo pumps will be started and slowly ramped up.

11.11 When the pumps have been operating for several minutes, the pump will be shut down and divers will check the results

11.12 Pulling the LS/FC across the lake will commence with diver checks at regular intervals to confirm trenching success and correct rate of progress

11.13 The rate of progress will be determined by the soil extraction progress and the ability of the pipeline to remain lowered astern of the LS.

11.14 Two Passes of the LS are expected to achieve the design depth.

12.0 As-Lowered Survey

12.1 After recovery of the lowering equipment, divers will again swim the line and perform elevation checks comparing the top of pipe (TOP) to the adjacent natural lake bed.

12.2 Divers will also note the amount of cover (if any) at each survey location

12.3 The Project Engineer will review the results and determine if and where additional lowering is required.

13.0 Supplemental Pipeline Lowering (Diver air-lift)

13.1 As instructed by the Project Engineer, the Dive crew will mobilize to noted locations and perform pipeline lowering operations

13.2 The divers will deploy the hand-held airlift equipment for short sections requiring lowering

13.3 The divers will redeploy the pipeline lowering equipment if the air-lift equipment is considered impractical

13.4 As each identified section is lowered, the divers will resurvey the elevations and advise the Project Engineer of the results

14.0 As-Built Survey

14.1 After the supplemental lowering operation, the divers will again swim the line and perform elevation checks comparing the top of pipe (TOP) to the adjacent natural lake bed.

14.2 Divers will also note the amount of cover (if any) at each survey location

14.3 The Project Engineer will review the results and determine if and where additional lowering is required.

15.0 Placement of Supplemental Protection (as required)

15.1 Based on the length of any section of pipeline that cannot be lowered to the required depth, the Project Engineer will determine the method and material that will be used as supplementary protection.

15.2 Flexible concrete mats will be the preferred protection material and these can be placed at selected locations as determined by protection requirements in areas where there is an increased level of marine traffic.

16.0 Shore Crossing Reinstatement

16.1 Land Surveyors will complete a longitudinal profile of the pipeline from the offshore limit of excavated trench to the work station +/- 200 inshore from the lake shore and confirm depth below natural ground/bed levels

16.2 After the pipeline is flooded, and during remedial lowering and back-filling operations (as needed), initiate back-filling of the shore crossing trenches at both shore lines

16.3 The excavators will transfer the berm material back to the pipeline trench and on top of the pipeline working from offshore to onshore

16.4 Continue the backfilling up to the work stations on both sides and restore the pipeline corridor

17.0 Hydrostatically Test the Crossing Section

17.1 After the as built survey is completed, Contractor will pressure the crossing section and perform an 8 hour hydrostatic test at 1.25 MAOP. This will be the official DOT hydrostatic test for the lake crossing section.

18.0 Prepare for tie-in and weld-on valves

18.1 Demobilize all equipment, materials and plant

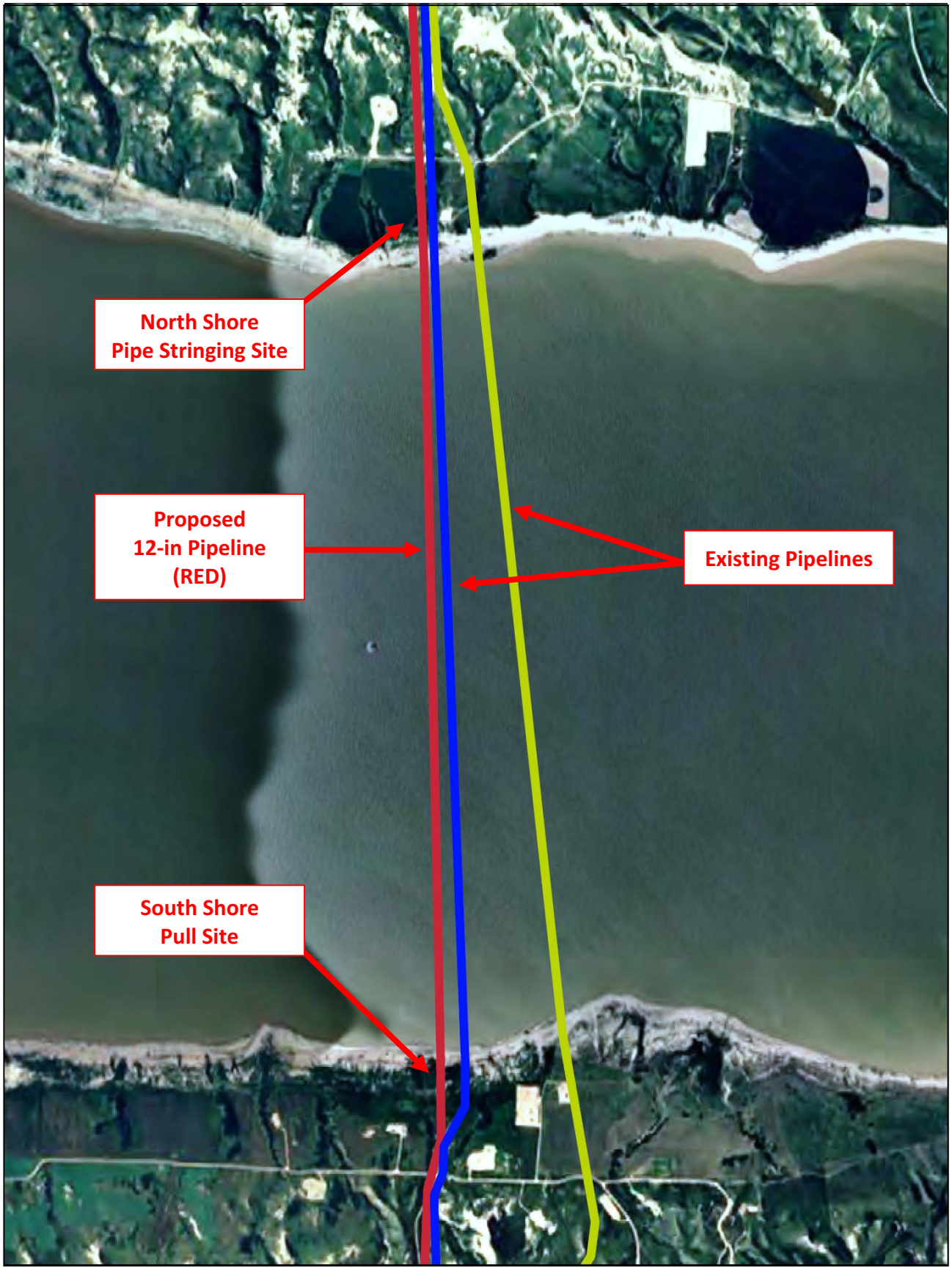
18.2 Clean up work sites

18.3 Weld a temporary security cap on the ends of the pipeline section

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology



10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Establishment of a typical main alignment pull site prior to fabricating the pipe strings. A similar site will be constructed on the north side of the lake.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Track rollers will be installed to support the pipe string on the main pull alignment as it is pulled toward the south shore.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

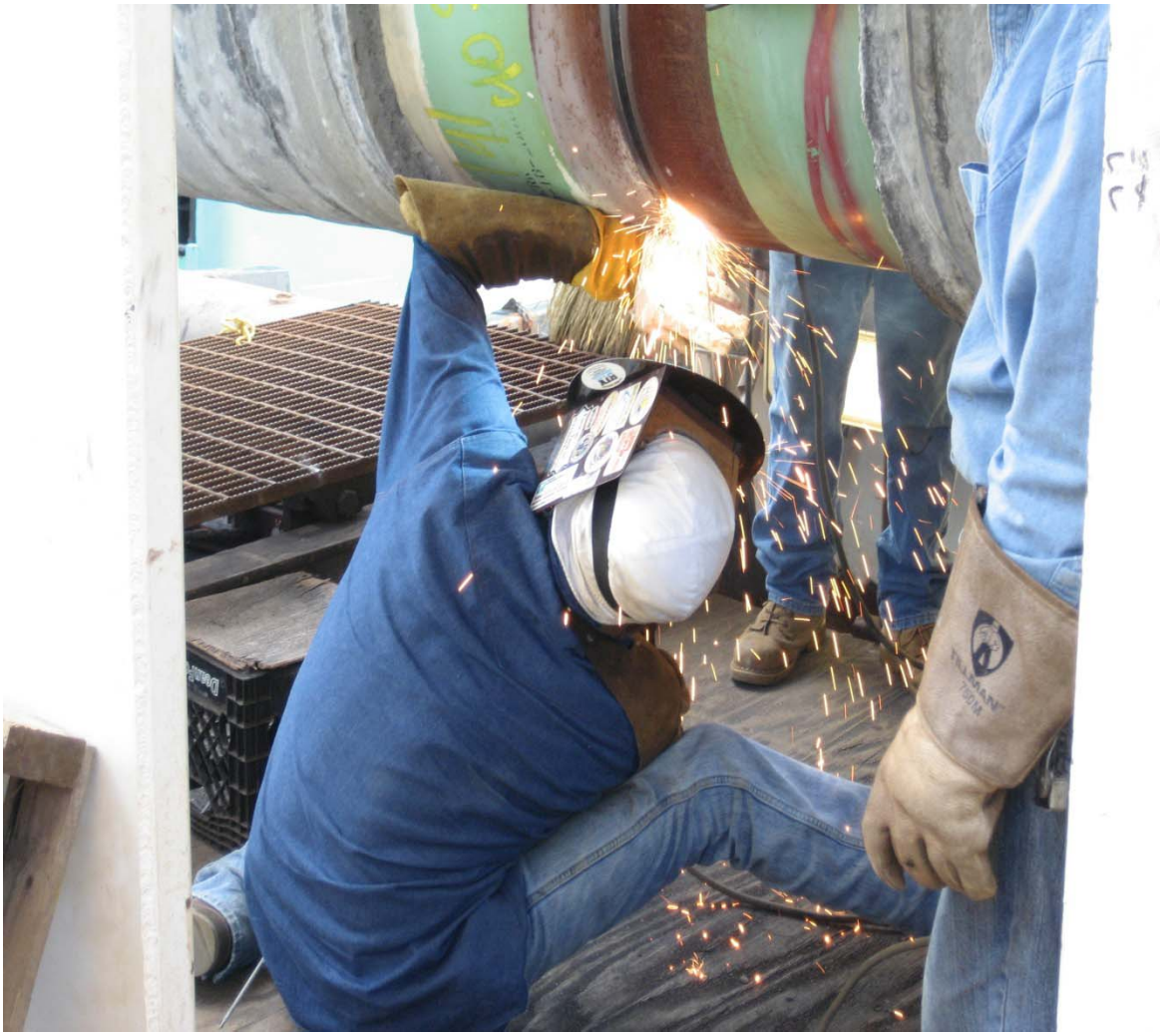
Proposed Construction Methodology

A pipe offloading operation. After offloading, the double random joints of pipe will be placed in rows for stringing.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology



Typical pipe welding operation

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Typical pipe string fabrication area offset from the main pull alignment

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

A linear line pulling winch similar to the unit that will be installed on the south shore to pull the pipe across the lake

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Typical pipe pull across a body of water. However for the crossing of Lake Sakakawea, the pipe will be pulled used a Controlled Bottom Pull method that will have the pipe on or near to the lake bed.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

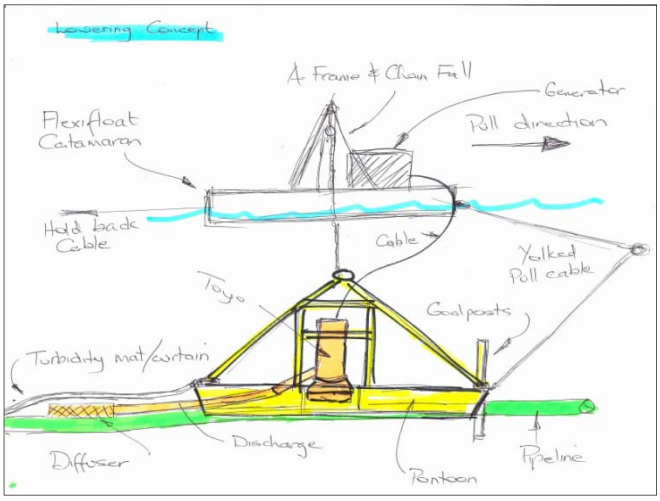
Proposed Construction Methodology

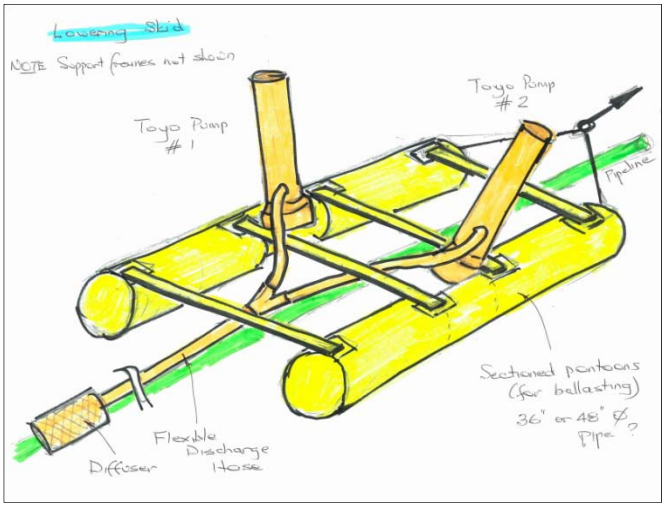
Typical shallow water survey launch that can be utilized during pull and lowering work phases to monitor progress and conformity

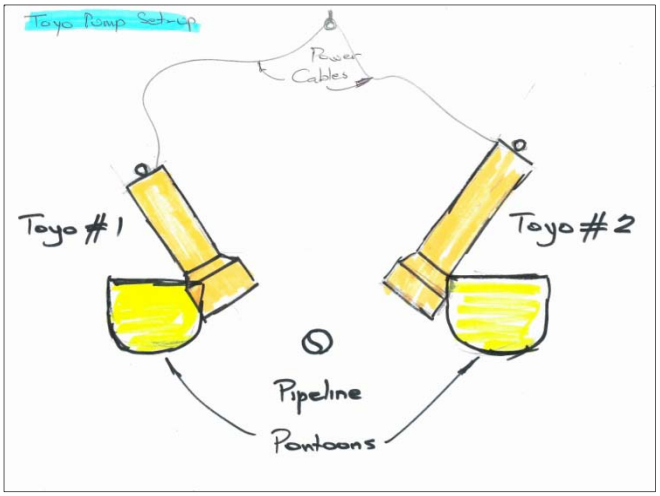
10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology



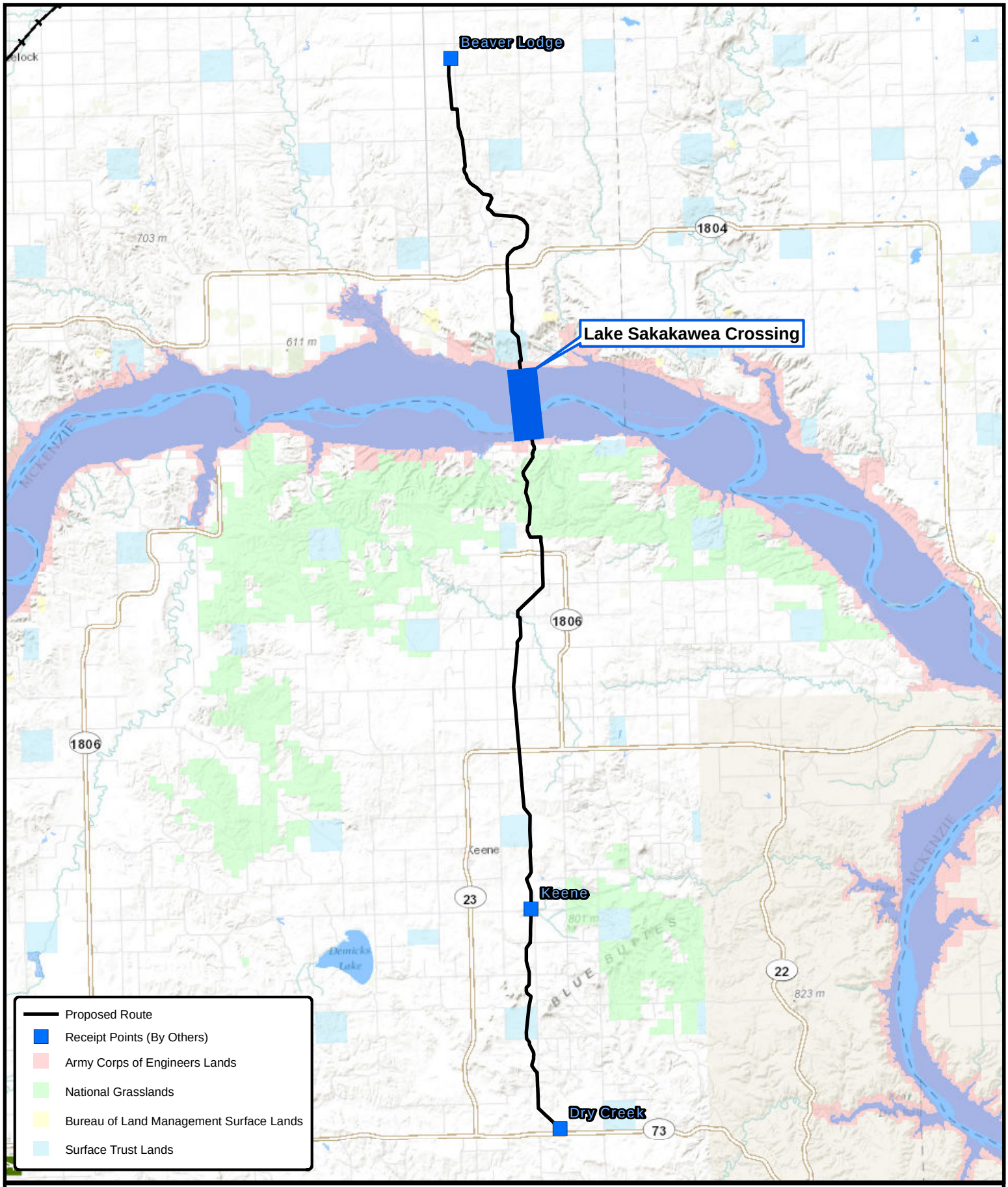




The above three conceptual sketches identify the lowering methodology that will be employed for the lake crossing

Appendix 9.2

Maps



NORTH

0 6,000 12,000 24,000

Feet

UTM 13N FT

BAKKENLINK PIPELINE PROJECT
PHASE II

BakkenLink

BARTLETT & WEST

Route is not final and is subject to change.

NORTH

0 600 1,200 2,400
Feet

UTM 13N FT

BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA CROSSING
SHORE TO SHORE CROSSING LENGTH 11,750'

BakkenLink
BARTLETT & WEST

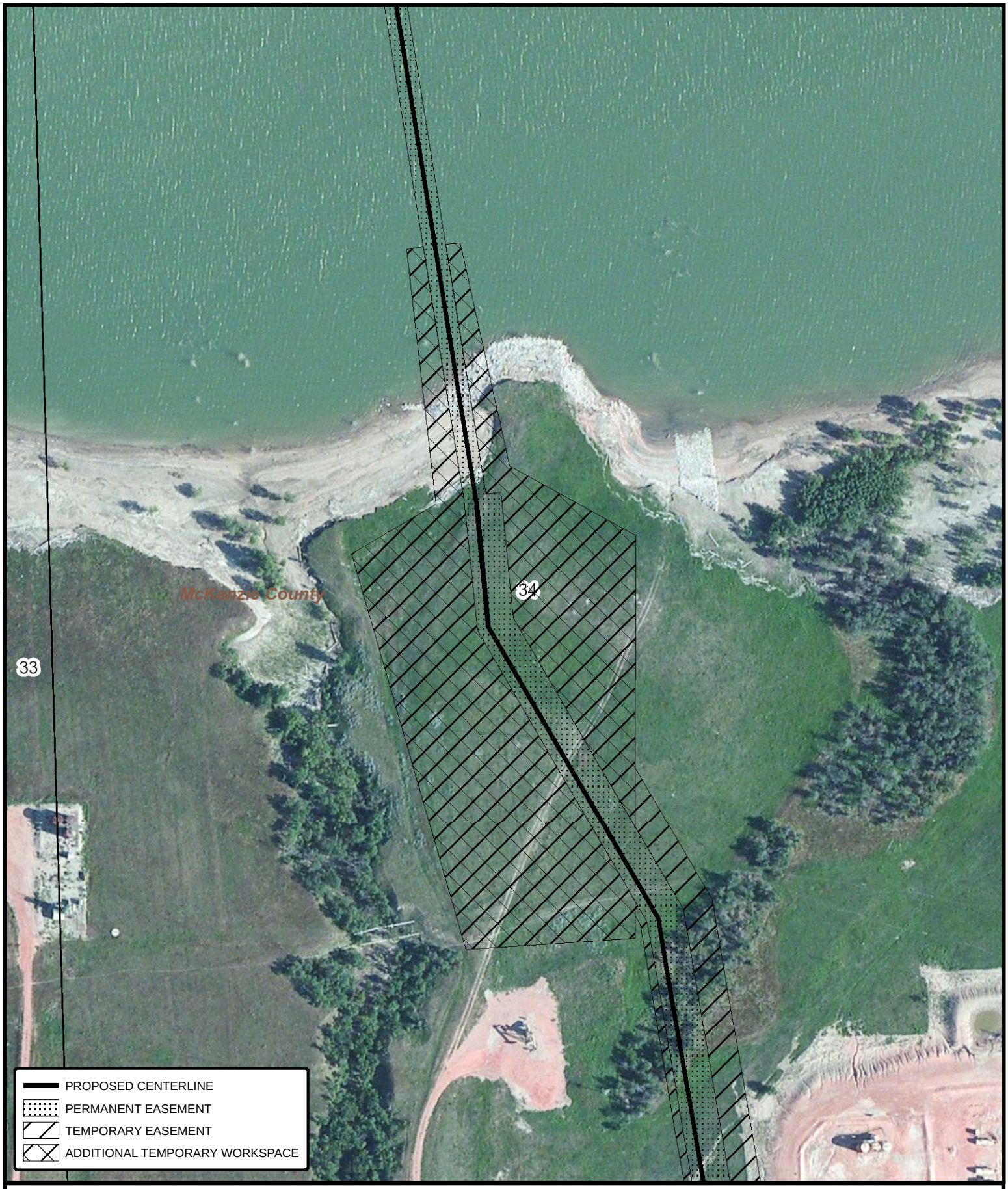
NORTH

0 100 200 400
Feet

UTM 13N FT

BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA
NORTH SHORE CROSSING

BakkenLink
BARTLETT & WEST



NORTH

0 50 100 200
Feet

UTM 13N FT

BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA
SOUTH SHORE CROSSING

BakkenLink
BARTLETT & WEST

Appendix 9.3

Soil Boring Report and Logs

A Subsurface Evaluation Report for

Bakkenlink Pipeline
Across Lake Sakakawea
South of Tioga, North Dakota

Professional Certification

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

10-5-11

Steven P. Nagle, PE
Principal Engineer
Registration Number 3894

STEVEN P. NAGLE
REGISTERED
PROFESSIONAL
PE 3894
ENGINEER
NORTH DAKOTA

FA-11-01275
October 5, 2011
Braun Intertec Corporation

BRAUN INTERTEC

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October 5, 2011 Project FA-11-01275

Mr. Jame Todd
Bartlett &West
3456 30th Avenue NE
Bismarck, ND 58503-0737

Dear Mr. Todd:

Re: Subsurface Evaluation for Bakkenlink Pipeline Crossing Lake Sakakawea, South of Tioga, North Dakota

We have completed the report of the Subsurface Evaluation authorized by you in accordance with the Master Service Agreement between Bartlett & West and Braun Intertec. The purpose of this evaluation was to provide lake-bottom soil data to aid in design of the pipeline which crosses Lake Sakakawea south of Tioga, North Dakota.

Summary of Results

A total of six (6) standard penetration test borings were performed in locations across the proposed alignment. The general soil profile consisted of lake sediment overlying alluvial soils. The lake sediment were encountered in three of the six borings and appeared to consist of 1 foot of "soil" that would classify as fat clay, however, the moisture content of the sediment was higher than the soils liquid limit. Therefore, this sediment was acting more as a fluid. Below the sediment, alluvial soils consisting of lean clay, silty sand, and poorly graded sand with silt and gravel was encountered. These alluvial soils are the native soils that were at this site prior to flooding of the lake. The cohesive portions of these soils generally were very soft to rather soft in consistency and the granular soils had a very loose to medium dense, relatively density.

Summary of Recommendations

The borings indicate that 0 to 1 foot of lake sediment has collected across the lake profile. It does not seem practical to "sink" a weighted pipeline into the sediment. We have provided information to assist in designing a support system, however, the soils below the lake sediment would adequately support the lowered pipeline or any supporting structure.

General

Please refer to the attached report for a more detailed summary of our analyses and recommendations. If we can provide additional assistance, or observation and testing services during construction, please call Steve Nagle at 701.238.3425.

Sincerely,

BRAUN INTERTEC CORPORATION

Debashis Sikdar, PE, PhD
Project Engineer

Steven P. Nagle, PE
Principal Engineer/Vice President

Attachment: Geotechnical Evaluation Report

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A. Introduction

A.1. Project

Bartlett & West is assisting their client in the design of the Bakkenlink pipeline Lake Sakakawea crossing. To assist in the design, Braun Intertec is performing a subsurface evaluation to determine the type of material in the lake bottom which will support the pipeline.

A.2. Purpose of This Evaluation

The purpose of this geotechnical evaluation is to provide soils data for preparing plans and specifications for the pipeline crossing.

A.3. Scope

The proposed scope has been requested by Mr. Jame Todd of Bartlett & West during several email messages. The final scope of work for this project included the following tasks:

- conducting six (6) penetration test borings approximately 10 feet below the lake bottom,
- collecting samples for ellutriate testing from each boring (ellutriate testing performed by others),
- performing strength testing (unconfined compression tests) at midcore depth in each boring,
- performing grain size distributions if sands are encountered,
- performing electrical resistivity testing in three of the borings,
- classifying the samples and preparing boring logs,
- providing a bearing capacity at the surface and midpoint of the boring,
- submitting a geotechnical evaluation report containing logs of the borings, analyses of the field laboratory tests, and recommendations.

A.4. Documents Provided

We were provided a profile of the proposed pipeline, and the GPS coordinates of the six borings.

B. Results

B.1. Logs

Log of Boring sheets indicating the depths and identifications of the various soil strata, penetration resistances, water level and laboratory test results are included in the Appendix. The strata changes were inferred from the changes in the penetration test samples and auger cuttings. It should be noted that the depths shown as changes between the strata are only approximate. The changes are likely transitions and the depths of the changes vary between the borings.

Geologic origins presented for each stratum on the Log of Boring sheets are based on the soil types, blows per foot, and available common knowledge of the depositional history of the site. Because of the complex glacial and post-glacial depositional environments, geologic origins are frequently difficult to ascertain. A detailed investigation of the geologic history of the site was not performed.

B.2. Site Conditions

The project is located approximately 200 feet west of where the existing Dakota Gasification Company's CO_2 pipeline crosses Lake Sakakawea. The pipeline crosses the lake in a relatively wide location.

B.3. Soils

A total of six (6) penetration test borings were performed across the lake, just east of the existing pipeline. The general soil profile consists of lake sediment overlying both cohesive and granular soil. The individual strata are described in more detail in the following sections**.**

B.3.a. Lake Sediment. Borings ST-2, ST-3 and ST-6 encountered 1 foot of lake sediment. The lake sediment classified as fat clay based on the results of the Atterberg limits. However, the moisture contents of the sediment were significantly higher than the Liquid Limit of the soil. Therefore the sediment was acting more like a liquid then a soil.

B.3.b. Alluvium. Underlying the lake sediment, the borings encountered both cohesive and granular alluvium. This alluvium is the native soil that existed at this location prior to the lake being filled. The cohesive alluvium consisted of fat clay, and lean clay with varying amounts of sand. The cohesive soil had a very soft to medium consistency.

The granular alluvium consisted of silty sand, and poorly graded sand with silt and gravel. The penetration resistance in the granular alluvium indicateed the relative density of the granular alluvium was very loose to medium dense.

B.4. Laboratory Test Results

The result of the laboratory tests performed on the different soil samples are presented on the respective boring logs. Also, a summary of all the test results are presented in the Table "Summary of Laboratory Test Data" in the Appendix of this report.

B.4.a. Moisture Content Tests

Moisture content (MC) tests (per ASTM D2216) were conducted on selected samples to aid in our classifications and estimations of the soils' engineering properties. The moisture contents of the soils tested in the sediment soils ranged from 104 to 105% and for alluvial soils ranged from 25 to 46 percent. All the soils are submerged with approximately 50 feet of standing water. All these moisture contents are saturated moisture contents of soil samples.

The results of the moisture content tests are listed in the "MC" column of the Log of Boring Sheets attached in the Appendix.

B.4.b. Unit Weight Tests

The unit weight tests were conducted on selected samples to aid in developing engineering parameters related to settlement calculations. The tests indicated the sediment soils had uniform wet density (WD) of 90 pounds per cubic foot (pcf). The wet densities of alluvial soils varied from 107 to 123 pcf. The results of the density tests are listed in the "Tests or Notes" column on the attached Log of Boring sheets.

B.4.c. Atterberg Limits Tests

The Atterberg limits tests (per ASTM D4318) were conducted on selected samples for classification, evaluation of the soils' plasticity, and estimation of engineering parameters related to consolidation to aid in settlement calculations. The tests indicated the selected

sediment sample had liquid limit (LL) of 76 percent, plastic limit (PL) of 16 percent, and plasticity index (PI) of 60 percent, indicating the soils are classified as fat clays (CH). The tests on the alluvium soil samples indicated they had liquid limits (LL) of 34 to 50 percent, plastic limits (PL) of 19 percent, and plasticity indices (PI) of 15 to 31 percent, indicating the soils are classified as lean clays (CL) and fat clays (CH). The results of the Atterberg Limits test are listed in the "Tests or Notes" column on the attached Log of Boring sheets.

B.4.d. Percent Passing the #200 Sieve Tests

Percent passing the #200 sieve analyses tests (P200) (per ASTM D1140) were performed to estimate the engineering properties of the granular material. The results of the P200 tests indicated the soils encountered had P200's ranging from 8 to 70 percent, indicating the soils are classified as poorly graded sand with silt and sandy lean clay.

B.4.e. Electrical Resistivity Testing

Electrical resistivity testing was conducted in the three selected alluvial soil samples. The electrical resistivity test results were generally in the range of 580 to 1900 Ohm-cm.

C. Analyses and Recommendations

C.1. Project Background

We understand the Bakkenlink pipeline will either be placed in the bottom of the lake through a direct cut or it will be sunk into place. Based on previous experience with pipelines crossing the lake, we assume the minimum cover depth goal is 5 feet. If sinking is feasible it will involve placing a concrete encased pipeline. At this time it does not appear that simply weighting the pipe will cause it to settle a minimum of 5 feet because we found 1 to 2 feet of sediment in three of the six borings. The direct cut method will likely require either a hydraulic jet or a dragline to create a trench for the pipeline.

If our understanding of the proposed project is not correct, or if the proposed grades differ significantly from the above grades, we should be informed. Additional analyses and revised recommendations may be necessary.

C.2. Sediment Parameters

As indicated, the sediment has moisture contents over the liquid limit of the soil and will act more like a liquid then a soil. In order to determine the weight needed in the pipeline to sink into the sediment, an estimate of the sediment unit weight is needed. The following table contains the information collected within the sediment in the various borings.

Table No. 1. Parameter of Lake Sediment.

Boring	Thickness (feet)	Moisture Content %	Wet * Density (pcf)**
ST-1	NA	-	-
ST-2	1	105	90
ST-3	1	105	90
ST-4	NA	-	-
ST-5	NA	-	-
ST-6	1	105	90

Note: * Wet Weight equals the total weight of the soil. To determine the effective weight, subtract the weight of water (62.4 pcf).
** pcf = Pounds Per Cubic Foot.

Because of the very soft and fluid nature of the sediment, we have no way to test the soil strength, however, there is likely some type of soil strength that has developed in the sediment. The strength of the sediment may be estimated as cohesion that has developed from the preconsolidation of the sediment.

On page 7.1-141 of the Department of Navy Design Manual 7.2, there is a relation to calculate the cohesion of a soil based on the preconsolidation of the soil (weight of material above the soil). The relation is: Cohesion = (Unit Weight of soil – Weight of Water) * Depth into the sediment *(0.11+0.0037 * Plastic Index of the Soil)

For this project, the PI of the sediment should be assumed to be at 60. This relationship shows that the strength of the sediment will increase with depth. The increase in the soil strength should be linear.

C.3. Bearing Capacity

As requested, we collected undisturbed samples from near the midpoint of the borings. We had planned to perform an unconfined compression test on the samples, however the samples were soft and became disturbed during the extraction process.

As an alternative, we recommend that the cohesion of the soil can be estimated by taking the blow count time 125 pounds per square foot. The ultimate bearing capacity of the soil can be roughly estimated by multipling the cohesion of a soil by 9. The net allowable bearing capacity of the alluvium soil at five feet depth below the existing lake bed for a spread footing foundation is estimated up to nine hundred (900) psf. This value includes a safety factor of at least 3.0 with regard to bearing capacity failure.

Although these soils have strength, their moisture content will cause these soils to deform and settle. Design of the pipeline will need to be designed to resist the movement of the soil.

C.3. Soil Corrosivity

The results of our electrical resistivity testing indicate that the soils are severely corrosive to steel structures. We recommend that corrosion protection be provided for below-grade ductile iron pipe.

Per current engineering practice, the corrosivity of concrete is evaluated based on the sulphate or chloride concentration tests of the on site soils. These tests were beyond the scope of work for the current project. However, based on our experience with the project site, we anticipate the soils on this site provide a mild to moderate degree of exposure to sulfate attack. Per the ACI requirements we recommend the cementitious material consist of *either* ASTM C 150 Type II cement (designed for moderate sulfate resistance) *or* a combination of any type of ASTM C 150 cement with sufficient quantities of fly ash and/or slag to produce an expansion not exceeding 0.05% at six months or 0.10% at one year when the combination is tested according to ASTM C 1012, “Standard Test Method for Length Change of Hydraulic-

Cement Mortars Exposed to a Sulfate Solution.” We also recommend that all below-grade and below-water concrete be designed with a water-cement ratio of 0.50 or less, and with a minimum 28-day compressive strength of 4000 psi.

D. Procedures

D.1. Drilling and Sampling

We performed the standard penetration test borings from July 25 to 27, 20011, with a trailer-mounted core and auger drill equipped with 3 1/4-inch, inside diameter hollow-stem auger to the bottom of the boring. Sampling for the borings was conducted in general accordance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils." We advanced the boreholes with the hollow-stem auger to the desired test depths. A 140-pound hammer falling 30 inches was then used to drive the standard 2-inch split-barrel sampler a total penetration of 2 feet below the tip of the hollow-stem auger. The blows for the middle foot of penetration were recorded and are an index of soil strength characteristics. Samples were taken at 2 foot vertical intervals for the termination depths of the borings. A representative portion of each sample was then sealed in a glass jar.

D.2. Soil Classifications

A geologist visually and manually classified soils encountered in the test borings in the field in accordance with ASTM D 2488, "Description and Identification of Soils (Visual-Manual Procedures)." A summary of the ASTM classification system is included in the Appendix. All samples were then returned to our laboratory for review of the field classifications by a geotechnical engineer. Representative samples will remain in our office for a period of 60 days to be available for your examination.

E. General

E.1. Basis of Recommendations

The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the attached boring logs. Often, variations occur between these borings, the nature and extent of which do not become evident until additional exploration or construction is conducted. A reevaluation of the recommendations of this report should be made after performing on-site observations during construction to note the characteristics of any variations. The variations may result in additional foundation costs, and it is suggested that a contingency be provided for this purpose.

It is recommended that a qualified firm be retained to perform the observation and testing program for the site preparation phase of this project. This will allow correlation of the soil conditions encountered during construction to the soil borings.

E.2. Soil Evaluation Basis

This report was prepared based on the requested scope of services. It is recommended that a qualified firm be retained to review the geotechnical aspects of any projects and specifications developed based on this report. This review should determine whether any designs have affected the validity of the recommendations, and whether our recommendations have been correctly interpreted and implemented in the design and specifications.

E.3. Use of Report

This report is for the exclusive use of Bartlett & West and their client to use to design the proposed structures and prepare construction documents. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report. The data, analyses and recommendations may not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us.

E.4. Level of Care

Services performed by Braun Intertec Corporation personnel for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time restraints. No warranty, expressed or implied, is made.

Appendix

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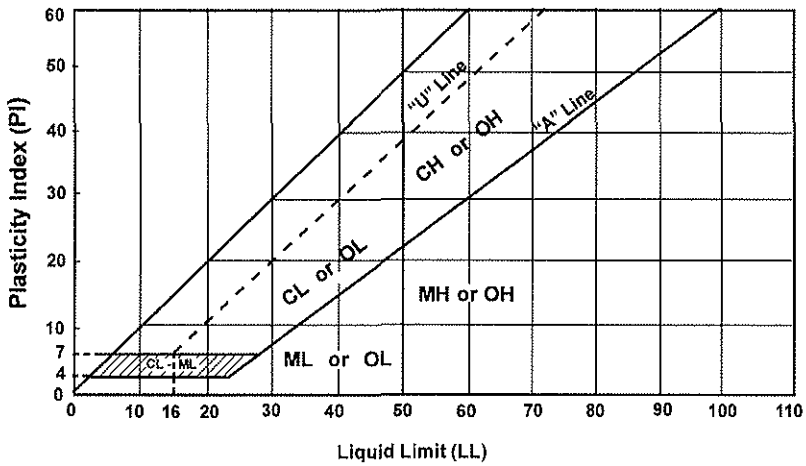
Descriptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification	
				Group Symbol	Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [i]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k l m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [k l m n]
				OL	Organic silt [k l m o]
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay [k l m]
			PI plots below "A" line	MH	Elastic silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [k l m p]
				OH	Organic silt [k l m q]
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat

a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60} / D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise, Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.

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LOG OF BORING

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-01**

LOCATION: 48 08' 56.538" N 102 53' 38.717" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/25/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1810.0	0.0							
		CL	SANDY LEAN CLAY, dark brown, wet, very soft. (Alluvium)	WH		27	123	P200=69.8%
1808.0	2.0							
		CH	FAT CLAY, dark brown and dark gray, wet, very soft. (Alluvium)	2		41	112	
				2		51	107	LL=50, PL=19, PI=31
1803.0	7.0					46		
		CL	LEAN CLAY with SAND, brown, wet, medium. (Alluvium)	6		45	110	
1800.0	10.0		Wood encountered at a depth of 9 feet.					
			END OF BORING.					
			Water depth 42 feet.					

LOG OF BORING N:\GINT\PROJECTS\FARGO\2011\01275.GPJ BRAUN_V8_CURRENT.GDT 8/12/11 15:07

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LOG OF BORING

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-02**

LOCATION: 48 08' 45.218" N 102 53' 37.628" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/25/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1806.0	0.0							
1805.0	1.0	CH	FAT CLAY, dark brown, wet, very soft. (Sediment)	WH		104	90	Sediment
		CL	LEAN CLAY, bown, wet, soft to rather soft. (Alluvium)	4		39	114	
						38		Electrical Resistivity =1800 ohm-cm
1801.0	5.0							
		SM	SILTY SAND, olive, waterbearing, medium dense to loose. (Alluvium)	14		34		P200=19.1%
				7		25		
1796.0	10.0							
			END OF BORING. Water depth 46 feet.					

LOG OF BORING N:\GINT\PROJECTS\FARGO\2011\01275.GPJ BRAUN_V8_CURRENT.GDT 8/12/11 15:07

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LOG OF BORING

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-03**

LOCATION: 48 08' 15.141" N 102 53' 34.395" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/26/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1803.0	0.0							
1802.0	1.0	CH	FAT CLAY, olive, wet, very soft. (Sediment)	WH		105	90	
		SM	SILTY SAND, brown, waterbearing, very loose to medium dense to dense. (Alluvium)	2		31		
			Encountered wood and organics at 3 feet.			35		
				11		29		P200=13.8
				29				
1793.0	10.0		END OF BORING. Water depth 49 feet.					

LOG OF BORING N:\GINT\PROJECTS\FARGO\2011\01275.GPJ BRAUN_V8_CURRENT.GDT 8/12/11 15:07

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LOG OF BORING

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-04**

LOCATION: 48 07' 16.571" N 102 53' 28.653" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/26/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1804.0	0.0	CL	LEAN CLAY, brown, wet, rather soft to soft. (Alluvium)	4		36	114	
				2		37	115	LL=34, PL=19, PI=15
1801.0	3.0	SM	SILTY SAND, dark brown, waterbearing, loose. (Alluvium)			34		Electrical Resistivity = 580 ohm-cm
				6		27		P200=46.1%
				9		29		
1794.0	10.0		END OF BORING. Water depth 48 feet.					

LOG OF BORING N:\GINT\PROJECTS\FARGO\2011\01275.GPJ BRAUN_V8_CURRENT.GDT 8/12/11 15:07

BRAUN INTERTEC

LOG OF BORING

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-05**

LOCATION: 48 07' 11.247" N 102 53' 28.391" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/27/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1808.0	0.0							
		CL	SANDY LEAN CLAY, olive, wet, very soft to rather soft. (Alluvium)	1		30	120	
				WH		38	114	
						40		
				2		42		P200=83.6%
				5		38		P200=84.4%
1798.0	10.0							
			END OF BORING.					
			Water depth of 44 feet.					

LOG OF BORING N:\GINT\PROJECTS\FARGO\2011\01275.GPJ BRAUN_V8_CURRENT.GDT 8/12/11 15:07

BRAUN INTERTEC

LOG OF BORING

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-06**

LOCATION: 48 07' 50.495" N 102 53' 31.978" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/27/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1804.0	0.0							
1803.0	1.0	CH	FAT CLAY, dark brown, wet, very soft. (Sediment)	2		105	90	LL=76, PL=16, PI=60
		CL	LEAN CLAY, dark gray, wet, soft to rather soft. (Alluvium)	6		30	120	
1800.5	3.5	SP	POORLY GRADED SAND with SILT and GRAVEL, fine to medium grained, brown, waterbearing, loose. (Alluvium)			40		Electrical Resistivity = 1900 ohm-cm
				4		27		LL=NP
				11		25		Gravel=34.8%, P200=8.19%
1794.0	10.0							
			END OF BORING.					
			Water 48 feet deep.					

LOG OF BORING N:\GINT\PROJECTS\FARGO\2011\01275.GPJ BRAUN_V8_CURRENT.GDT 8/12/11 15:07

SUMMARY OF LABORATORY TEST DATA

Project No.: FA-11-01275		Bakkenlink Pipeline Crossing Lake Sakakawea Tioga, North Dakota

Boring No.	Sample Type	Depth	Moisture Content	Moisture Density	Atterberg Limits + MC	P200	Electrical Resistivity (Ohm-cm)	Remarks
ST-01	Composite	0' - 2'	27	123		69.8%		
ST-01	Composite	2' - 4'	41	112				
ST-01	Composite	4' - 6'	51	107	LL=50, PL=19, PI=31			
ST-01	Composite	6' - 8'	46					
ST-01	Composite	8' - 10'	45	110				
ST-02	Composite	0' - 2'	104	90				
ST-02	Composite	2' - 4'	39	114				
ST-02	Composite	4' - 6'	38				1800	
ST-02	Composite	6' - 8'	34			19.1%		
ST-02	Composite	8' - 10'	25					
ST-03	Composite	0' - 2'	105	90				
ST-03	Composite	2' - 4'	31					
ST-03	Composite	4' - 6'	35					
ST-03	Composite	6' - 8'	29			13.8%		
ST-03	Composite	8' - 10'						
ST-04	Composite	0' - 2'	36	114				
ST-04	Composite	2' - 4'	37	115	LL=34, PL=19, PI=15			
ST-04	Composite	4' - 6'	34				580	
ST-04	Composite	6' - 8'	27			46.1%		
ST-04	Composite	8' - 10'	29					
ST-05	Composite	0' - 2'	30	120				
ST-05	Composite	2' - 4'	38	114				
ST-05	Composite	4' - 6'	40					
ST-05	Composite	6' - 8'	42			83.6%		
ST-05	Composite	8' - 10'	38			84.4%		
ST-06	Composite	0' - 2'	105	90	LL=76, PL=16, PI=60			
ST-06	Composite	2' - 4'	30	120				
ST-06	Composite	4' - 6'	40				1900	
ST-06	Composite	6' - 8'	27		LL= NP			
ST-06	Composite	8' - 10'	25			8.19%		Gravel= 34.8%

Appendix 9.4

Memo on Concrete Weight Coating of Maine Pipeline Protection

Project Memorandum

PCS Project No.	**10045**
Project	**Bakkenlink Pipeline Project**
Aspect	**Lake Sakakawea Crossing**
To	**Jarrett Davis**
From	**Terry Oram**
Subject	**Pipeline Protection**

PCS has extensive experience in developing solutions for the protection of installed marine pipelines. Each project is unique and requires specific design and construction efforts to ensure that the pipeline is installed and operated in a safe manner based on the location and marine traffic plying the waters in the immediate vicinity. For projects in areas of higher than normal marine traffic, the safety of the pipeline under study will be reviewed and evaluated by subject matter experts (SME) in the field of marine engineering and more particularly, the study of anchors and anchor impacts, These studies are intended to develop criteria for pipe wall thicknesses, concrete weight coating density and thickness, depth of pipeline lowering, backfill requirements and in the extreme cases, engineered back-fill or other mechanical protection.

One such study involved the physical evaluation of a range (in weight/size) of anchors being dropped onto a pipeline with varied protective covering to confirm that the planned pipeline was adequately designed and the lowering and protective cover provided 100% protection. In this case a 24-inch pipeline (0.576-inch wall, X-60 with 3.35 inches of 190 pcf concrete weight coat (CWC)) was positioned on land and subjected to 2.5, 4, 7, 9, and 12.5 ton anchors being dropped on the pipeline from a crane. It was found that the concrete coated pipe was able to withstand a direct hit from up to a 4 ton anchor without any permanent dent or deformation of the steel pipe. In all test cases, including the dropping of the anchors directly on the bare girth weld, the pressurized pipe did not fail and in the case of the 2.5 ton (5000 pound) anchor, the CWC was only slightly damaged.

Our understanding of the marine traffic plying Lake Sakakawea in the area of the proposed pipeline crossing is that the boat sizes are generally less than 30 feet LOA including salmon fishing using downrigger equipment. It is assumed that with the presence of multiple existing pipelines crossing in the immediate vicinity of the proposed pipeline route and the direction from the USACE for our pipeline to be routed in this same general area as the existing pipelines, that no dredging or capital works will be performed in this area by the USACE. This being the case, protection of the pipeline will be developed for inadvertent or deliberate anchor drops from 30 feet LOA boats and impacts from downrigger equipment.

The attached *Anchor Selection and Specifications Guide* from Fortress Marine Anchors identifies that 30 feet LOA boat would not use any type of anchor weighing more than 30 pounds confirming a boaters rule of thumb of I pound per I foot of length. The downrigger system uses a 10-20 pound weight to keep the gear at a preferred depth in the water column. If the weight is lowered to the bottom during trawling, it would not damage the lowered pipeline.

Based on these conditions, PCS is satisfied that with the pipeline as designed, as concrete weight coated and lowered with the top of pipe below the natural lake bed, will be adequately protected and safe for operation.

FORTRESS
MARINE ANCHORS
NOT JUST STRONGER, LIGHTER!

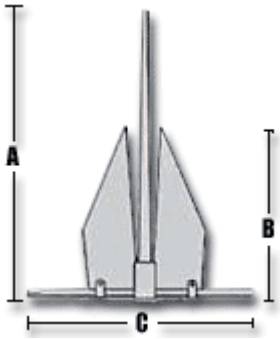
Fortress Marine Anchors
1386 West McNab Road
Fort Lauderdale, Florida, USA 33309

Anchor Selection & Specifications Guide

Boat size recommendations are for boats of average windage and proportions in 30 knots of wind, average bottom conditions, and moderate protection from open seas. Remember that the loads in 42 knots of wind are twice as much as in 30 knots.

Use three-strand nylon rope, 6-12 ft (2-4 m) of chain and a minimum of 5:1 scope. Also, a minimum of 6 ft (2 m) of chain should be used for every 25 ft (8 m) of water depth. For storm conditions use an anchor one or two sizes larger.

Exclusively on Fortress...



FORTRESS SELECTION GUIDE

Model		FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125
Boat Length	ft	16'-27'	28'-32'	33'-38'	39'-45'	46'-51'	52'-58'	59'-68'	69'-150'
	m	5-8	8-10	10-12	12-14	14-15	16-18	18-21	21-46
Weight	lb	4	7	10	15	21	32	47	69
	kg	1.8	3.2	4.5	6.8	9.5	14.4	21.2	31.1
Replaces Steel Anchors	lb	6-9	10-13	14-18	19-28	33-50	50-65	70-90	100-170
	kg	3-4	5-6	6-8	9-13	15-23	23-29	32-41	45-77

HOLDING POWER

Model	FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125

Working Load	lb	700	900	1.250	2,000	3,000	4,000	5,250	6,750
	kg	318	408	567	907	1,351	1,814	2,381	3,062
32 Degree Hard Sand Holding Power	lb	2,800	3,600	5,000	8,000	12,000	16,000	21,000	27,000
	kg	1,270	1,633	2,268	3,629	5,443	7,258	9,536	12,247
45 Degree Soft Mud Holding Power	lb	840	1,080	1,500	2,400	3,600	4,800	6,300	8,100
	kg	381	490	680	1,089	1,633	2,177	2,858	3,674
32 Degree Soft Mud Holding Power	lb	420	540	750	1,200	1,800	2,400	3,150	4,050
	kg	191	245	340	544	816	1,089	1,429	1,837

DIMENSIONS

Model		FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125
"A" Shank Length [diagram]	in	24"	27"	31"	36"	40"	46"	51"	56"
	mm	610	685	787	914	1,016	1,168	1,295	1,422
"B" Fluke Length [diagram]	in	14"	16"	18"	21"	24"	27"	30"	33"
	mm	356	406	457	533	610	686	762	838
"C" Stock Length [diagram]	in	19"	22"	25"	29"	32"	37"	41"	45"
	mm	483	559	635	737	813	940	1,041	1,143

SUPPORT HARDWARE

Model		FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125
Proof Coil Chain	in	3/16"	1/4"	5/16"	3/8"	3/8"	1/2"	1/2"	1/2"
	mm	5	6	8	9	9	13	13	13
Nylon Rope**	in	3/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"
	mm	9	9	13	16	19	22	25	32
Shackle Size	in	1/4"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	5/8"
	mm	6	6	8	10	12	12	16	16

NOTE: Hard sand holding power figures above represent loads actually achieved on production FORTRESS and Guardian anchors under controlled horizontal pull conditions without dragging or resulting in disabling structural deformation.

** Rope recommendations are based on 25% of breaking strength. Rope must be in good condition.

Appendix 9.5

Memo on Lake Crossing Lowering Equipment, Experience and Planning

Project Memorandum

PCS Project No.	**10045**
Project	**Bakkenlink Pipeline Project**
Aspect	**Lake Sakakawea Crossing**
To	**Jarrett Davis**
From	**Terry Oram**
Subject	**Lake Crossing Lowering Equipment, Experience and Planning**

Submersible or slurry pumps are used by marine construction and diving groups to extract and/or relocate large volumes of seabed materials in a safe and controlled manner. The Toyo pump is one of the more commonly used and well known types of submersible pumps available to the marine construction industry for seabed material relocation solutions when diver operated air-lift equipment is inadequate. The pump is particularly effective when precise removal of materials is required in sensitive, confined and/or restricted locations.

The Toyo pump has been adapted and utilized to solve a wide range of subsea extraction and material transfer projects. The diversity of these applications and the importance of solving each situation in a timely manner provides evidence of the trust that international and domestic operators and contractors have of Toyo's effectiveness as a problem solving tool. Additional support for the Toyo pump is provided by the US Army Engineer Waterways Experiment Station document DRP 3-05 dated 1992 that reported on the results of full-scale field tests that "The Toyo pump performed the best overall and was only bettered by the Indian River Inlet educator when pumping wood debris". The reference to this report is made to illustrate the effectiveness of the Toyo pump in lifting and moving the type of soils that were found on the lake bottom and to the depth of the intended trench during the geotechnical investigations. In the report, sand, gravel, rip-rap, timber, plastic liners, aluminum cans were used as the "medium" for the trials. By comparison, the lake bed materials are more mundane and are described as *"The general soil profile consisted of lake sediment overlying alluvial soils. The lake sediment were encountered in four of the six borings and appeared to consist of 1 foot of "soil" that would classify as fat clay, however, the moisture content of the sediment was higher than the soils liquid limit. Therefore, this sediment was acting more as a fluid. Below the sediment, alluvial soils consisting of lean clay, silty sand, and poorly graded sand with silt and gravel were encountered. These alluvial soils are the native soils that were at this site prior to flooding of the lake. The cohesive portions of these soils generally were very soft to rather soft in consistency and the granular soils had a very loose to medium dense, relatively density"* Note 1.

Note 1

"Subsurface Evaluation for Bakkenlink Pipeline Crossing Lake Sakakawea, South of Tioga, North Dakota" by Braun Intertec Corporation

Lake Crossing Lowering, Equipment, Experience and Planning.

An unique aspect of dredging with the Toyo submersible pumps is the lack of turbidity. As the impeller rotates the slurry exits the pump discharge at a much higher velocity than the entry point. This creates a low pressure zone at the impeller eye and atmospheric pressure pushes more slurry into the pump. This is commonly referred to as the ability of the pump to create suction. In addition, the agitator directs flow away from the impeller creating an additional low pressure area between the agitator and the impeller. All the solids that are disturbed from their settled state are drawn into the low pressure area and through the pump - minimizing turbidity. Turbidity is further reduced due to the fact that the Toyo pump typically operates sub surface - below the mud line.

Most pipelines in the Gulf of Mexico (GOM) are lowered using jetting technology. In the jetting process, soils beneath the pipeline are fluidized with high pressure water and air-lifts remove the fluidized soil from beneath the pipe. As the jet sled is pulled forward, the pipeline astern of the sled settles into the jetted trench. Jetting has been used in the GOM since the 1950's after unburied pipelines were found to be susceptible to fishery operations and were unprotected during a storm events. The lowering of the pipeline with the top of pipeline three feet or more below the natural seabed, was introduced to protect and stabilize the pipeline and became a required standard by Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), for all new pipelines.

The concept of utilizing a submersible pump for lowering pipelines on a skid mounting straddling an installed pipeline is not new. Horizon Construction adapted a 1960's vintage conventional jet sled (see attachments) for use in the North East offshore environment. The design replaced the surface mounted jet pumps and compressors that are part of a normal marine jetting spread and concentrated the prime operating units at the immediate work area. The results from equipment trials prior to mobilization for the North East Gateway project offshore Boston proved the effectiveness of the new system.

The lack of marine equipment on Lake Sakakawea directed PCS to a pipe-pull methodology using a linear line pulling winch. With this winch mobilized and used to pull the pipeline across the lake, the use of the winch to progress a pipeline lowering sled and surface pontoons become the lake was reviewed. Each pipeline lowering project is unique and equipment is developed to solve the specific needs of the location, seabed conditions, environment and marine equipment availability. Utilizing experience gained from projects in Indonesia, Malaysia, Thailand and other locations where small sleds were utilized to lower pipelines using winches to progress the operation and divers to operate and monitor the progress, PCS developed a concept for a lighter model sled based on the seabed and environmental conditions and the lack of dedicated marine support and floating lifting equipment on Lake Sakakawea. Jeveler Construction Co. Inc. (Jeveler) has also developed a single Toyo sled unit (see attachments) that again minimizes the weight and subsequent transportation effort. Both designs will be reviewed and evaluated as the project progresses to construction with one of the designs being developed to a testing stage.

Lake Crossing Lowering, Equipment, Experience and Planning.

For the lake crossing, the pipeline trench length between the shorelines and outside the area lowered using land-based excavators is approximately 12,000 feet. The depth of trench is targeted for 6 feet. The width of the trench will vary (soil types) but is expected to be an 8 feet box cut with natural sloughing of the walls. This equates to an approximate 21,000 cubic yard trenching operation. Based on a conservative production rate of 250 cubic yards per hour (see report DRP 3-05) with an effective 10 hour day operation, the total duration is expected to be 9 days. The first pass is expected to lower the pipeline between 75% to 100% with subsequent lowering performed by divers if lowering is required in isolated locations or with another pass of the sled if extended sections require supplemental lowering. Rigging up for an additional pass of the sled will add approximately 2 days to the schedule to allow for relocation of the resources and rerunning the pull cable. The dive team will monitor the progress of the sled and the effectiveness of the operation. This monitoring will include increasing or decreasing the rate of travel as the lowering results are surveyed astern of the sled as the pipeline settles into the jetted trench. The divers will compare the natural lake bed (at an undisturbed offset) with the bottom of trench and top of pipe using depth (kluge) indicating hose or instrumentation similar to a C-Depth system (see attachments). Additionally, after the dive team has advised the Project Engineer that a section of the pipeline has been lowered to grade, a series of echo sounder cross sectional runs will be made at suitable spacing along the line by the Surveyors.

The pipeline applications for the Toyo pump over its 60 year plus life span are numerous and in some cases proprietary however some of its achievements are listed below:

1. Lowering of the shallow water section of a major 36-inch trunk line in the GOM in oyster bed areas (PCS was the Project Manager for this project)
2. Lowering of a 7,000 feet section of a 36-inch natural gas line in the GOM conducted under FERC jurisdiction (PCS personnel were part of the project team)
3. Used in the construction of a lowering tool as an alternative/back-up solution for several Atlantic seaboard pipeline projects (PCS was the Project Manager for this project)
4. Excavation of a pipeline trench adjacent to a producing trunk line in Sabah, Malaysia (PCS personnel were part of the project team)
5. Uncovering and exposing pipelines requiring repairs post Hurricane Rita (PCS was the Project Manager for this project)
6. Lowering of a 7,700 feet section of 30-inch natural gas pipeline displaced by a hurricane in the GOM under MMS jurisdiction (PCS personnel were part of the project team)
7. Maintenance of a dredged pipelines trench for a triple beach pulls in Sarawak, Malaysia (a PCS person was the Project Manager of this operation)
8. Lowering of several innershore pipelines in Taiwan. (PCS personnel were part of the project team)
9. Lowering of the innershore section of a 36-inch trunkline crossing the Tapti River in India (a PCS person was the Project Manager of this operation)

10. Lowering of multiple pipelines for a new pipeline crossing in the GOM (PCS personnel were part of the project team)
11. Excavation in the immediate shore crossing for an oil loading line at Map Ta Phut Thailand (a PCS person was the Project Manager of this operation)

For most of these pipeline projects, PCS personnel have played a senior role in either the design, the development of the application or the actual operation.

Jeveler Construction Co. Inc (Jeveler) is a Louisiana dredging contractor and equipment supplier that has participated and developed unique solutions to a wide range of subsea dredging projects using Toyo pumps. PCS has reviewed several projects with Jeveler and will most likely seek their input for the pipeline lowering of the Lake Sakakawea pipeline crossing. In addition to its participation in several of the named pipeline projects, Jeveler has a long list of non-pipeline accomplishments including the following where Toyo pumps were utilized:

1. Several large land developments in the Corpus Christi area (Padre Isles, Pelican Cove and Island Moorings).
2. Services in hazardous waste removal, wetland restoration, cofferdam dredging and other forms of environmental dredging. Our experience in moving materials has allowed us to modify the Toyo pumps to maximize their capabilities and minimize time and cost.
3. Dredging Contaminated Sediment - Along the bank of the Hylebos Waterway in Tacoma, Washington 32,000 cubic yards of contaminated sediment is being removed and treated, including some of the most dangerous chemicals in the Commencement Bay. The Toyo submersible dredge pump was specified as the preferred method of dredging due to the limited turbidity created when dredging as well as the high solids content when submerged in material. The treatment costs are considerable, so the focus is dredging at the highest solids content possible. Material is being pumped 2,000 feet to a treatment/dewatering process. The sediment is then trucked to a disposal site.
4. Wetland Restoration - This project was for marsh restoration near the mouth of the Neches River. A spoil disposal area was created from the dredging of a canal, a cooling water supply source for the power plant, was excavated down to natural marsh levels to create “coastal prairie” The excavated spoils were hauled to a centrally located pit, mixed with water from the canal to form slurry and pumped into the dead marsh area to form islands and higher elevations to promote growth of vegetation.
5. Filling Geotubes - beach stabilization project for NASA. 4,600 feet of 34’ circumference tubes filled up to 6’ in height with a medium grained sand. Excavators fed the sand to Javeler's hydraulic drive 75 hp submersible agitator pump which was placed in a 30' x 20' x 5' deep pit. The sand slurry was pumped through 2,300 feet of 8 inch HDPE pipe to fill the geotubes.

The following articles and brochures are attached to demonstrate the versatility and effectiveness of the Toyo pump that will be primary lowering tool for the Lake Sakakawea pipeline crossing

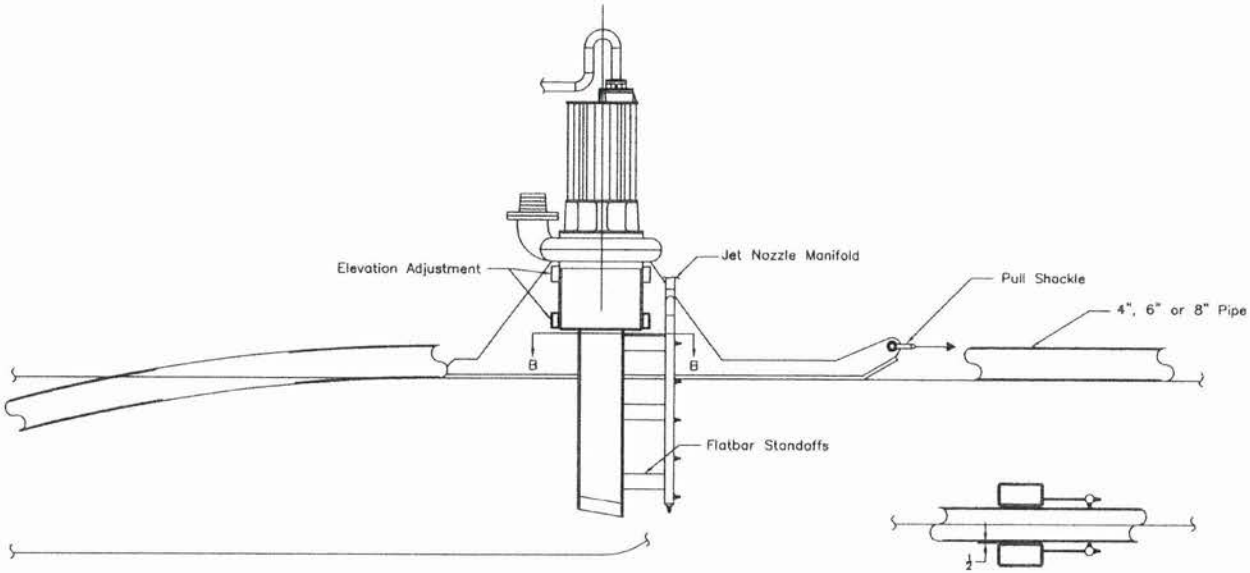
Lake Crossing Lowering, Equipment, Experience and Planning.

Attachments:

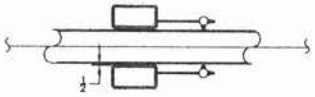
1. Alternative Pipeline Dredge Assembly (by Jeveler)
2. Javeler 75 converted Toyo pump (by Jeveler)
3. Toyo pumps incorporated in a jet sled (for NE application)
4. Description of the lowering the 7000 feet of 36-inch pipeline
5. Dredging Research Technical Notes (DRP-3-05)
6. Electronic Diver Depth Monitoring System

Revision 0
PCS 10045
October 18, 2011

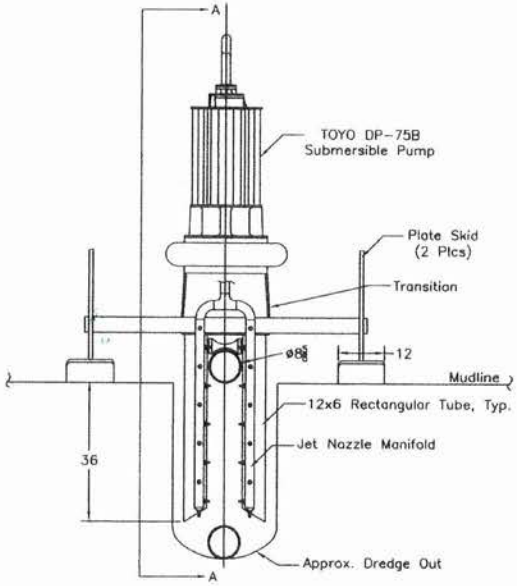
ALTERNATIVE PIPELINE DREDGE DESIGN



Elevation – Section A–A



Plan – Section B–B



Elevation – View from Front

NOTES
Concept Drawing

ENGR RECORD	DATE	Javeler Construction	
		Pipeline Dredge Assembly	
DRAWN BY: RG	3/08		
CHECKED BY:		JOB NO.:	
APP. BY:		DRAWING NO.:	
APP. BY:			SHEET: 1 OF 3
SCALE: NTS			REV NO.: 0

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JAVELER 75 CONVERTED TOYO PUMP

Javeler 75 - Serious Excavation

Submersible Dredge Pump System with 8" Discharge

The 75 is designed to move high volumes of material with controlled discharge in rugged offshore conditions. With Javeler's knowledge and experience there is no better way to move the earth.

SPECIALIZED DREDGING & EQUIPMENT

It's more than a pump; it's how Javeler makes it work.

EXPERIENCE: Javeler offers more than just excavation equipment. For over 40 years, Javeler has continually provided innovative dredging solutions around the world from the Gulf of Mexico to the North Sea.

24 HOUR SUPPORT: Get it when you need it. Our commitment ensures the work gets done quickly and correctly. Javeler has backup systems to ensure minimal loss of productivity.

FIELD PERSONNEL: Experienced technicians available for on-site assistance to make your job easier. All offshore personnel are TWIC, SafeGulf, Water Survival and CPR certified.

8" Discharge

75 PUMP SPECIFICATIONS

	Electric	Hydraulic
Discharge	8 inch	8 inch
Motor	75 hp	up to 150 hp
Capacity	1600 gpm	up to 2500 gpm
Head	96 feet	up to 170 feet
Production (based on free flowing sand)	75-150+ cy/hour	75-180+ cy/hour
Power Source	175 kw generator	HPU
Reel	static cable reel	hydraulic hose reel
Maximum Depth	150 feet	850+ feet (Greater depths with ROV)

*Pressure compensated for depths greater than 150 feet. A 75 hydraulic is also available for depths up to 150 feet

DIMENSIONS & WEIGHTS

	Electric	Hydraulic
Pump	6'H x 4'W x 3'D 2500 lbs.	6'H x 4'W x 3'D 2200 lbs.
Transport Skid (pump included)	13'L x 4'W x 5'H 4200 lbs.	6'L x 4'W x 8'H 3500 lbs.
Power Source	13'L x 4'W x 8'H 8600 lbs.	12'L x 5'W x 8'H 10,000 lbs.
Hydraulic Hose Reel	N/A	9'L x 7'W x 8'H 10,000 lbs.

OPTIONAL EQUIPMENT

Jetting
Multiple jetting options.

Discharge Hose
Available with or without floats.

HDPE Pipe
8" or 10" SDR 17

Jet Hose Reels
Up to 850' capacity.

Power Generation
Hydraulic Power Units & Electric Generators

Job Storage
8'x10' portable workshops equipped with tools and spare parts.

Transport Basket
24'L x 8'W x 3'H Makes transportation & handling safe & easy.

APPLICATIONS:

Deepwater Dredging	Well-Site Excavation
Offshore Dredging	Platform Abandonment
Decommissioning	Pipeline Burial/Retrieval
Salvage	Internal Pile Excavation
P&A Excavation	Jack Up Leg Excavation

Javeler

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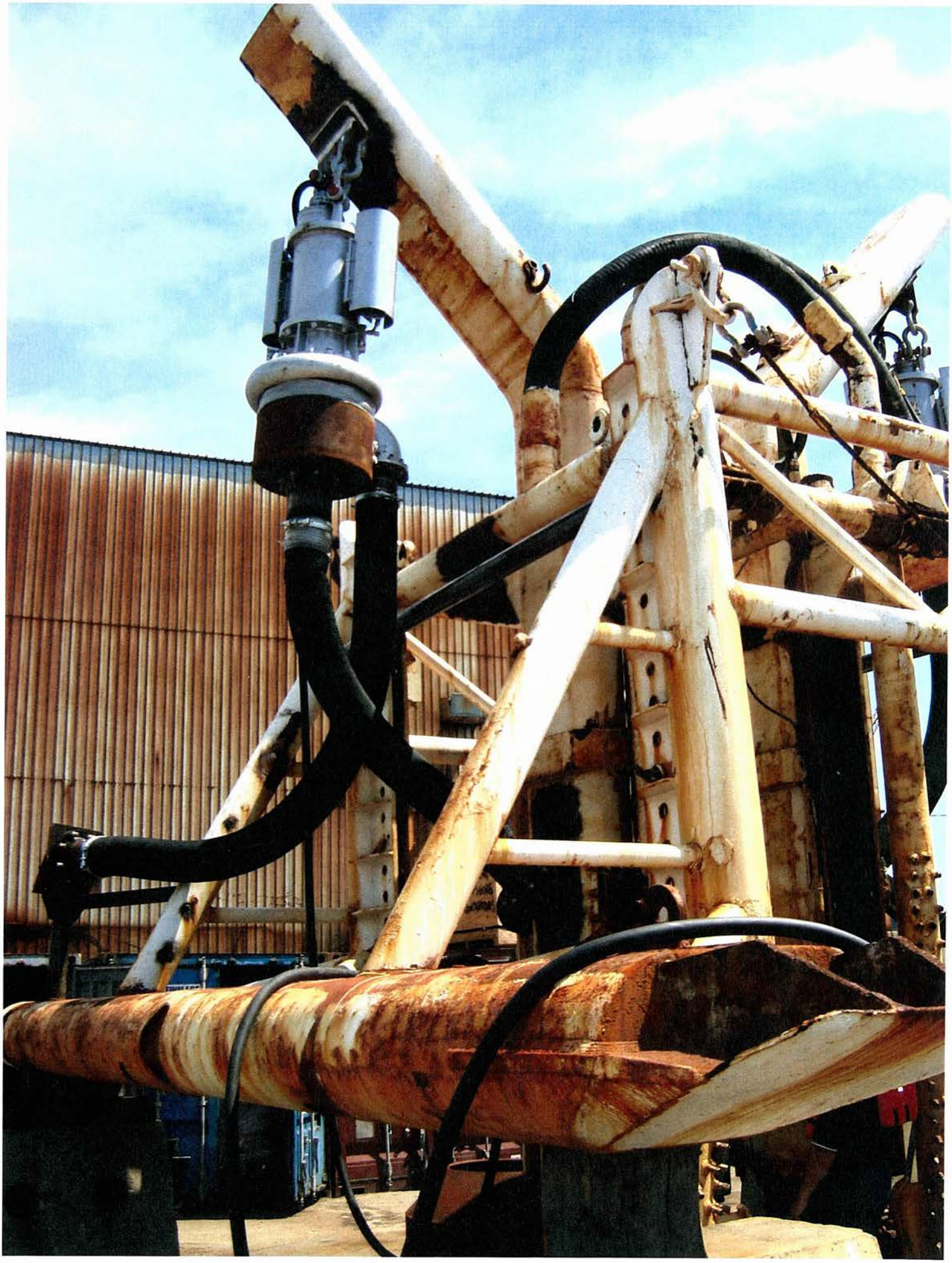
TOYO PUMPS INCORPORATED IN A JET SLED



LOWERING OF 7000 FEET OF 36-INCH PIPELINE

BP Pipeline Bury Project Summary

Oct 06

BP had to bury 7,000' of exposed 36 inch natural gas pipeline (10 miles offshore - Destin pipeline) with 6 feet of cover. The initial attempt to bury the pipe was with a Rotech 8000, but there were difficulties controlling the movement and placement of the sugar sand.

Chet Morrison was prime contractor with spud barges "Dolly" and the "14". Water depth of 15 feet.

Javeler rigged up two electric DP 150B pumps (8,000 lbs each), to straddle the pipe and bury it. The operation was carried out while the pipeline was under pressure and flowing natural gas.

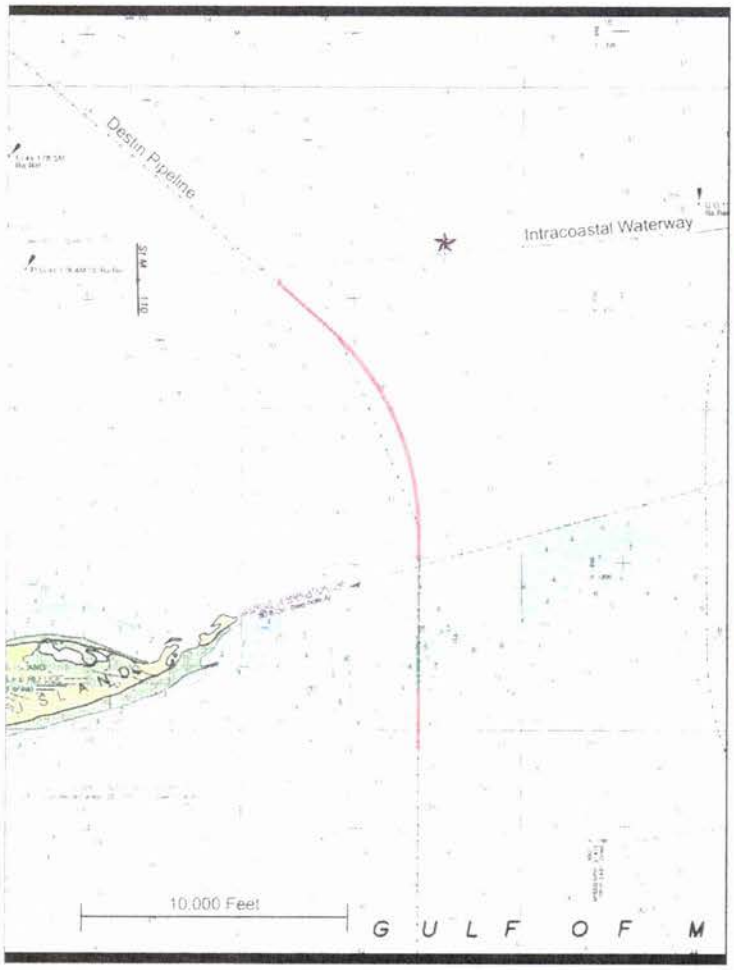
One barge carried all the equipment and backups, including generators and jet pumps, along with the crane to maneuver the twin dredge pump system. The second barge was outfitted with a second crane for handling the discharge lines and to house personnel.

The twin 150B dredge pump system was held in the vertical position at all times. Pumps were lowered (straddling the pipeline) and sand pumped through two separate floating 10 inch discharge lines approximately 200 feet away. The twin dredge pump system was continually raised and lowered, moving along the pipe, swinging in a 90 degree arc before barge was repositioned. Prior to repositioning, the dredge system was used to sweep the trench to excavate to grade. The pipeline lowered itself into the trench after excavating about 150 foot length.

An ROV was used to profile the pipe. Positioning was controlled via GPS and digging depth was monitored by metering the cable and sling. A tag line ran from the dredge pumps to a kevel on the deck of the barge.

Jetting was accomplished using a jet pump feeding water into the saddle, then branched off through 4 inch lines to each jet ring on the DP 150B pump. The saddle also had jets pointing inward.

Dredging activities lasted 2.5 weeks (single shift). ROV sweep revealed no damage to the pipeline coating.


Destin Pipeline
Intracoastal Waterway
10,000 Feet
G U L F O F M

DREDGING RESEARCH TECHNICAL NOTES (DRP-3-05)

DRP-3-05
May 1992

Dredging Research Technical Notes

Controlled Tests of Eductors and Submersible Pumps

Purpose

This technical note summarizes a series of full-scale tests on the US Army Engineer Waterways Experiment Station (WES) Dredging Research Program (DRP) eductor, a commercial eductor, and two commercial submersible pumps. The note covers test equipment, material, and procedures used to evaluate the performance of the eductors and submersible pumps in clean sand and a variety of debris types. Information provided will assist personnel in selecting equipment for specific dredging and sand bypassing applications.

Background

Eductors (jet pumps) are hydraulic pumps with no moving parts, relying instead on an exchange of momentum to entrain the slurry (Richardson and McNair 1981). Eductors have been used for sand bypassing at inlets since the early 1970s with varying degrees of success. Improvements in increased debris resistance and ease of deployment and retrieval were identified as items needed to make eductor sand bypassing more widely applicable, and resulted in the DRP work unit Improved Eductors for Sand Bypassing.

Additional Information

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Note: The contents of this technical note are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such products.

US Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, MS 39180-6199

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Description of Eductors and Submersible Pumps Tested

Through a series of contracts, the DRP eductor was designed, constructed, and tested. Some of the design features (Figures 1 and 2) include a smooth cylindrical outer shape to prevent debris (logs and sticks) from jamming in the eductor and making retrieval difficult, a series of fluidizing nozzles around the perimeter of the tip to fluidize the sand for removal and to allow heavy debris to sink below the eductors, a grate over the entrance to prevent debris from entering the suction chamber, and a ring jet to reduce pullout forces.

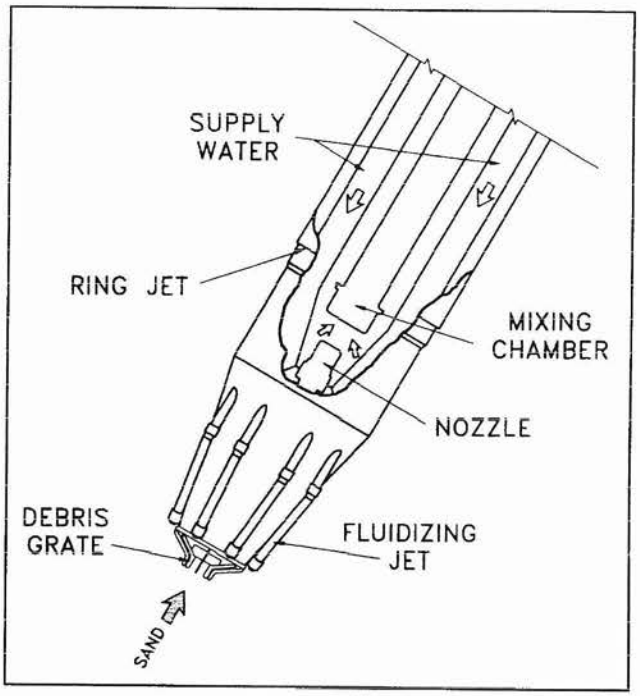

Figure 1. Schematic of DRP eductor

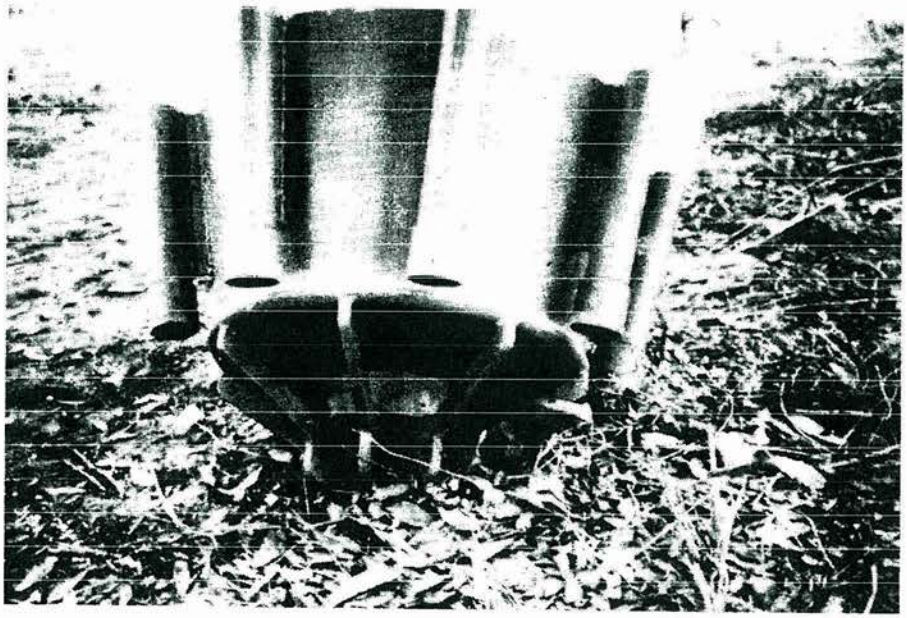

Figure 2. DRP eductor

As a baseline comparison, the eductor used at the Indian River Inlet, Delaware, Sand Bypass System also was tested; see *Dredging Research Technical Notes* DRP 3-03 (Clausner 1990a) for additional details. This eductor, built by Standard Gravel of Franklinton, Louisiana, has the same basic hydraulics as the DRP eductor. However, this eductor has a simple suction duct and a linear manifold of fluidizing nozzles (Figures 3 and 4). The Indian River Inlet eductor has been used successfully for over two years, bypassing over 150,000 cu yd before the test date (by January 1992 the bypass system had transferred over 200,000 cu yd). Testing of the Indian River Inlet eductor provided an excellent standard against which to compare the DRP eductor.

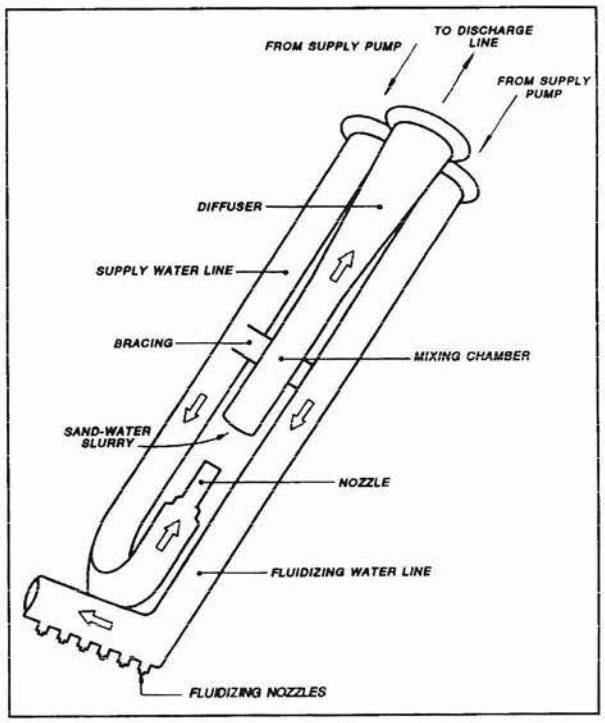

Figure 3. Schematic of Indian River Inlet eductor

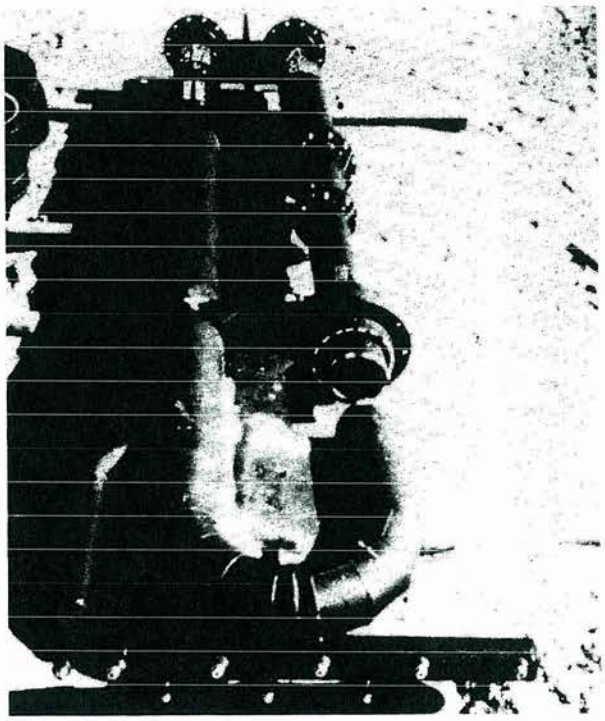

Figure 4. Indian River Inlet eductor

Another facet of the Improved Eductor work unit is to investigate alternatives to eductors with submersible pumps being a likely alternative (Clausner 1990b). Consequently two submersible pumps were included in the testing program. The first pump tested was an H&H model PF50 x 8P 8-in. hydraulically powered submersible pump with a 75-gallon per minute (gpm) (M76 x 5.0) hydraulic motor (Figure 5). The final pump tested was a Toyo DP-150B electrically

Figure 5. H&H PF50 by 8P submersible pump

powered, 10-in. submersible pump (Figure 6). Table 1 summarizes the characteristics of the eductors and submersible pumps tested.

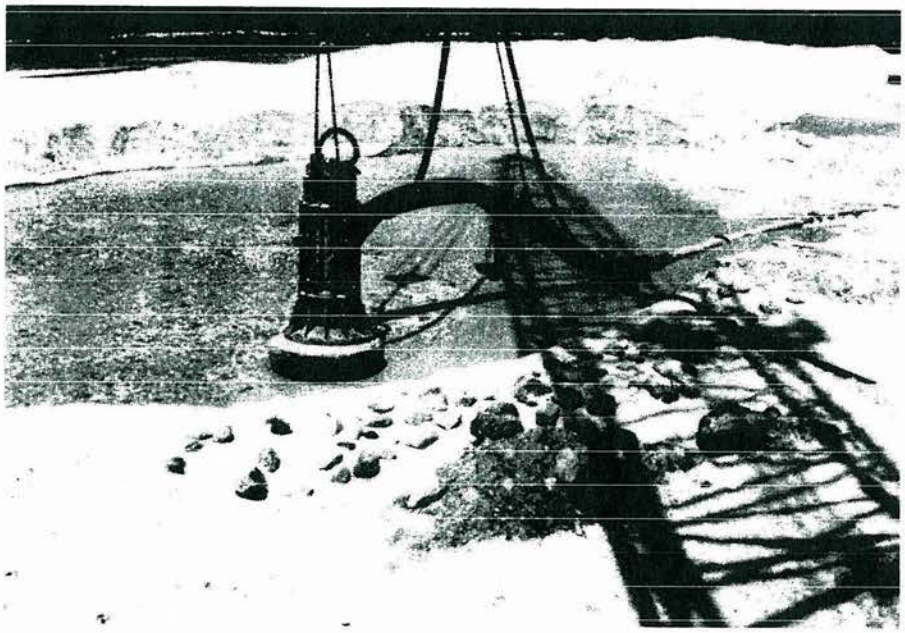

Figure 6. Toyo DP150B submersible pump

Table 1
Eductors and Submersible Pumps Tested*

Item/ Manufacturer	Physical Characteristics	Power Source Characteristics	Average Horsepower Consumed
DRP Eductor/ Genflo Standard Gravel Company	20-ft-long, 9,000-lb, mixer, 6-in. discharge pipe, 10 in. long	450-hp diesel, pump, 3,300 gpm at 155 psi	300
Indian River Inlet Eductor/ Genflo - Standard Gravel Company	20-ft-long, 3,500-lb, mixer, 6-in. discharge pipe, 10 in. long	450-hp diesel, pump, 3,300 gpm at 155 psi	300
H&H Model PF 50 x 8 with 20 percent chrome and nickel inlay	3-ft-long, 3-ft-wide, 724-lb, max. spherical solid, 4-in. discharge pipe, 8 in. long	275-hp diesel, hydraulic pump, 75 gpm at 2,000 psi	150
Toyo DP-150B high chrome pump with external agitator	8-ft-long, 3-ft-diameter, 8,000-lb, max. spherical solid, 4-1/2-in. discharge pipe, 10 in. long	300-hp diesel, generator	150-200

* The last column is an estimate of the horsepower required from each power source by each pump during operation. The eductors only require about a 300-hp diesel for actual operation. The H&H pump used is normally supplied with a 150-hp power source; the larger unit used was only one available at the time of the test. The Toyo pump requires a high starting horsepower, but only consumes 150-200 hp during operation.

Test Location

The tests were conducted at Standard Gravel Company's Enon, Louisiana, gravel pit (approximately 65 miles north of New Orleans). The availability of support equipment and electrical power and the relatively close proximity to the US Army Engineer Waterways Experiment Station (WES) made this site attractive. This site was selected because it also closely simulates applicable conditions at coastal bypassing locations.

Test Layout and Equipment

The test location has a large area of clean sand (mean diameter, 0.3 mm, less than 5 percent fines) in excess of 25 ft thick that could be saturated to simulate sand bypassing at a coastal location. The test site setup was nearly identical for both the eductor and submersible pump tests (Figure 7). The site encompassed an area approximately 300 by 450 ft and had a portable building where instrumentation used to monitor performance and archive test data was housed. Table 2 gives characteristics of the pumps used during the tests. A large crane (110-ton, 100-ft-long boom) was used to deploy the eductors and submersible pumps. A 3-cu yd backhoe, an 18-ton boom crane, and a bulldozer were also used to move pipe, grade sand, and perform other operations.

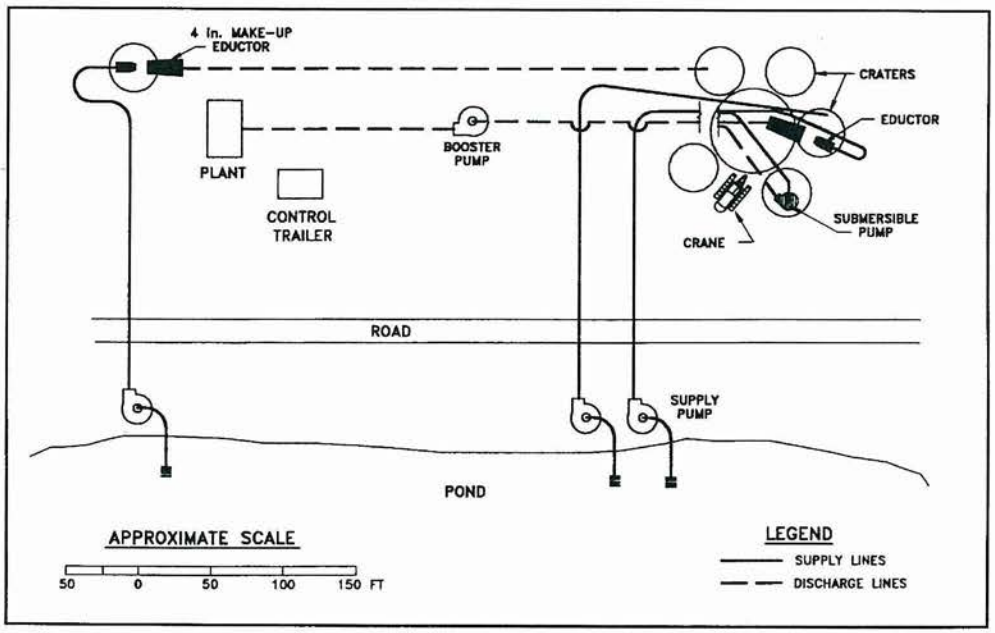

Figure 7. Test site configuration

Table 2
Water Pumps Used during Tests

Equipment	Horsepower	Flow Rate, gpm
Makeup water to crater	250	3,000
Inline booster	180	3,300
Supply pump for return eductor	180	1,500

Conditions at coastal sites were simulated by saturating the crater test area. This was done by pumping water to the crater before and during tests at a rate sufficient to keep the crater filled with water.

During the eductor tests, motive water to the eductors was provided by a supply pump from an adjacent pond through a 10-in. ID steel pipeline about 250 ft long. Slurry dredged by the eductors and submersible pumps flowed through an 11-in. ID high-density polyethylene (HDPE) pipeline to a booster pump. Discharge from the booster pump went through a 10-in. steel pipeline to a processing plant (classification tower with a 1-1/2 in. square grid grizzly), which was used to separate debris from the sand. The 30-ft tower minus the 10-ft drop in elevation from the booster pump to the bottom of the tower resulted in a 20-ft vertical lift. Sand separated by the processing plant was recycled back to the primary test area using a 4-in. eductor powered by a separate supply pump.

Instrumentation included pressure gages on the discharge side of the supply pump, at the inlet to the booster pump, and on the discharge side of the booster pump. A nuclear density meter and doppler flow meter were mounted on the vertical section of pipe attached to the processing plant. Pressure data, slurry velocity, slurry percent solids (by weight), and production (cubic yards per hour) were displayed and recorded on a personal computer after passing through a signal-conditioning unit. The hardware and software used to collect the data were originally developed under DRP work unit Production Meter Technology. For this test, the software was expanded considerably to allow display and user-friendly operation. WES Instrumentation Services Division developed the software and the signal-conditioning unit and installed the pressure transducers. Overall, the data collection system worked extremely well, with data being collected every 10 sec during the tests.

A video camera aimed at the test crater was used to document each test. A second video camera was focused on the computer screen as a backup in case of failure by the computer to record the test data.

Test Procedures

Pressure transducers were calibrated before testing (calibrations were stored in the computer) and the nuclear density meter was equalized daily (a two-hour warmup period). Predetermined motive water pump and booster pump pressures were established before the eductor test trials, as was the booster pump pressure for the submersible pump test trials. Each unit's production capacity was tested in "clean" sand and in sand-debris combinations for a 30-min duration of continuous performance in each test. Three separate trials were conducted for each combination in almost every case. For a limited number of cases only two runs were made.

The crane was used to deploy the eductor or submersible pump and reposition it as needed during each trial. The same crane operator was

used for all the tests conducted with different types of pumps and debris combinations. The debris combinations were laid on clean sand in a random pattern within a radius of approximately 15 ft around the point of application of the pump. As the unit excavated sand, the debris would "fall" into the crater. This method was used because debris in sand bypassing operations is encountered in a similar manner.

During the trial, when a substantial drop in percent solids was observed, the pump was lifted from the crater bottom and swung to the left or right approximately 5 ft and then set back on the bottom. This kept the pump in the debris field yet allowed it to possibly clear itself. During the stone debris trials it was observed that stones too large to enter the pump would accumulate in the bottom of the crater and form a barrier between the pump and sand, thus reducing production rates. The repositioning of the pump would allow it to excavate sand on the fringes of the consolidated barrier and pump slurry at higher rates until the process repeated itself. A video camera recorded the pump in the crater during the trial and documented debris accumulation at various locations (at the grizzly, in the booster pump stone box, or pump suction duct).

Under certain conditions, the submersible pumps could acquire slurry at very high percent solids concentrations (sometimes exceeding 60 percent solids by weight). At this point the discharge line was susceptible to being plugged if a slope cave-in temporarily choked the pump or if the pump momentarily lost power. At these times the operator would raise the submersible pump 1 or 2 ft to reduce solids concentrations. It was not always possible to give the operator sufficient notice to prevent plugging the line.

At the completion of each test with debris combinations, the crater area would be contaminated by debris that was too large to be transported by the system or that did not come into contact with the pump. Because of this, the contaminated area was surveyed by conventional methods, its position logged, and it was not used again. The flexible plastic HDPE pipe allowed the pumps to be redeployed in uncontaminated areas immediately adjacent to the previous debris trial.

The sand and debris combinations consisted of the following materials:

- Clean sand with a mean diameter of 0.3 mm and less than 5 percent fines.
- 16 cu ft of cut wood that varied in length from 1 to 3 ft with the diameters varying from 1 to 6 in. Before the tests, the wood pieces were soaked in water to produce a negative buoyancy which caused them to sink to the bottom of the crater during the trial.
- 16 cu ft of stone riprap ranging in size from 2 in. to 18 in. with a mean diameter of 7 in.

- 60 garbage-bag sized plastic liners (weighted with sand) and 15 "swim fins" fabricated from 3/4 in., 4-ply conveyor belt cut into 9- by 24-in. rectangular pieces.
- Aluminum beverage cans (punctured to sink). About 500 were tested in one jet pump trial with no apparent effect on production (minute pieces of shredded cans were observed at the grizzly) so the use of this debris was discontinued.
- Kelp. Kelp was donated by the San Diego Parks and Recreation Department, but the test runs with this debris were discontinued due to the kelp's increasing rate of deterioration and negligible effect on production rates. Had fresh kelp been available, it likely would have had a measurable impact on production.

In addition to the debris tests, the DRP eductor was tested for ease of deployment and retrieval. The deployment tests consisted of measuring the time required to sink the unit to a depth of 18 ft using only the fluidizing jets. By modifying the fluidizing jets so that the rear two jets pointed back toward the deployment frame with the remaining jets pointed straight down, the unit sunk to design depth in 90 sec.

During the retrieval tests, the deployment frame was removed to allow the eductor to sink vertically into the sand a distance of 18 to 20 ft. Then a series of pull tests were done with the crane acting through an inline load cell. Variables tested included the amount of time the unit was allowed to sit and the active assistance of the three hydraulic units — the fluidizing jets, the ring jet, and the eductor itself. Pullout loads ranged from 34,000 lb to 10,000 lb. The most important factor in keeping pullout forces to a minimum was allowing the sand around the whole unit to become fully fluidized, thereby reducing skin friction and preventing a vacuum. This was accomplished by operating the eductor and blocking the discharge line, and/or using the ring jet or fluidizers. The higher flows achieved by blocking the eductor discharge line (so all the water exits the open end of the eductor) provided the quickest saturation of the sand. However, the other two methods also were effective. It was concluded that the ring jet was not needed.

Results and Discussion

Sixty-one tests were conducted, with 48 of the tests meeting the WES criteria of 30 min of continuous performance. The average production rates for each set of tests are contained in Table 3. The DRP eductor and the Indian River Inlet eductor had very similar performance in clean sand, about 350 cu yd/hr. As expected, performance was reduced substantially in debris. The DRP eductor was measurably better in stone (244 versus 203 cu yd/hr) and garbage bags and swim fins (215 versus 186 cu yd/hr). The Indian River Inlet eductor was superior in wood (322 versus 269 cu yd/hr).

Table 3 Test Results Summary		
Equipment Tested	**Debris Type**	**Average Production Rate, cu yd/hr**
DRP eductor	Sand	355
	Stone	244
	Garbage bags and swim fins	215
	Wood	269
Indian River Inlet eductor	Sand	346
	Stone	203
	Garbage bags	186
	Wood	322
H&H submersible pump	Sand	221
	Stone	84
	Garbage bags and swim fins	188
Toyo submersible pump	Sand	375
	Stone	403
	Garbage bags and swim fins	322
	Wood	241

Of the two submersible pumps, the Toyo pump had consistently higher production in clean sand and all types of debris, while the H&H pump had the least amount of production of any unit tested. It should be noted that the H&H pump was an 8-in. pump, while the eductors and Toyo pump were 10 in. Had a 10-in. discharge coupling that attached directly to the pump housing been available for the H&H pump, an increase in production rate of up to 15 percent probably would have been possible (personal communication, Mr. Howard Stovall, Vice President, H&H Pump Company, January 24, 1992). This potentially would have raised production rates for the H&H pump to 254, 97, and 216 cu yd/hr in sand, stone, and garbage bags and swim fins, respectively. The H&H pump was more prone to plugging of the discharge line than any of the other units tested, having three instances where the line was plugged. A considerable amount of operator attention to raising and lowering the H&H pump to achieve maximum production and prevent plugging of the discharge line was required.

The Toyo pump was a much larger, heavier unit than the H&H pump. It also is much more expensive. Purchase price for the Toyo pump as tested was estimated at $73,300. The purchase price of the 8-in. H&H pump was approximately $15,300. The Toyo pump had the highest overall production of any unit tested, over 400 cu yd/hr. The improved production in stone versus sand was probably due to the operator gaining experience with the Toyo pump. The garbage bags and swim fins had an appreciable impact on production, reducing it to 322 and 241 cu yd/hr, respectively. The Toyo pump also was very sensitive to operator control, with relatively constant raising and lowering of the unit required to maintain high production and prevent plugging of the discharge line.

Conclusions

In clean sand, performance of the DRP eductor and the more conventional Indian River Inlet eductor are about the same. Performance in debris was a function of the type of debris. The grate on the DRP eductor keeps out stone and garbage bags/swim fins better than the Indian River Inlet eductor; however, the grate is more prone to clogging with wood. The Indian River Inlet eductor is more susceptible to stones entering into the suction chamber, thereby reducing performance.

The H&H pump in its present form is not well suited to the types of debris tested. It is very susceptible to both rocks and wood. A rock guard, relatively easily fabricated (and also available from the manufacturer), could help solve these problems, though probably reducing performance somewhat.

The Toyo pump performed the best overall and was only bettered by the Indian River Inlet eductor when pumping wood debris.

The lack of a requirement for constant operator control and the relative immunity to line plugging make the eductors well suited to long-term bypass operations. The choice of a particular eductor will depend on the type and amount of debris present. The Toyo pump's high production and apparent ruggedness make it a possible candidate for bypass operations (particularly those not suited for eductors), but the level of operator control required to achieve the high production rates and the potential for line plugging must be considered. The H&H pump's low cost and light weight (approximately 724 lb) make it well suited for smaller, aperiodic bypass and dredging jobs.

The Vicksburg District's Monroe Navigation Field Office used similar logic before purchasing a lightweight submersible pump to maintain locks and dams on the Red River. For small aperiodic dredging jobs, the purchase price can be a more important factor than production rate.

A detailed description of the tests will be published in a future DRP report.

Acknowledgements

The DRP acknowledges the cooperation of the following companies and agencies: H&H Pump Company, Toyo Pump Company, Javeler Construction Company, Delaware Department of Natural Resources and Environment Control, Standard Gravel Company, and the San Diego Parks and Recreation Department.

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Surface Unit Exterior Dimensions (L x W x H)	299 x 248 x 195mm
Transducer Dimensions (L x Diameter)	125mm x 16mm

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Surface Unit	12vDC Rechargeable Battery
Battery Life	4 hours

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Depth Range	0-100m

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LAKE SAKAKAWEA PIPELINE CROSSING REPORT

Construction Methodology Evaluation – Horizontal Directional Drilling

BakkenLink Pipeline Project
Western North Dakota

BakkenLink Pipeline, LLC

This report has been produced as a supplement to *Lake Sakakawea Pipeline Crossing Report* issued by BakkenLink November 2011

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Executive Summary

The crossing of Lake Sakakawea is a key logistical consideration for the routing the of the proposed BakkenLink Pipeline from Beaver Lodge to Fryburg in North Dakota that will provide much-needed transportation capacity for crude oil produced from the Bakken oil play. BakkenLink Pipeline LLC (BakkenLink) has evaluated several options for the proposed lake crossing route and selected a lake crossing north of Keene. This decision was a result of BakkenLink consultation with government agencies, discussions with industry professionals and contractors, and in line with commercial drivers. BakkenLink has provided information describing its preferred lake crossing location and method and its resulting impacts and mitigation techniques in its *Lake Sakakawea Pipeline Crossing Report*, dated November 3, 2011.

As part of the review of the lake crossing, federal agencies have requested additional rationale and background information about the Horizontal Directional Drilling (HDD) technique that was listed as an alternative method of installation to the Company preferred Pipeline-Pull method.

Horizontal Directional Drilling (HDD) is a growing pipeline installation technique that is used where traditional open trench construction is unfavorable. This technique, detailed in Section 3.1, has been growing in popularity and in capability in recent years. The lake geography in this area was concerning for BakkenLink's Engineer with regard to HDD installation. The lake's relatively flat shorelines span 12,000 feet and are surrounded by rolling hills and ravines that yield to high bluffs at the top of the lake valley. The expansive width of the lake would challenge HDD technology and the valley topography is not ideal for HDD operations. BakkenLink consulted with leading drillers to determine the feasibility of an HDD in the area of the lake crossing. The unprecedented 14,000-foot drilled crossing that would be required was considered to be at the outer limits of current equipment capabilities. Drilling contractors discussed with BakkenLink that an HDD of that magnitude would require extensive sub-surface investigations, described in Section 3.6, encounter large risks during construction, described in Section 3.4, and come with no guarantee of success. While a successful HDD would yield no environmental impacts to the lake and minimize pre-construction permitting, a failure of the HDD could put the crossing in jeopardy of large lake impacts, extensive construction and environmental mitigation, and increased costs and schedule delays.

The geotechnical and geophysical investigations required for a drill of this magnitude would likely only provide data suggesting the drill is relatively more or less feasible. Because a drill of this length and potential depth has never been performed, there is no data to support its absolute feasibility. The subsurface investigations may provide information about the most suitable substrata, the type of soils, the equipment that will be required, the potential risks, etc., but it cannot determine success of the operation.

In light of the risks inherent in an HDD of this magnitude, and based on the unique site conditions of the lake at the crossing, BakkenLink proposed a "pipeline-pull" as its preferred installation technique, detailed in Section 4. This method constructs the pipeline one segment at a time from one end of the shoreline, slowly pulling the pipe across the other shoreline using floatation devices. The pipe is sunk to the lake bottom and lowered into the lake sediment using a lowering sled, common in Gulf of Mexico and other international operations. This method is has low intrinsic risk and has been proven to succeed. The main concern involves the impact to the lake caused by operations within the lake itself. BakkenLink's Engineer has extensive experience with this technique and has provided turbidity and re-sedimentation mitigation measures that are commonly used and generally accepted by government agencies and industry standards in the Gulf of Mexico.

BakkenLink has provided additional information evaluating and comparing the risks and benefits of both the HDD and Pipeline-Pull methods, summarized in Section 5. With respect to the risks associated with the installation method, failure BakkenLink supports the preferred Pipeline-Pull method as it is confident that the construction technique will yield no significant impacts to the lake. Bakkenlink concludes that because costly geotechnical and geophysical investigations cannot determine the certainty of installation of this unprecedented drill, then geotechnical studies would not be necessary in the Company's evaluation of the riskier HDD method, particularly with a feasible, low impact, high success pipeline-pull option. This is especially relevant in light of a similar trenched technique being used in the lake within the last 5 years where no significant impacts were experienced in the lake.

1. Lake Sakakawea Crossing

1.1. Pipeline Routing

BakkenLink Pipeline LLC (BakkenLink) is planning to build a new crude oil pipeline to provide much needed capacity to transport the increasing supplies of crude oil produced from the Bakken oil play to multiple export outlets. The pipeline will consist of approximately 144 miles of 8-inch and 12-inch steel crude oil pipeline extending from Beaver Lodge, North Dakota to a proposed crude oil rail loading facility located near Fryburg, North Dakota (Rail Facility). .

The Lake Sakakawea crossing between Beaver lodge and Keene is a key logistical consideration for the routing of the pipeline. A crude oil pipeline across Lake Sakakawea will provide increased connectivity between oil production and shipping opportunities, allowing producers access to multiple export outlets on both north and south sides of the Lake Sakakawea. The crossing will significantly reduce the number of trucks required to move crude oil through Williston and New Town, North Dakota to get around this transportation barrier. BakkenLink's proposed pipeline would offers bi-directional flow depending on the commercial demands of the regional markets.

BakkenLink evaluated several options for the proposed lake crossing route. Each option was considered with respect to regional access to markets, economics, engineering design, construction feasibility, schedule and environmental impacts. As part of the project planning, regional US Army Corps of Engineers (USACE), Bureau of Land Management (BLM), US Forest Service (USFS), and US Fish & Wildlife Service (USFWS) agencies were consulted to obtain guidance with regard to the Lake crossing location and methodology in 2010 and 2011. These consultations were integral to selecting the proposed location for the crossing. A location north of Keene was selected and will have minimal effects on resources and residents in the proximity of the lake while meeting the necessary commercial commitments and construction requirements.

1.2. Lake Characteristics at the Proposed Crossing

The selected crossing location north of Keene is favored due to its optimized path between receipt points of the proposed BakkenLink system and the proximity to an existing pipeline corridor. However, this area entails a crossing along the relatively wide central section of the lake. The current crossing from shoreline to shoreline is approximately 12,150 feet. The width of the crossing and the lake water depth are key considerations for the construction method evaluation. At the time of the hydrographic survey performed in the early summer of 2011, the maximum water depth was approximately 50 feet and the bottom substrate is characterized by a 1-2-foot layer of fine silt and mud.

The immediate shorelines in the proposed corridor are characterized by relatively flat plains. However, within 2,000 feet from the water's edge, rolling hills and ravines yield to the high bluffs above the lake, constituting an approximately 450-foot elevation change within one mile from the shoreline. The bluffs rise to approximate elevations of 2,300 feet overlooking the shoreline with elevation about 1,860 feet above sea level.

1.3. Alternate Locations

During initial consultation in 2010, BakkenLink presented the different crossing location options for discussion at meetings with federal agencies. BakkenLink identified three potential alternate locations with various advantages and disadvantages as compared to the current location.

Between the area near Williston, where the Missouri River begins to widen into the lake, and a substantial narrowing of the lake near New Town, only one location along the central part of the lake provides a width that could reduce the 12,000-foot crossing length of the proposed location. Approximately 7-8 miles west

of the proposed location, a narrowing point in the lake reduces the shoreline width to approximately 8,000 feet. This area provides a reduction in lake width and more favorable terrain for construction, but also presents a higher concentration of endangered species.

Another crossing locale considered was near the village of Four Bears and New Town. This area is approximately 20 miles southeast of the proposed location and is along the same corridor as the Four Bears Bridge (ND HWY 23) crossing. After desktop studies, favorable locations for a potential drilled crossing were identified both north and south of the Four Bears Bridge. These crossings would be approximately 7,000 feet and 5,000 feet for the crossings north and south of the lake, respectively. These lengths are significantly more favorable for the success of a potential Horizontal Directional Drill (HDD), however, both locations increase the pipeline reroute length considerably (estimated to be an additional 30 miles of pipeline) between the proposed receipt points at Keene and Beaver Lodge in the BakkenLink system.

As a result of the meetings with the federal agencies and the commercial drivers for the project, the other crossing locations were eliminated in favor of the proposed route north of Keene. A summary of the meeting minutes concerning lake crossing locations and methods are available in BakkenLink's *Lake Sakakawea Pipeline Crossing Report* dated November 14, 2011.

1.4. Pipelines and Facilities in the Vicinity

As mentioned previously, the proposed crossing location is adjacent to an existing pipeline corridor. The following pipelines have been identified in the vicinity of the proposed lake crossing at the site north of Keene:

Pipeline Owner	Outer Diameter of Pipe	Number of Pipelines	Construction Method	Product
Amerada Hess	8"	3	Open cut – 1950s	Gas
Amerada Hess	16"	1	Open cut – 1950s	Gas
Amoco Pipeline (Tesoro)	12"	1	Open cut? – 1954	Crude Oil
Dakota Gasification Company (exposed and replaced 2007)	14"	1	Open cut -1999	CO_2
Dakota Gasification Company (Replaced 1999 line)	14"	1	Open cut with lay barge & controlled depth tow – (2007)	CO_2

The Hess gas and Tesoro oil pipelines predate the flooding of the lake in the mid-1950s and were installed utilizing open cut trenching methods. The Dakota Gasification Company (DGC) pipeline, also installed using open cut techniques, was constructed when the lake water level was only 10 feet deep in the center of the Missouri River Thalweg (old river channel). The alignment of the proposed pipeline is approximately 200 feet west of the existing DGC pipeline.

2. Construction Methodology Evaluation

2.1. Construction Methods

During the project planning stages, several crossing construction methodologies were evaluated. The evaluated options include:

1. Conventional offshore pipelay from a marine barge accompanied by trenching to lower the pipeline and tie-in operations at the north and south shores of the lake;

2. Horizontal Directional Drill (HDD) Options:
    a) a single HDD across the entire lake crossing from a single onshore location;
    b) a dual HDD from both shores toward the center of the lake, also referred to as a "intersect method" with drills intersecting under the lake;
    c) a dual HDD from the shores of the lake to the center of the lake with an intermediate underwater tie-in operation utilizing a dredge and barge;
3. Pipeline-Pull Methods:
    a) perform a pipeline-pull operation with a buoyant pipeline constructed on a stationary offshore barge positioned midstream and then pull the line toward each shore line in sequence. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the intermediate tie-in operation from the vessel;
    b) perform a pipeline-pull operation with the pipeline made entirely from one shoreline and then pull the line across the water. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the tie-in operations from each shoreline.

2.2. Method Evaluations

The conventional marine pipelay, dual HDD with marine vessels, and the pipeline-pull from a stationary marine barge are not favored options due to the necessity of offshore equipment. Although the lay barges, stationary jack-up barges and other support vessels and equipment are plentiful in the Gulf of Mexico and other coastal areas, mobilization of such large and specialized equipment to this region is not feasible and is cost prohibitive . Additionally, the water depth conditions of the lake increase vessel susceptibility to weather.

The plausible HDD options, the single HDD and dual HDD intersect methods, both involve drilling beneath the lake to depths ranging from 50 to 300 below the lake bottom to install the pipe. The length and depth of the crossing introduce engineering and construction risks and a drill of this magnitude is unprecedented exceeding the current world and US domestic HDD records in length (12,000 and 10,000 feet, respectively) and depth. Although HDD is a proven and effective solution to pipeline installation, it is not without limitations.

The pipeline-pull method from the shoreline is a common installation technique used in similar shallow water conditions in the Gulf of Mexico and internationally; however, the disadvantage to this method is that lowering of the pipe requires a lowering method that fluidizes lake sediments where lake turbidity could be experienced. With proven equipment and mitigation measures, turbidity and re-sedimentation issues can be mitigated during construction activities.

BakkenLink engaged the expertise of qualified industry consultants to evaluate methodologies. With the construction and environmental risks and costs considered, BakkenLink selected the pipeline-pull method from a single shoreline (Option 3b) as the most favorable option, consistent with the company's risk tolerances and environmental strategies. More information about the HDD and pipeline-pull methods, supplemental to BakkenLink's *Lake Sakakawea Pipeline Crossing Report* is presented in the following sections.

3. Horizontal Directional Drilling (HDD) Methodology

3.1. Typical HDD Construction

In general, horizontal directional drilling is a trenchless technique for installing pipelines or other linear utilities to minimize surface or sensitive area disruptions and install pipe where conventional installation techniques are not favorable. The first phase consists of drilling a directionally controlled pilot hole along a predetermined path extending from grade at one end to grade at the opposite end. The entry and exit holes for the HDD are typically designed to be set-back from the area of avoidance to allow for the geometry of the drill to reach a desired target depth. For example, entry and exit holes for a river crossing may be set-back an additional 50 feet from the river banks to allow for the geometry of the drill to reach the designed depth. In the case of the Lake Sakakawea crossing, the set-back from the shoreline for drill entry and exit could range between 200 and 1700 feet depending on the required drill depth beneath the lake bed.

The second phase consists of enlarging the pilot hole to a size that will accommodate pulling the pipeline through the enlarged hole. Generally, the hole should be 1.5 to 2 times the outer diameter of the pipe. Preliminary analysis of the HDD of the Lake Sakakawea crossing indicates a 24 inch hole would be recommended for the 12-inch pipeline. The enlargement of the pilot hole, or reaming, is accomplished by pulling reaming heads of specific diameters through the hole, in stages if necessary, to create a wider hole. All stages of HDD involve circulating drilling fluid from equipment on the surface through the drill pipe to a downhole bit or reamer, and back to the surface through the annular space between the pipe and the wall of the hole. The drill mud serves several purposes: to control the frictional heating of the drilling components, remove large cuttings, and keep the drilling equipment lubricated. In a separate operation, while the hole is being drilled, the pipe is being welded to the length of the HDD and tested in one piece along the construction easement. Once the drilled hole is prepared and stable, the welded pipeline, or drill string, is pulled. Generally the pipe string is laid out and welded on the exit side of the drill. The drill string can be assembled in segments instead of a continuous length; however pipe pulling operations will cease while the segments are being welded together. This cessation of pull back activities can lead to the drilled hole seizing up or even collapsing depending on subsurface conditions. To minimize the risk of the drilled hole failing, a continuous drill string fabrication is preferred, provided enough workspace/acreage exists.

The major advantage of the HDD technique is the minimal effects on sensitive surface areas and temporary surface impacts during construction activities. Additional workspace is required at the drill entry and exit locations, generally 300 feet by 300 feet as well an area to string, weld and leak test the pipe prior to pull back. This drill stringing area is essential for proper alignment of the pipeline as it is pulled through the hole.

The HDD technique does have limitations and significant risks that could outweigh the benefits. Extensive subsurface evaluations and explorations must first be performed to determine if suitable conditions exist to support the drilling operations. Should the geotechnical investigations shows unfavorable subsurface conditions, drill failure could result in the inability to properly steer the drill head, inability to maintain the hole integrity, excessive drill stresses on the pipe, and/or inability for drill equipment to deliver the torque capacity necessary for extensive drilling operations. Additionally, drilling fluid will be under great pressures during drilling operations and when expended down-hole, it will flow in the path of least resistance. In the drilled annulus, this path may be an existing fracture or fissure in the substrata, a high porosity streak, and/or a pocket of incompetent substrate material being penetrated. These paths could lead to the surface and unplanned releases of drilling fluid (“frac out”) can occur. Although the fluid is not considered hazardous, may result in environmental impacts to the lake if drilling fluid returns to the surface... Thus, the feasibility of successful HDDs are highly dependent on the geotechnical characteristics of the area being drilled.

3.2. Single HDD Method

Because of the lake width at the crossing of 2.3 miles (12,150 feet), a single HDD operation across the entire lake would require an unprecedented drill and pipe string of an estimated 14,000 feet to include the set-back distances. This length would exceed both world and domestic HDD record lengths as mentioned in Section 2.2. Although such a lengthy HDD operation could be theoretically feasible under optimal circumstances, many unfavorable risks are involved. As drill lengths increase, so will drilling fluid pressures which will increase the likelihood of an inadvertent return, even in considerably competent substrates. As pipe lengths increase, the tensile and axial forces acting on the drill pipe and pipe string can become uncontrollable and cause bending or buckling of the pipeline, adding considerable difficulty and potential failure of the HDD operation. Additionally, as the pressures and lengths increase, additional pumping and support equipment are required, increasing the construction footprint and complexity of the project and pushing drilling equipment beyond its upper limits.

3.3. Dual HDD Intersect Method ("Intersect Method")

A dual HDD intersect method would utilize two drilling rigs operating on both the north and south shores of the lake that drill toward each other and intersect forming a continuous drill hole. Advances in drill head controlling and positioning systems have allowed drillers to intersect pilot passes from opposite ends of a proposed HDD. Once the intersected pilot hole has been drilled, reaming operations begin and the process reverts to traditional single HDD operations, where reaming and pulling occurs from one end of the drill. This method is more feasible than the single HDD method because the initial pilot hole drills are more manageable in length. Additionally, longer successful drills have been completed using the dual method over the single drill method. Again, even while this option may be technically achievable, the method's success greatly depends on the subsurface conditions. Like the single HDD method, this option would still involve very high drilling fluid pressures, the potential for frac out, and difficulties when trying to pull the pipe back through the pilot hole.

3.4. HDD Construction Risk

At the initial stages of the Lake crossing construction method evaluation, the BakkenLink team consulted with prominent drilling contractors in the pipeline industry regarding the feasibility of the HDD method for crossing the lake. Although the dual HDD intersect method is more feasible, the consulting contractor advised that a 14,000-foot drill is still on the outer limits of the equipment capabilities. This length has not yet been proven under these conditions and introduces extensive risk to the project. The current world record for such a drill is 12,000 feet performed in the United Kingdom and the current United States domestic record is approximately 10,000 feet, both performed in recent years. Despite the evidence that the industry is moving toward longer successful drills, this 14,000-foot drill, under the site-specific circumstances, would be unprecedented. The high level of risk for a failed drill in these soils, the loss of pipe due to sticking or buckling, and the increased potential for inadvertent returns make the odds of completing this specific HDD very risky.

In addition to the limitations of the HDD technology, the surface conditions for this operation are not ideal. As previously discussed, a pipe is typically strung and welded along the construction easement to the full length of the drill and properly aligned prior to pull-back. The pull-back string for this project would be the entire estimated 14,000 feet of drill length. Yet, the surface topography along the shoreline of the lake does not allow for a full length pipe string. The rolling nature of the lake valley and large elevation changes caused by the lake bluffs prohibit the continuous stringing of pipe. Consequently, multiple shorter strings must be laid out as the topography allows. This allows the pipe to be aligned properly during pull-back but requires that the pull be stopped incrementally to allow for welding of each pipe string that is welded to the tail of the pipe in the hole. This start and stop technique will greatly increase the chances of hole collapse and pipe sticking or buckling.

Other negative scenarios for HDD installation include drill pipe or pipe string buckling or sticking, inadvertent return of drilling mud, or failure to accomplish a drill. In the event of drill pipe buckling or shearing during drilling operations, the contractor would need to pull back the drill string and replace the damaged pipeline. If the issue is severe enough, the contractor may recommend or require alternate methods to complete the drill that can add substantial costs or schedule delays. In the event of inadvertent returns, drilling operations would halt and drilling mud pressures would be reduced to moderate surface returns. In order to prevent subsequent returns, the area of fracture would need to be grouted or otherwise mitigated in some manner depending on the circumstances of the release prior to recommencing of drilling operations. If the pipe string gets stuck or buckles during pull-back operations, the pipe string would likely be required to be completely removed, inspected and repaired before reattempting installation. In the case of a failure to accomplish the drill path or repeated failures in the pull-back, the contractor may recommend an alternate depth or alternate location to provide a higher likelihood of drill success. If this should result, the costs and delays in construction would be substantial. If the drill is deemed "failed," the pipeline installation method would need to revert to another method, most likely the well proven pipeline-pull method or an open-cut method.

3.5. Key Feasibility Information – Geological Conditions

Characterization of the subsurface conditions across the lake would be required to determine the feasibility on an HDD operation, should that be the selected method, and help to quantify the severity of some of the risks associated with an HDD of 14,000 feet. It should be noted that the performeance subsurface investigations cannot provide conclusive proof for the success of an HDD, only whether more or less favorable conditions exist. For an unprecedented drill of this length, best management practices necessitate a comprehensive campaign employing geotechnical corings up to 50 foot below the intended drill depth and at intervals of 500 to 1000 feet across the lake. Additionally, geophysical soundings would be used to verify the corings. The geotechnical and geophysical data would allow for a continuous horizontal and vertical characterization of the lake crossing substrate to assess whether substrate would support HDD operations at all. Essentially, the more information obtained about the subsurface conditions, the better quantification of feasibility and risk can be determined concerning an HDD of subject length. Additionally, should the drill be determined to be feasible, the subsurface conditions will drive the drilling equipment employed and specific drilling techniques that may affect cost and scheduling.

BakkenLink did not feel that conducting an extensive subsurface investigation would be beneficial when compared to other methods, particularly the favored pipeline-pull method, where less extensive surficial geotechnical surveys could be undertaken with more surety and less cost.

3.6. Non-Construction Related Risk

The preceding sections describe the technical advantages and disadvantages associated with performing an HDD to accomplish the lake crossing from a construction standpoint. In addition to the risks mentioned for construction feasibility, this method can also affect the logistics and scheduling of the project that were considered by BakkenLink.

Cost is a major concern for any project, particularly as it relates to risk. Investors, designers and builders all prefer a level confidence and stability while minimizing risk where possible. BakkenLink, in its due diligence, assessed the risks and benefits of an HDD and deemed them to have high costs and high risks. As compared to alternatives that were considered, the HDD option was found to be much more costly to construct and have a greater chance for schedule creep and cost increases. From the beginning, costly and timely geotechnical and geophysical investigations would be required to properly determine feasibility, design and mitigation techniques. Should the HDD be successful as designed, the Company would have higher initial costs but would have avoided environmental mitigation costs and additional permitting. However, should the HDD frac out during the drill, or fail due to pipe buckling or sticking, the Company would face large expenses in the form of increased contractor costs due to

redrilling or lost equipment retrieval, substantial environmental mitigation costs, the risk of a recurrence of failure and schedule delays. Schedule delays could push construction operations to encroach on nesting seasons, creating a situation where demobilization and remobilization of construction equipment could cause additional ground disturbances.

When assessing the risks, potential mitigation procedures and potential for cost and schedule creep, the HDD option was not the preferred construction methodology. The most favorable method, as described in the BakkenLink *Lake Sakakawea Pipeline Crossing Report*, is the pipeline-pull method, which involves the highest potential for success, fewest unknown risks, insignificant environmental impacts, manageable mitigation factors, and minimal potential for cost and schedule creeping.

4. Preferred Methodology – Pipeline-Pull

BakkenLink has provided additional information about its preferred method in its *Lake Sakakawea Pipeline Crossing Report*, which was provided to the relevant federal agencies for review. The report details the evaluated methodologies and outlined the selection process. The preferred "Pipeline-Pull" method, as described by BakkenLink, is summarized below.

The Pipeline-Pull method is a common pipeline installation technique used in various construction circumstances and is adaptable to meet the site specific construction requirements. In the case of the Lake Sakakawea crossing, this method would require work sites at both shorelines. At one end, a high powered winch will be stationed and aligned to pull the assembled pipeline originating from the opposite shore. On the other side, a construction "assembly line" is constructed that will allow for the systematic assembly of the pipeline. The pipeline is welded and tested along this assembly line until it is ready to begin crossing the lake. As new pipe is added to the end of the pipe string, the winch slowly pulls the pipe across the lake one pipe length at a time. As the completed pipe is pulled across, floatation devices are used to keep the pipe a certain distance above the lake bottom as to not impede surface traffic. After the pipeline has fully crossed the lake, the floatation devices are removed and the pipeline is lowered to the lake bottom.

Once the assembly and positioning of the pipeline is complete, it must be lowered below the lake bottom for additional protection and positioning as required by federal regulations. BakkenLink has proposed using a common jetting technique that has been adapted for the site specific conditions of the lake. A customized lowering sled will use fluid jets and suction pumps to fluidize the lake bottom under the pipeline, causing the pipeline to sink into the fluidized substrate as the sled is pulled along the lake bottom. This proven technique will be adapted from typical Gulf of Mexico practices to minimize the turbidity of the sled. A slurry diffuser and turbidity mats are part of the adapted design of the jetting sled to mitigate turbidity and re-sedimentation in the lake. In addition to the jetting sled modifications to reduce turbidity, other mitigative measures can be employed to ensure minimal and localized effects to the lake, including turbidity monitoring and turbidity curtains.

During the evaluation process, BakkenLink conducted subsurface investigations of the lake sediments to determine the feasibility of lowering operations any effects that turbidity and re-sedimentation may have based on the components of the sediment. After initial concerns with re-sedimentation, the North Dakota Department of Health – Water Quality Division analyzed the sediment findings and during additional discussions with BakkenLink, expressed confidence in this lowering method.

Negative effects toward the pallid sturgeon were also considered by BakkenLink. The proposed crossing location is not within designated critical spawning habitat. The construction schedule BakkenLink is proposing for the lake crossing would avoid the spawning periods for the pallid sturgeon. Additionally, turbidity is not perceived to be an issue affecting the sturgeon, as they prefer turbid flowing water. Any

impacts will be insignificant, short lived and should not exceed the impacts of the DGC installation in 2007.

BakkenLink is confident that, in the unlikely event of pipeline leaks or spills, the pipeline-pull method will allow quick and reliable access to the damaged portion of pipeline for immediate mitigation and repair. Contrastingly for HDD, in the unlikely event of leaks or spills, the depth of the pipeline as a result of HDD installation will not allow access to any localized damaged area.

In addition to the above considerations, installation of the pipeline employing the pipeline-pull method has supplementary advantages to the regional infrastructure. The system in-service date would be sooner than if an HDD method were employed and would remove significant traffic and wear for regional infrastrucure currently used for oil transportation activities. With an initial oil transportation capacity of 65,000 BPD, this translates into removing upwards of 400 truckloads of oil per day from roads and highways transporting Bakken crude between lease and tank batteries around Johnson's Corner and multiple pipeline and rail destinations in Ross/Stanley/Berthold in western North Dakota.

5. Method Comparison –Push-Pull vs. HDD

	Pipeline-Pull Method	**HDD Intersect Method**
Installation Technique	• Method proven in Gulf of Mexico. High percentage success rate with minimum long term impacts. (Examples provided in *Lake Sakakawea Pipeline Crossing Report)*	• Installation success rate undetermined as drill length and application are unprecedented. • Finding suitable subsurface strata to support drilling activities. • Increased pipe stress during installation activities. • Bore hole collapse during drilling operations. • Contingency plan/alternative installation technique recommended in case of failure.
Installation Schedule	• Current schedule estimates construction August thru December 2012. • Approximately 115 day duration • Low risk of schedule creep	• Current schedule estimates construction August 2012 thru January 2013. • Approximately100 day duration. • Winter installation preferred to be able to field verify drill head locations and increase odds of pilot hole intersection on frozen lake. • Potential for schedule creep dependent on success of drilling operations

System In-Service Schedule *(BakkenLink System – Beaver Lodge to Fryburg)*	• System in-service by December 2012 (pending permit issuance). • In service sooner (than HDD method), resulting in more oil transportation being removed from regional infrastructure.	• Earliest in service date March 2013 (pending permit issuance).
Subsurface Exploration Requirements	• Hydrographic/hazard survey characterizing soils along the route. • Performed July 2011. 6 bore samples taken at roughly 1800-foot intervals to 10 foot depth.	• Extensive subsurface evaluation with core drills up to 300 feet at 500-1000 foot intervals with geophysical data to tie in subsurface geological strata for continuous horizontal characterization for determining drill depth, external pipe stresses during installation and equipment requirements. • Schedule estimates exploration not complete until June 2012 (best-case)
Environmental Impact	• Mild to insignificant turbidity expected during pipeline lowering activities. • Mitigated by turbidity screens (approved and successful mitigation technique used in Gulf of Mexico) • Use of USACE approved hydraulic excavators in operation	• If drill successful, no environmental impacts • Hydraulic fracturing/high permeability streaks/inadvertent returns during drilling process resulting in drilling mud (bentonite) release in Lake
Temporary Workspace Requirements	• 330 by 1150 feet workspace on North and 400 by 680 feet South shores of lake • Approximately 652,000 sq.ft. total	• 300 by 300 feet workspace on North and South Shores of lake plus drill string pull back area of 14,000' X 25' • Approximately 530,000 sq.ft. total
Pipe Stringing	• Ability to install pipe segments ("pipe joint") segments to pipe string during pipeline "assembly line" installation activities with minimal risk to success of installation.	• Recommend to have single 14,000' drill string to minimize potential for pipe getting stuck during pull back operations. • Workspace limited on North and South shores of lake for continuous drill string fabrication. • Topography also prohibits single pipe string. • Drill string segmentation will be required, which increases the chances of pipe seizing during pull-back operations.
Pipe Stresses during Installation	• Minimal axial and tensile stresses experienced during push-pull and lowering	• Length of drill exposes drill pipe and pipe string to high torque and risks buckling and sticking during drilling and/or pull-back

Operations/Maintenance	• Easily access to pipeline following installation for quick identification of failure, mitigation and repair damage	• Inability to locate point of leak and repair. Pipeline would require re-installation resulting in abandonment of installed pipe.
Pipeline Protection/Cover	• Lowering to 3-4 feet below lake bed per Federal regulations • Concrete weight coating for additional protection	• Depth of drill provides protection to pipeline
Cost	• Reduced costs for surveys, installation costs and turbidity mitigation compared to HDD • In unlikely event of damage to pipeline, cost to access and repair pipeline minimal (compared to HDD pipe)	• Expensive subsurface explorations and installation method • Mitigation measures may be substantial based on conditions of surface returns • In unlikely event of damage to pipeline, cost to access and repair pipeline substantial (including redrill and abandonment of pipe)

6. Conclusion

In summation, with all data available under consideration, BakkenLink, in its due diligence, advocates the pipeline-pull installation methodology over HDD installation at the Corps designated crossing location. The advantages of this method include a higher installation success with a proven methodology, reduced installation and subsurface investigation costs, and proven experience in managing and implementing this technique. Its main disadvantage includes the creation of minimal turbidity and re-sedimentation but which can be successfully mitigated during construction activities. Consequently, this technique was considered the best Risk- Reward scenario, with reward being confidence of a successful installation and risk being short term turbidity mitigation and cost contingencies. Contrastingly, the HDD Risk-Reward profile, where the reward of possibility no impact to the lake is not considered to outweigh the risks of HDD uncertainties, frac out impacts to the lake, and drilling or installation failures, does not support this method.

Appendix XI

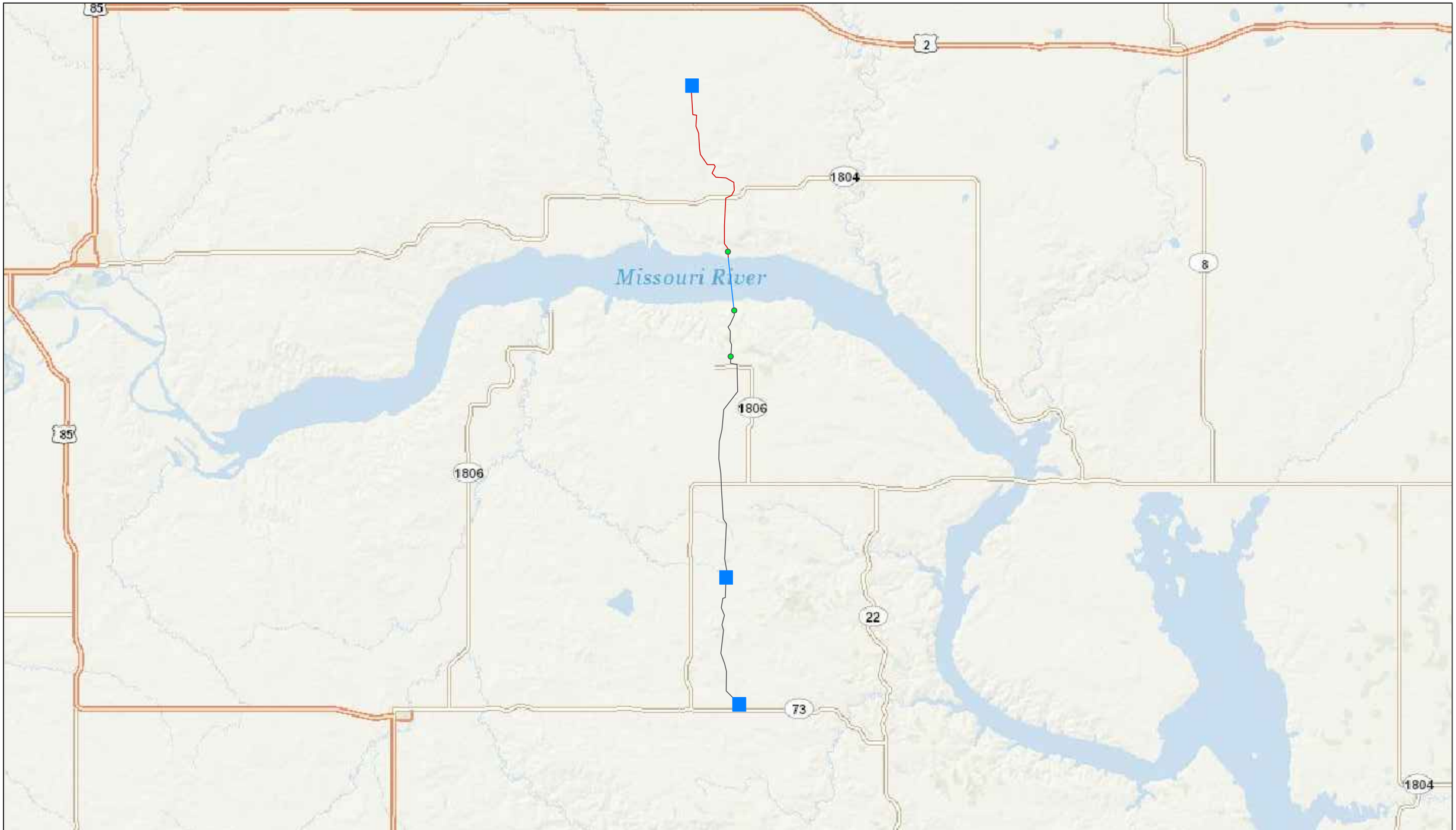
Access Road and Improvements Table

BAKKEN LINK NORTH- ACCESS ROADS								
NAME	SURFACE	TYPE	CONDITION	TWN	R	S	LENGTH	IMPROVEMENT
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	150	96	1	1051	NONE
30TH ST	GRAVEL	COUNTY	IMPROVED	150	96	**1**	1713	NONE
32ND ST	PAVED	FEDERAL	PAVED	151	96	25	4273	NONE
33RD ST	GRAVEL	COUNTY	IMPROVED	151	96	13/24	4799	NONE
34TH ST	GRAVEL	COUNTY	IMPROVED	151	96	12/13	4855	NONE
38TH ST	GRAVEL	COUNTY	IMPROVED	152	96	24/25	5753	NONE
40TH ST	GRAVEL	COUNTY	IMPROVED	152	96	12/13	3254	NONE
41ST ST	TRAIL	COUNTY	2-TRACK(N.I.)	152	96	1/12	2920	GRAVEL
42ND ST	GRAVEL	COUNTY	IMPROVED	152	96	1	2382	NONE
43RD ST	GRAVEL	COUNTY	IMPROVED	153	95	28/33	2228	NONE
44TH ST	GRAVEL	COUNTY	IMPROVED	153	95	22/27	1679	NONE
104TH AVE	GRAVEL	COUNTY	IMPROVED	153	95	16/15	2285	NONE
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	154	95	15/16	5574	NONE
52ND ST	GRAVEL	COUNTY	IMPROVED	154	95	9/16	3831	NONE
53RD ST	TRAIL	PRIVATE	2-TRACK(N.I.)	154	95	4/9	270	GRAVEL
53RD ST	2-TRACK	COUNTY	GRADED & DRAINED	154	95	4/9	2726	NONE
56TH ST(MOE 2)	GRAVEL	PRIVATE	IMPROVED	155	95	29	1730	NONE
57TH ST	GRAVEL	COUNTY	IMPROVED	155	95	20	4286	NONE
59TH ST	GRAVEL	COUNTY	IMPROVED	155	95	6/7	618	NONE
36TH ST	TRAIL	PRIVATE	2-TRACK(N.I)	152	96	36	4046	GRAVEL
37TH ST	TRAIL	PRIVATE	FENCE LINE(N.I.)	152	96	25/36	4996	GRAVEL
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	153	95	16	703	NONE
46TH ST	GRAVEL	COUNTY	IMPROVED	153	95	9/10	1070	NONE
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	153	95	3/4	1162	NONE
48TH ST	GRAVEL	COUNTY	IMPROVED	154	95	34	2135	NONE
PRIVATE ROAD	GRAVEL	PRIVATE	IMPROVED	155	95	8	396	NONE
28TH ST	GRAVEL	COUNTY	IMPROVED	150	96	12	1199	NONE
OIL PAD ROAD	TRAIL	PRIVATE	2-TRACK(MAT)	153	95	4	397	MAT
102ND RD	GRAVEL	COUNTY	IMPROVED	154	95	16	1637	NONE
60TH ST	GRAVEL	COUNTY	IMPROVED	155	95	6	988	NONE
104TH AVE	GRAVEL	COUNTY	IMPROVED	155	95	8	1279	NONE
103RD AVE	GRAVEL	COUNTY	IMPROVED	155	95	20	985	NONE
1804	PAVED	STATE	PAVED	155	95	33	3417	NONE
MOE 1	GRAVEL	PRIVATE	IMPROVED	155	95	27	903	NONE
MOE 4	GRAVEL	PRIVATE	IMPROVED	155	95	17	2800	NONE
MOE 3	GRAVEL	PRIVATE	IMPROVED	155	95	20	1317	NONE
MOE 4	GRASS	PRIVATE	UNIMPROVED(MAT)	155	95	17	134	NONE
MOE 3	TRAIL	PRIVATE	2-TRACK(N.I.)	155	95	20	2824	GRAVEL
OIL PAD ROAD	TRAIL	PRIVATE	2-TRACK(N.I.)	154	95	16	368	GRAVEL
MOE 5	GRAVEL	PRIVATE	IMPROVED	155	95	34	1736	NONE
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	150	96	1	589	NONE
FROM OIL PAD	GRASS	PRIVATE	UNIMPROVED(MAT)	153	95	4	305	MAT

DRILL ACCESS	GRASS	PRIVATE	UNIMPROVED(MAT)	155	95	17	551	MAT
38TH ST	GRASS	PRIVATE	UNIMPROVED(MAT)	152	96	24	456	MAT
MOE 1	TRAIL	PRIVATE	2-TRACK(MAT)	155	95	27	2217	MAT
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	153	95	4	579	NONE
TOTAL ACCESS ROADS = 46								

Appendix XII

Construction Segment Map



REVISIONS			
NO.	DATE	BY	DESCRIPTION

DRWN. BY: DJC
CHK'D BY:
PROJECT NO.: 016853.200
DATE: 00/00/0000

Scale 1:200,000
0 3mi 6mi

Construction Scope

SHEET NO.: 1 of 1

BakkenLink
BakkenLink Pipeline, LLC
2101 46th Ave SE, Suite 2
Mandan, ND 58503

BILL OF MATERIALS

ITEM	QTY.

NOTES
1. THIS IS NOT A SURVEY DOCUMENT. SURVEY DATA PROVIDED BY BARTLETT & WEST, INC.
2. AERIAL PHOTOGRAPHY PROVIDED BY ESRI, INC. ALL EXISTING FEATURES ON THESE PLANS ARE FOR INFORMATION ONLY. NO GUARANTEE IS OFFERED OR TO BE IMPLIED.

LEGEND
= Segment 1 (22.8 miles)
= Segment 2 (2.8 miles)
= Segment 3 (11.5 miles)
= Main Line Valve
= Receipt Point

BARTLETT & WEST
3456 Century Ave.
Bismarck, ND 58503

Appendix XIII

Construction Mitigation Reclamation Plan (CMRP)

BAKKENLINK PIPELINE PROJECT

CONSTRUCTION, MITIGATION, AND RECLAMATION PLAN

February 2014
Rev. 1

DRAFT

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1.0 INTRODUCTION

The construction, mitigation, and reclamation requirements described in this Plan apply to work on all of BakkenLink Pipeline, LLC's (BakkenLink's) BakkenLink Pipeline Project (Project) lands, including the following;

- uplands, including agricultural (cultivated or capable of being cultivated) lands, pasture lands; range lands; grass lands; forested lands; lands in residential, commercial, or industrial areas; lands in public rights of way; and lands in private rights-of-way;
- wetlands; and
- waterbodies and riparian areas.

BakkenLink, during the construction, operation, and maintenance of the Project, shall implement the construction, mitigation, and reclamation actions contained in this Plan to the extent that they do not conflict with the requirements of any applicable federal, state, or local rules and regulations, or other permits or approvals that are applicable to the Project. Additionally, BakkenLink may deviate from specific requirements of this Plan on specific private lands as agreed to by landowners or as required to suit actual site conditions as determined and directed by BakkenLink. All work must be in compliance with federal, state, and local permits.

The Project will be designed, constructed, operated and maintained in a manner that meets or exceeds applicable industry standards and regulatory requirements.
BakkenLink's Pipeline Operation and Maintenance Plan and Emergency Response Plan will outline the preventative maintenance, inspection, line patrol, leak detection systems, SCADA, and other pipeline integrity management procedures to be implemented during operation of the Project.

2.0 GENERAL CONDITIONS

2.1 Training

Experienced, well-trained personnel are essential for the successful implementation of this Plan. BakkenLink and its Contractors shall undergo prevention and response, as well as safety training. The program shall be designed to improve awareness of safety requirements, pollution control laws and procedures, and proper operation and maintenance of equipment.

The construction contractor (Contractor), and all of his subcontractors shall ensure that persons engaged in Project construction are informed of the construction requirements and that they attend and receive training regarding these requirements as well as all laws, rules and regulations applicable to the work. Prior to construction, all Project personnel will be trained on environmental permit requirements and environmental specifications, including fuel handling and storage, cultural resource protection methods, stream and wetland crossing requirements, and sensitive species protection measures.

Contractor personnel shall attend a training session before the beginning of construction and during construction as environmental issues and incidents warrant. Additional training sessions shall be held for newly assigned personnel prior to commencing work on the Project.

All Contractor personnel shall attend the training session prior to entering the construction right-of-way. All Contractor personnel shall sign an acknowledgement of having attended the appropriate level of training. In order to ensure successful compliance, Contractor personnel shall attend repeat or supplemental training if compliance is not satisfactory or as new, significant new issues arise.

All visitors and any other personnel without specific work assignments shall be required to attend a safety and environmental awareness orientation prior to being granted access to any construction sites.

2.2 Environmental Inspection

BakkenLink will use Environmental Inspectors on each construction spread. The Environmental Inspectors will review the Project activities daily for compliance with state, federal and local regulatory requirements. The Environmental Inspectors will have the authority to stop specific tasks as approved by the Chief Inspector. They can also order corrective action in the event that construction activities violate the provisions of this Plan, landowner requirements, or any applicable permit requirements.

2.3 Advance Notice of Access to Property Prior to Construction

Prior to initially accessing landowners' property, BakkenLink shall provide the landowner or tenant with a minimum of 24 hours prior notice unless otherwise negotiated with the landowner and as described in the Project line list. Contractor shall give BakkenLink 48 hours of prior notice regarding the need for access. Additionally, the landowner or tenant shall be provided with BakkenLink contact information. Landowners may utilize contact information to inform BakkenLink of any concerns related to construction.

Prior notice shall consist of a personal contact, a telephone contact, or delivery of written notice to the landowner to inform the landowner of whereby the landowner or tenant is informed of BakkenLink's intent to initially access the land. The landowner or tenant need not acknowledge receipt of written notice before BakkenLink can enter the landowner's property.

BakkenLink will coordinate with managers of public lands to reduce conflicts between construction activities and recreational uses. BakkenLink will consult with land managers on state and federal lands regarding any necessary construction and maintenance restrictions consistent with management and use of such lands. Damages from disruption of recreational uses of private lands will be the subject of compensation negotiations with individual landowners.

2.4 Other Notifications

The Contractor shall notify, in writing, both BakkenLink and the authority having jurisdiction over any road, railroad, canal, drainage ditch, river, foreign pipeline, or other utility to be crossed by the pipeline at least 48 hours (excluding Saturdays, Sundays, and statutory holidays), or as specified on the applicable permit(s), prior to commencement of pipeline construction, in order that the said authority may appoint an inspector to ensure that the crossing is constructed in a satisfactory manner.

The Contractor shall notify BakkenLink of any spill of a potentially hazardous substance in accordance with the Spill Prevention, Containment, and Coutermeasure Plan (SPCC Plan). The Contractor shall notify BakkenLInk immediately of any spill of any substance to a wetland or waterbody.

The Contractor shall notify BakkenLink of any existing soil contamination discovered during construction.

The Contractor shall immediately notify BakkenLink of the discovery of previously unreported historic property, other significant cultural materials, or suspected human remains uncovered during pipeline construction.

The Contractor shall immediately notify BakkenLink of a Project-related injury or mortality of a threatened or endangered species.

2.5 Damages to Private Property

Pipeline construction activities shall be confined to the construction right-of-way, temporary work space, additional temporary work space, and approved access routes.

BakkenLink shall reasonably compensate landowners for any construction-related damages caused by BakkenLink which occur on or off of the established pipeline construction right-of-way.

BakkenLink shall reasonably compensate landowners for damages to private property caused by BakkenLink beyond the initial construction and reclamation of the pipeline, to include those damages caused by BakkenLink during future construction, operation, maintenance, and repairs relating to the pipeline.

2.6 Appearance of Worksite

The construction right-of-way shall be maintained in a clean, neat condition at all times. At no time shall litter be allowed to accumulate at any location on the construction right-of-way. The Contractor shall provide a daily garbage detail with each major construction crew to keep the construction right-of-way clear of trash, pipe banding and spacers, waste from coating products, welding rods, timber skids, defective materials and all construction and other debris immediately behind construction operations unless otherwise approved by BakkenLink. Paper from wrapping or coating products or lightweight items shall not be permitted to be scattered by the wind.

The traveled surfaces of roads, streets, highways, etc. (and railroads when applicable) shall be cleaned free of mud, dirt, or any debris deposited by equipment traversing these roads or exiting from the construction right-of-way.

2.7 Access

Prior to the pipeline's installation, BakkenLink and the landowner shall reach a mutually acceptable agreement on the route that shall be utilized by the Contractor for entering and exiting the pipeline construction right-of-way should access to the construction right-of-way not be practicable or feasible from adjacent segments of the pipeline construction right-of-way, public road, or railroad right-of-way.

All construction vehicles and equipment traffic shall be confined to the public roads, private roads acquired for use by BakkenLink, and the construction right-of-way. Table 2 includes a list of all access roads, ownership, necessary improvements and width of disturbance. If temporary private access roads are constructed, they shall be designed to maintain proper drainage and shall be built to minimize soil erosion.

Sufficiently sized gaps shall be left in all spoil and topsoil wind rows and a hard or soft plug shall be left in the trench at all temporary private access roads and obvious livestock or wildlife trails unless the landowner agrees prior to construction that these access points can be blocked during construction.

All construction-related access roads to the right-of-way shall be marked with signs. Any private roads not to be utilized during construction shall also be marked.

2.8 Aboveground Facilities

Locations for aboveground facilities shall be selected in a manner so as to be as unobtrusive as reasonably possible to ongoing agricultural or other landowner activities occurring on the lands adjacent to the facilities. If it is not feasible, to avoid interference, such activities shall be located so as to incur the least hindrance to the adjacent agricultural operations (i.e., located in field corners or areas where at least one side is not used for cropping purposes) provided the location is consistent with the design constraints of the pipeline. Aboveground facilities shall avoid floodplains and wetlands to the maximum extent possible. Additionally, they shall be located to avoid existing drain tile systems to the extent possible. To further reduce visual impacts from aboveground pipeline facilities and structures, BakkenLink will comply with standard industry painting practices with respect to aboveground facilities. BakkenLink will address any visual aesthetics issues with landowners through individual consultations.

2.9 Minimum Depth of Cover

The pipeline shall be installed so that the top of the pipe and coating is a minimum depth of 5 feet below the bottom of waterbodies including rivers, creeks, streams, ditches, and drains. This depth shall normally be maintained

over a distance of 15 feet on each side of the waterbody measured from the top of the defined stream channel. If concrete weights or concrete coated pipe is utilized for negative buoyancy of the pipeline, the minimum depth of cover shall be measured from the top of the concrete to the original ground contour. The following table indicates standard depths that would apply to pipeline construction.

Location	Excavation (inches)
Undeveloped Section Line crossing	72
Rangeland and cultivated lands	48
Industrial, commercial, and residential areas	48
Crossings of inland bodies of water with a width of at least 100 ft from high water mark to high water mark	60
Drainage ditches at public roads and railroads	60

Depth of cover requirements may be modified by BakkenLink based on site-specific conditions. However, all depths shall be in compliance with all established codes.

2.10 Non-Hazardous Waste Disposal

Non-hazardous pipeline construction wastes include human waste, trash, pipe banding and spacers, waste from coating products, welding rods, timber skids, cleared vegetation, stumps, and rock.

All waste which contains (or at any time contained) oil, grease, solvents, or other petroleum products falls within the scope of the oil and hazardous substances control, cleanup, and disposal procedures. This material shall be segregated for handling and disposal as hazardous wastes.

The Contractor shall be responsible for ensuring that human wastes are handled and disposed of exclusively by means of portable, self-contained toilets during all construction operations. Wastes from these units shall be collected by a licensed contractor for disposal only at licensed and approved facilities.

The Contractor shall remove all trash from the construction right-of-way on a daily basis unless otherwise approved or directed by BakkenLink.

The Contractor shall dispose of HDD drill cuttings and drilling mud at an agency approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by BakkenLink, or hauling to an approved licensed landfill or other site approved by BakkenLink.

The Contractor shall remove all extraneous vegetative, rock, and other natural debris from the construction right-of-way by the completion of cleanup

The Contractor shall remove all trash and wastes from Contractor yards, and Pipe Yards, and staging areas when work is completed at each location.

The Contractor shall dispose of all waste materials at licensed waste disposal facilities. Wastes shall not be disposed of in any other fashion such as un-permitted burying or burning.

2.11 Hazardous Wastes

The Contractor shall ensure that all hazardous and potentially hazardous materials are transported, stored, and handled in accordance with all applicable regulations. Workers exposed to or required to handle dangerous materials shall be trained in accordance with the applicable regulations and the manufacturer's recommendations.

The Contractor shall dispose of all hazardous materials at licensed waste disposal facilities. Hazardous wastes shall not be disposed of in any other fashion such as un-permitted burying or burning.

All transporters of oil, hazardous substances, and hazardous wastes shall be licensed and certified according to the applicable state vehicle code. Incidents on public highways shall be reported to the appropriate agencies.

All hazardous wastes being transported off-site shall be manifested. The manifest shall conform to requirements of the appropriate state agency. The transporter shall be licensed and certified to handle hazardous wastes on the public highways. The vehicles as well as the drivers must conform to all applicable vehicle codes for transporting hazardous wastes. The manifest shall conform to 49 CFR Parts 172.101, 172.202, and 172.203.

If toxic or hazardous waste materials or containers are encountered during construction, the Contractor shall stop work immediately to prevent disturbing or further disturbing the waste material and shall immediately notify BakkenLink. The Contractor shall not restart work until clearance is granted by BakkenLink.

2.12 Noise Control

The Contractor shall minimize noise during non-daylight hours and within 1 mile of residences or other noise-sensitive areas such as hospitals, motels or campgrounds. BakkenLink shall abide by all applicable noise regulations regarding noise near residential and commercial/industrial areas. The Contractor shall provide notice to BakkenLink if noise levels are expected to exceed bylaws for a short duration. BakkenLink will give advanced notice to landowners within 500 feet of right-of-way prior to construction, limit the hours during which construction activities with high-decibel noise levels are conducted, coordinate work schedules, and ensure that construction proceeds quickly through such areas.

The Contractor shall minimize noise in the immediate vicinity of herds of livestock or poultry operations, which are particularly sensitive to noise.

2.13 Weed Control

The Contractor shall thoroughly clean all construction equipment, including timber mats, prior to moving the equipment to the job site to limit the potential for the spread of noxious weeds, insects and soil-borne pests. The Contractor shall clean the equipment with high-pressure washing equipment.

Prior to construction, BakkenLink will mark all areas of the right-of-way which contain infestations of noxious, invasive species or soil-borne pests. Such marking will clearly indicate the limits of the infestation along the right-of-way. During construction, the Contractor shall clean the tracks, tires, and blades of equipment by hand (track shovel) or compressed air to remove excess soil prior to movement of equipment out of weed or soil-borne pest infested areas or utilize cleaning stations to remove vegetative materials using water under high pressure.

The Contractor shall use mulch and straw or hay bales that are Certified Weed Free in the State of North Dakota for temporary erosion and sediment control.

The Contractor shall implement pre-construction treatments such as mowing prior to seed development or herbicide application to areas of noxious weed infestation prior to other clearing, grading, trenching, or other soil disturbing work at locations identified in the construction drawings.

BakkenLink will implement mitigation or protection measures for conducting vegetation control where necessary before and after construction. Typical agricultural herbicides, developed in consultation with county or state regulatory agencies, will be used. Herbicide types will be determined based on the weed species requiring control. The Contractor shall apply herbicides, where required, within one week, or as deemed necessary for optimum mortality success, prior to disturbing the area by clearing, grading, trenching, or other soil disturbing work. Herbicides shall be applied by applicators appropriately licensed or certified by the state in which the work is conducted. All herbicides applied prior to construction shall be non-residual or shall have a significant residual effect no longer than 30 days. Herbicides applied during construction shall be non-residual. BakkenLink will implement mitigation or protection measures in the use of pesticides and herbicides along the pipeline corridor to reduce potential impacts to avian and wildlife species.

The Contractor shall not use herbicides in or within 100 feet of a wetland or waterbody.

After completion of pipeline construction, on any construction right-of-way over which BakkenLink will retain control over the surface use of the land after construction (i.e., valve sites, metering stations, pump stations, etc.), BakkenLink shall provide for weed control to limit the potential for the spread of weeds onto adjacent lands. Any weed control spraying performed by BakkenLink shall be done by a state-licensed pesticide applicator.

BakkenLink shall be responsible for reimbursing all reasonable costs incurred by owners of land adjacent to aboveground facilities when the landowners must

control weeds on their land which can be reasonably determined to have spread from land occupied by BakkenLink's aboveground facilities.

2.14 Dust Control

The Contractor shall at all times control airborne dust levels during construction activities. The Contractor shall employ water trucks, sprinklers or other approved chemical applications as necessary to reduce dust to acceptable levels. Utilization of chemical applications is limited to roads.

Dust shall be strictly controlled where the construction work approaches dwellings, farm buildings, and other areas occupied by people and when the pipeline parallels an existing road or highway. This shall also apply to access roads where dust raised by construction vehicles may irritate or inconvenience local residents. The speed of all Contractor vehicles shall be controlled in these areas. Emissions from construction equipment combustion, open burning, and temporary fuel transfer systems and associated tanks will be controlled to the extent required by state and local agencies through the permit process.

The Contractor shall take appropriate precautions to prevent fugitive emissions caused by sand blasting from reaching any residence or public building. The Contractor shall place curtains of suitable material, as necessary, to prevent wind-blown particles from sand blasting operations from reaching any residence or public building.

Additional measures may be required by state regulations or local ordinances. The Contractor will comply with all applicable state regulations and local ordinances with respect to truck transportation and fugitive dust emissions.

2.15 Off Road Vehicle Control

BakkenLink shall offer to landowners or managers of forested lands to install and maintain measures to control unauthorized vehicle access to the construction right-of-way where appropriate. These measures may include the following unless otherwise approved or directed by BakkenLink based on site specific conditions or circumstances:

- signs;
- fences with locking gates;
- slash and timber barriers, pipe barriers, or boulders lined across the construction right-of-way; and
- conifers or other appropriate trees or shrubs across the construction right-of-way.

2.16 Fire Prevention and Control

The Contractor shall comply with all federal, state, county and local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following mitigation measures shall be implemented to prevent fire hazards and control of fires:

- A list of relevant fire authorities and their designated representative to contact shall be maintained on site by construction personnel.
- Adequate fire fighting equipment shall be available on site in accordance with the applicable regulatory requirements shall be available on site.
- The level of fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level and related implications.
- The Contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed.
- Specifically, the Contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, grinding, and burning of brush or vegetative debris.
- In the event of a fire, the Contractor shall immediately use resources necessary to contain the fire. Contractor shall simultaneously notify local emergency response personnel.
- All tree clearing activities are to be carried out in accordance with local rules and regulations for the prevention of forest fires.
- Burning shall be done in compliance with state, county, or local applicable regulations.
- Any burning will be done within the right-of-way. Only small piles shall be burned to avoid overheating or damage to trees or other structures along the right-of-way.
- Flammable wastes shall be removed from the construction site on a regular basis.
- Flammable materials kept on the construction site must be stored in approved containers away from ignition sources.
- Smoking shall be prohibited around flammable materials.
- Smoking shall be prohibited on the entire construction site when the fire hazard is high.

2.17 Road and Railroad Crossings

Construction across paved roads, highways, and railroads will be in accordance with the requirements of the road and railroad crossing permits and approvals

obtained by BakkenLink. In general, all major paved roads, all primary gravel roads, highways, and railroads will be crossed by boring beneath the road or railroad. Boring requires the excavation of a pit on each side of the feature, the placement of boring equipment in the pit, and boring a hole under the road at least equal to the diameter of the pipe. Once the hole is bored, a prefabricated pipe section will be pulled through the borehole. For long crossings, sections can be welded onto the pipe string just before being pulled through the borehole. Boring will result in minimal or no disruption to traffic at road or railroad crossings. Each boring will be expected to take 1 to 2 days for most roads and railroads and up to 10 days for long crossings such as interstate or four-lane highways.

Most smaller, unpaved roads and driveways will be crossed using the open-cut method where permitted by local authorities or private owners. The open-cut method will require temporary closure of the road to traffic and establishment of detours. If no reasonable detour is feasible, at least one lane of traffic will be kept open, except during brief periods when it is essential to close the road to install the pipeline. Most open-cut road crossings can be finished and the road resurfaced in 1 or 2 days. Contractor will take measures, such as posting signs at open-cut road crossings, to ensure safety and minimize traffic disruptions.

2.18 Adverse Weather

The Contractor shall restrict certain construction activities and work in excessively wet soil conditions to minimize rutting and soil compaction. In determining when or where construction activities should be restricted or suspended during wet conditions, the Contractor shall consider the following factors:

- the extent that rutting may cause mixing of topsoil with subsoil layers or damage to tile drains;
- excessive buildup of mud on tires and cleats;
- excessive ponding of water at the soil surface; and
- the potential for excessive soil compaction.

The Contractor shall implement mitigative measures as directed by BakkenLink in order to minimize rutting and soil compaction in excessively wet soil conditions which may include:

- restricting work to areas on the spread where conditions allow;
- using low ground weight, wide-track equipment, or other low impact construction techniques;
- limiting work to areas that have adequately drained soils or have a cover of vegetation ,such as sod, crops or crop residues, sufficient to prevent mixing of topsoil with subsoil layers or damage to drain tiles; and
- installing geotextile material or construction mats in problem areas.

"Stop work" authority will be designated to the Chief Inspector but will be implemented when recommended by the Environmental Inspector.

2.19 Cultural Resources

BakkenLink intends to avoid cultural resources to the extent practicable by rerouting the pipeline corridor and related appurtenances, avoiding construction activities on properties listed in or eligible for listing in the National Register of Historic Places (NRHP) or those whose eligibility for listing have not been determined, as well as boring or using HDD through culturally sterile soils. Avoidance will be in accordance to guidance provided by the State Historical Society of North Dakota, the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS).

The Contractor shall implement the measures outlined in the Unanticipated Discovery Plan to minimize disturbance to cultural sites and shall take immediate action as outlined if any unanticipated cultural discovery is encountered during construction.

The preferred treatment of any historical property or culturally significant site is avoidance. Where necessary, BakkenLink will monitor the construction spread using a cultural resource monitor working under the direction of a professional who meets the standards of the *Professional Qualification Standards in Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines*(48 FR 44716, September 29, 1983).

Prior to commencing construction, BakkenLink also will provide an appropriate level of training to all construction personnel so that the requirements of any unanticipated discovery plan are understood and unanticipated discoveries are quickly identified.

The contractor shall implement the measures outlined in the Unanticipated Discovery Plan that has been adopted to minimize disturbance to cultural sites and shall take immediate action as outlined if any unrecorded cultural resource is encountered during construction. In the event an unanticipated cultural discovery is made, the Contractor will immediately halt all construction activities within a 100-foot radius, including construction related traffic; notify BakkenLink's consulting archaeologist; and implement interim measures to protect the discovery from looting or vandalism according to the Unanticipated Discovery Plan. The BLM, SHPT, and local and tribal authorities, as appropriate, will be notified immediately upon encountering the discovery. Construction will not proceed within the 100-foot radius of a discovery site until all consulting parties agree that the terms of the Unanticipated Discovery Plan are satisfied and BakkenLink receives notification from the appropriate agencies. No work or activity within the 100-foot buffer area may take place until approvals are communicated at the spread level by the lead Environmental Inspector.

3.0 SPILL PREVENTION AND CONTAINMENT

Spill prevention and containment applies to the use and management of hazardous materials on the construction right-of-way and all ancillary areas during construction.

This includes the refueling or servicing of all equipment with diesel fuel, gasoline, lubricating oils, grease, and hydraulic and other fluids during normal upland applications and special applications within 100 feet of perennial streams or wetlands.

BakkenLink will prepare a project-specific Spill Prevention Containment and Countermeasure (SPCC) Plan. The Contractor shall provide additional information to complete the SPCC Plan for each construction spread, and shall provide site-specific data that meets the requirements of 40 CFR Part 112 for every location used for staging fuel or oil storage tanks and for every location used for bulk fuel or oil transfer. Each SPCC Plan will be prepared prior to introducing the subject fuel, oil, or hazardous material to the subject location.

3.1 Spill Prevention

3.1.1 Staging Areas

Staging areas (including pipe stockpile sites) shall be set up for the construction spreads. No bulk fuel and storage tanks will be placed in the construction ROW. Hazardous materials at staging areas shall be stored in compliance with federal and state laws. The following spill prevention measures shall be implemented by the Contractor:

- Contractor fuel trucks shall be loaded at existing bulk fuel dealerships or from bulk tanks set up for that purpose at the staging area. In the former case, the bulk dealer is responsible for preventing and controlling spills.
- The Environmental Inspector shall inspect the tank site for compliance with the 100-foot setback requirement and approve the tank site prior to installing bulk fuel or storage tanks on the construction yard.
- Fuels and lubricants shall be stored only at designated staging areas. Storage of fuel and lubricants in the staging area shall be at least 100 feet away from the water's edge. Refueling and lubrication of equipment shall be restricted to upland areas at least 100 feet away from perennial streams and wetlands.
- Contractors shall be required to perform all routine equipment maintenance at the staging area and recover and dispose of wastes in an appropriate manner.
- Fixed fuel dispensing locations will be provided with secondary containment to capture fuel from leaks, drips, and overfills.
- Temporary liners, berms, or dikes (secondary containment) shall be constructed around the aboveground bulk tanks, providing 110 percent containment volume of the largest storage tank or trailer within the containment structure, so that potential spill materials shall be contained and collected in specified areas. Tanks shall not be placed in areas subject to periodic flooding or washout.
- Drivers of tank trucks are responsible for safety and spill prevention during tank truck unloading. Procedures for loading and unloading tank trucks shall meet the minimum requirements established by the

Department of Transportation.

- Drivers of tank trucks are responsible for setting brakes and chocking wheels prior to off loading. Warning signs requiring drivers to set brakes and chock wheels shall be displayed at all tanks. Proper grounding of equipment shall be undertaken during fuel transfer operations. Drivers shall observe and control the fueling operations at all times to prevent overfilling the temporary tank.
- Prior to departure of any tank truck, all vehicle outlets shall be examined closely by the driver for leakage, tightened, adjusted or replaced to prevent leakage while in transit.
- A supply of sorbent and barrier materials sufficient to allow the rapid containment and recovery of spills shall be maintained at each construction staging area. Sorbent and barrier materials shall also be utilized to contain runoff from contaminated areas.
- Shovels and drums shall be kept at each of the individual staging areas. In the event that small quantities of soil become contaminated, shovels shall be utilized to collect the soil and the material shall be stored in 55-gallon drums. Large quantities of contaminated soil may be bio-remediated on site or disposed in an approved landfill, subject to government approval, or collected utilizing heavy equipment, and stored in drums or other suitable containers prior to disposal. Should contamination occur adjacent to staging areas as a result of runoff, shovels or heavy equipment shall be utilized to collect the contaminated material. Contaminated soil shall be disposed of in accordance with state and federal regulations.
- Temporary aboveground tanks shall be subject to visual inspection on a monthly basis and when the tank is refilled. Inspection records shall be maintained. Operators shall routinely keep tanks under close surveillance and potential leaks or spills shall be quickly detected.
- Visible fuel leaks shall be reported to the Contractors' designated representative and corrected as soon as conditions warrant. BakkenLink's designated representative shall be informed.
- Drain valves on temporary tanks shall be locked to prevent accidental or unauthorized discharges from the tank.
- Oil and other hazardous materials stored in 350-gallon totes, 55-gallon drums, 5-gallon pails, smaller retail-size containers or other portable containers will be staged or stored in areas with a secondary temporary containment structure. Secondary containment structures may consist of temporary earthen berms with a chemical resistant liner, or a portable containment system constructed of steel, PVC, or other suitable material. The secondary containment structure will be capable of containing 110 percent of the volume of material stored in these areas.

BakkenLink may allow modification of the above specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits.

3.1.2 Construction Right-of-Way

The Contractor will ensure that all equipment is free of leaks prior to use on the Project and prior to entering or working in or near waterbodies or wetlands. Throughout construction, the Contractor will conduct regular maintenance and inspections of the equipment to reduce the potential for spills or leaks.

Rubber-tired vehicles (pickup trucks, buses) normally shall refuel at the construction staging areas or commercial gas stations. Tracked machinery (backhoes, bulldozers) shall be refueled and lubricated on the construction right-of-way. Equipment maintenance shall be conducted in staging areas when practical. When impractical, repairs to equipment can be made on the construction right-of-way when approved by BakkenLink's representative.

Each fuel truck that transports and dispenses fuel to construction equipment or Project vehicles along the construction ROW or within equipment staging and material areas shall carry an oil spill response kit and spill response equipment onboard at all times. In the event that response materials are depleted through use or their condition is deteriorated through age, the materials will be replenished prior to placing the fueling vehicle back into service.

The following preventive measures apply to refueling and lubricating activities on the construction right-of-way:

- Construction activities shall be conducted to allow for prompt and effective cleanup of spills of fuel and other hazardous materials. Each construction crew, including cleanup crews shall have on hand sufficient tools and material to stop leaks and supplies of absorbent and barrier materials to allow rapid containment and recovery of spilled materials. Crew members must know and follow the procedure for reporting spills.
- Refueling and lubricating of construction equipment shall be restricted to upland areas at least 100 feet away from perennial streams and wetlands. Where this is not possible (e.g., trench dewatering pumps), the equipment shall be fueled by designated personnel with special training in refueling, spill containment, and cleanup. The Environmental Inspector shall ensure that signs are installed identifying restricted areas.
- No fuel, oil or hazardous material storage, staging, or transfer other than refueling will occur within 100 feet of any storm drain, drop inlet, or high consequence area (HCA).
- Spent oils, lubricants, filters, etc. shall be collected and disposed of at an approved location in accordance with state and federal regulations.
- Equipment shall not be washed in streams.

- Stationary equipment will be placed within a secondary containment if it will be operated or require refueling within 100 feet of a wetland or waterbody boundary.

BakkenLink may allow modification of the above specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits.

3.2 Contingency Plans

The Contractor shall develop emergency response procedures for all incidents (e.g., spills, leaks, fires) involving hazardous materials which could pose a threat to human health or the environment. The procedures shall address activities in all work areas, as well as during transport to and from the construction right-of-way and to any disposal or recycling facility.

3.3 Equipment

The Contractor shall retain emergency response equipment in all areas where hazardous materials are handled or stored. This equipment shall be readily available to respond to a hazardous material emergency. Such equipment shall include, but not be limited to, the following:

- first aid supplies;
- phone or communications radio;
- protective clothing (Tyvek suit, gloves, goggles, boots);
- hand-held fire equipment;
- absorbent material and storage containers;
- non-sparking bung wrench and shovel; and
- brooms and dust pan.

Hazardous material emergency equipment shall be carried in all mechanic and supervisor vehicles. This equipment shall include, at a minimum:

- first aid supplies;
- phone or communications radio;
- 2 sets of protective clothing (Tyvek suit, gloves, goggles, boots);
- 1 non-sparking shovel;
- 6 plastic garbage bags (20 gallon);
- 10 absorbent socks and spill pads;
- Hand-held fire extinguisher;
- barrier tape; and
- 2 orange reflector cones.

Fuel and service trucks shall carry a minimum of 20 pounds of suitable commercial sorbent material.

The Contractor shall inspect emergency equipment weekly, and service and maintain equipment regularly. Records shall be kept of all inspections and services.

3.4 Emergency Notification

Emergency notification procedures between the Contractor and BakkenLink shall be established in the planning stages of construction. A BakkenLink representative shall be identified to serve as contact in the event of a spill during construction activities. In the event of a spill meeting government reporting criteria, the Contractor immediately shall notify the BakkenLink representative who, in turn, shall notify the appropriate regulatory agencies.

Any material released into water that creates a sheen must be reported immediately to BakkenLink. The Contractor is required to notify BakkenLink immediately if there is any spill of oil, oil products, or hazardous materials that reaches a wetland or waterbody. Incidents on public highways shall be reported to BakkenLink and the appropriate agencies by BakkenLink.

If a spill occurs on navigable waters of the United States, BakkenLink shall notify the National Response Center (NRC) at 1-800-424-8802. For spills that occur on public lands, into surface waters, or into sensitive areas, the appropriate governmental agency's district office also shall be notified.

3.5 Spill Containment and Countermeasures

In the event of a spill of hazardous material, Contractor personnel shall:

- notify the appointed BakkenLink representative;
- identify the product hazards related to the spilled material and implement appropriate safety procedures, based on the nature of the hazard;
- control danger to the public and personnel at the site;
- implement spill contingency plans and mobilize appropriate resources and manpower;
- isolate or shutdown the source of the spill;
- block manholes or culverts to limit spill travel;
- initiate containment procedures to limit the spill to as small an area as possible to prevent damage to property or areas of environment concern (e.g., watercourses); and
- commence recovery of the spill and cleanup operations.

When notified of a spill, the BakkenLink representative shall immediately ensure that:

- Action is taken to control danger to the public and personnel at the site.

- Spill contingency plans are implemented and necessary equipment and manpower are mobilized.
- Measures are taken to isolate or shutdown the source of the spill.
- All resources necessary to contain, recover and clean up the spill are available.
- Any resources requested by the Contractor from BakkenLink are provided.
- The appropriate agencies are notified. For spills which occur on public lands, into surface waters or into sensitive areas, the appropriate federal or state managing office shall also be notified and involved in the incident.

For a land spill, berms shall be constructed with available equipment to physically contain the spill. Personnel entry and travel on contaminated soils shall be minimized. Sorbent materials shall be applied or, if necessary, heavily contaminated soils shall be removed to an approved facility. Contaminated sorbent materials and vegetation shall also be disposed of at an approved facility.

For a spill threatening a waterbody, berms or trenches shall be constructed to contain the spill prior to entry into the waterbody. Deployment of booms, skimmers, and sorbent materials shall be necessary if the spill reaches the water. The spilled product shall be recovered and the contaminated area shall be cleaned up in consultation with spill response specialists and appropriate government agencies.

4.0 UPLANDS (AGRICULTURAL, FOREST, PASTURE, RANGE AND GRASS LANDS)

4.1 Interference with Irrigation Systems

If existing irrigation systems (flood irrigation, ditch irrigation, pivot, wheel, or other type of spray irrigation systems), irrigation ditches, or sheet flow irrigation shall be impacted by the construction of the pipeline, the following mitigation measures shall be implemented unless otherwise approved or directed by BakkenLink:

- If it is feasible and mutually acceptable to BakkenLink and the landowner or landowner's designate, temporary measures shall be implemented to allow an irrigation system to continue to operate across land on which the pipeline is being constructed.
- If the pipeline or temporary work areas intersect an operational (or soon to be operational) pivot or other spray irrigation system, BakkenLink shall establish with the landowner or landowner's designate an acceptable amount of time the irrigation system may be out of service. If an irrigation system interruption results in crop damages, either on the pipeline construction right-of-way or off the construction right-of-way, the landowner shall be compensated reasonably for all such crop damages.
- If the pipeline or temporary work areas intersect an operational sheet flow irrigation system, BakkenLink shall establish with the landowner or

landowner's designate an acceptable amount of time the irrigation system may be out of service. If an irrigation system interruption results in crop damages, either on the pipeline construction right-of-way or off the construction right-of-way, the landowner shall be compensated reasonably for all such crop damages.

- Irrigation ditches that are active at the time of construction shall not be stopped or obstructed except for the length of time to install the pipeline beneath the ditch (typically, one day or less) unless otherwise approved or directed by BakkenLink.

4.2 Clearing

The objective of clearing is to provide a clear and unobstructed right-of-way for safe and efficient construction of the pipeline. The following mitigation measures shall be implemented:

- Construction traffic shall be restricted to the construction right-of-way, existing roads, and approved private roads.
- Construction right-of-way boundaries including pre-approved temporary workspace shall be clearly staked to prevent disturbance to unauthorized areas.
- If crops are present, they shall be mowed or disced to ground level unless an agreement is made for the landowner to remove.
- Burning is prohibited on cultivated land.
- Construction right-of-way at timber shelterbelts in agricultural areas shall be reduced to the minimum necessary to construct the pipeline.

4.3 Topsoil Removal and Storage

The objective of topsoil handling is to maintain topsoil capability by conserving topsoil for future replacement and reclamation and to minimize the degradation of topsoil from compaction, rutting, loss of organic matter, or soil mixing so that successful reclamation of the right-of-way can occur. The following mitigative measures shall be implemented during topsoil removal and storage unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- In cultivated and agricultural lands, the actual depth of the topsoil, to a maximum depth of 12 inches, will be stripped from:
    - The area excavated above the pipeline
    - The area above the pipeline plus the spoil storage
- As required by applicable permit agreements with the landowner or as dictated by site-specific conditions.

- Stripped topsoil is to be stockpiled in a windrow along the edge of the right-of-way. The Contractor shall perform work in a manner to minimize the potential for subsoil and topsoil to be mixed.
- Under no circumstances shall the Contractor use topsoil to fill a low area.
- If required due to excessively windy conditions, topsoil piles shall be tackified using either water or a suitable tackifier (liquid mulch binder).
- Gaps in the rows of topsoil will be left in order to allow drainage and prevent ponding of water adjacent to or on the right-of-way.
- Topsoil shall not be utilized to construct ramps at road or waterbody crossings.

4.4 Grading

The objective of grading is to develop a right-of-way that allows the safe passage of equipment and meets the bending limitations of the pipe. The following mitigative measures shall be implemented during grading unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- All grading shall be undertaken with the understanding that original contours and drainage patterns shall be re-established to the extent practicable..
- Agricultural areas that have terraces shall be surveyed to establish pre-construction contours to be utilized for restoration of the terraces after construction.
- On steep slopes, or wherever erosion potential is high, temporary erosion control measures shall be implemented.
- Bar ditches adjacent to existing roadways to be crossed during construction shall be adequately ramped with grade or ditch spoil to prevent damage to the road shoulder and ditch.
- Where the construction surface remains inadequate to support equipment travel, timber mats, timber riprap, or other method shall be used to stabilize surface conditions.

The Contractor shall limit the interruption of the surface drain network in the vicinity of the right-of-way using the appropriate methods:

- providing gaps in the rows of subsoil and topsoil in order to prevent any accumulation of water on the land;
- preventing obstructions in furrows, furrow drains, and ditches;
- installing flumes and ramps in furrows, furrow drains, and ditches to facilitate water flow across the construction right-of-way and allow for construction equipment traffic; and

installing flumes over the trench for any watercourse where flow is continuous during construction.

4.5 Temporary Erosion and Sediment Control

4.5.1 General

Temporary erosion and sediment control measures shall be installed immediately after initial disturbance of the soil, maintained throughout construction (on a daily basis), and reinstalled as necessary until replaced by permanent erosion control structures or restoration of the construction right-of-way is complete.

Specifications and configurations for erosion and sediment control measures may be modified by BakkenLink as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

The Contractor shall inspect all temporary erosion control measures at least daily in areas of active construction or equipment operation, weekly in areas with no construction or equipment operation, and within 24 hours of each significant rainfall event of 0.5 inches or greater. The Contractor shall repair all ineffective temporary erosion control measures as expediently as practicable.

4.5.2 Sediment Barriers

Sediment barriers shall be constructed of silt fence, staked hay or straw bales, compacted earth (e.g., drivable berms across travel lanes), sand bags, or other appropriate materials.

The Contractor shall install sediment barriers in accordance with Company specifications or as otherwise approved or directed by BakkenLink. The Contractor is responsible for properly installing, maintaining, and replacing temporary and permanent erosion controls throughout construction and cleanup. In wetland or riparian zones, the Contractor will install sediment control structures along the construction right-of-way edges prior to vegetation removal where practicable. The aforementioned sediment barriers may be used interchangeably or together depending on site-specific conditions. In most cases, silt fence shall be utilized where longer sediment barriers are required.

Sediment barriers shall be installed below disturbed areas where there is hazard of offsite sedimentation. These areas include:

- the base of slopes adjacent to road crossings;
- the edge of the construction right-of-way adjacent to and upgradient of a roadway, flowing stream, spring, wetland, or impoundment;
- trench or test water discharge locations where required;
- where waterbodies or wetlands are adjacent to the construction right-of-way; (the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way)

- across the entire construction right-of-way at flowing waterbody crossings;
- right-of-way immediately upslope of the wetland boundary at all standard (saturated or standing water) wetland crossings as necessary to prevent sediment flow into the wetland; (Sediment control barriers are not required at “dry” wetlands.)
- along the edge of the construction right-of-way within standard (saturated or standing water) wetland boundaries as necessary to contain spoil and sediment within the construction right-of-way. Sediment control barriers are not required at “dry” wetlands

Sediment barriers placed at the toe of a slope shall be set a sufficient distance from the toe of the slope, if possible, in order to increase ponding volume.

Sediment control barriers shall be placed so as not to hinder construction operations. If silt fence or straw bale sediment barriers (in lieu of driveable berms) are placed across the entire construction right-of-way at waterbodies, wetlands, or upslope of roads, a provision shall be made for temporary traffic flow through a gap for vehicles and equipment to pass within the structure. Immediately following each day’s shutdown of construction activities, a row of straw bales or a section of silt fence shall be placed across the upgradient side of the gap with sufficient overlap at each end of the barrier gap to eliminate sediment bypass flow, followed by bales tightly fitted to fill the gap. Following completion of the equipment crossing, the gap shall be closed using silt fence or straw bale sediment barrier.

The Contractor shall maintain straw bale and silt fence sediment barriers by removing collected sediment and replacing damaged bales. Sediment shall be removed and placed where it shall not reenter the barrier when sediment loading is greater than 40 percent or if directed by BakkenLink. If straw bale filters cannot be cleaned out due to access problems, the Contractor shall place a new row of sediment barriers upslope.

The Contractor shall use mulch and straw bales that are free of noxious weeds. Mulch or straw bales that contain evidence of noxious weeds or other undesirable species shall be rejected by the Contractor.

The Contractor shall remove sediment barriers, except those needed for permanent erosion and sediment control, during clean up of the construction right-of-way.

4.5.3 Trench Plugs

The Contractor shall use trench plugs at the edge of flowing waterbody crossings and at the edge of wetlands with standing water to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody. Trench plugs shall be of sufficient size to withstand upslope water pressure.

4.5.4 Temporary Slope Breakers (Water Bars)

The Contractor shall install temporary slope breakers on slopes greater than 5% on all disturbed lands at the following recommended spacing:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

The gradient of each slope breaker shall be 2 to 4 percent.

If so directed by the landowner, the Contractor may not install temporary slope breakers (water bars) in cultivated land.

Temporary slope breakers shall be constructed of soil, silt fence, staked straw bales, sand bags, or similar materials authorized by BakkenLink.

The Contractor shall direct the outfall of each temporary slope breaker to a stable, well-vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way as shown in Detail 3. The outfall of each temporary slope breaker shall be installed to prevent sediment discharge into wetlands, waterbodies, or other sensitive resources.

Specifications and configurations for temporary slope breakers may be modified by BakkenLink as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

4.5.5 Drainage Channels or Ditches

Drainage channels or ditches shall be used on a limited basis to provide drainage along the construction right-of-way and toe of cut slopes as well as to direct surface runoff across the construction right-of-way or away from disturbances and onto natural undisturbed ground. Channels or ditches shall be constructed by the Contractor during grading operations. Where there is inadequate vegetation at the channel or ditch outlet, sediment barriers, check berms, or other appropriate measures shall be used to control erosion.

4.5.6 Temporary Mulching

Unless otherwise directed by BakkenLink, the Contractor shall apply temporary seed and/or mulch on disturbed construction work areas that have been inactive for one month or are expected to be inactive for a month or more. The Contractor shall not apply temporary mulch in cultivated areas unless specifically requested by the landowner. The Contractor shall not apply mulch within wetland boundaries.

Temporary mulch of straw or equivalent applied on slopes shall be spread uniformly to cover at least 75 percent of the ground surface at an approximate rate of 2 tons per acre of straw or its equivalent. Mulch application on slopes within 100 feet of waterbodies and wetlands shall be increased to an approximate rate of 3 tons per acre.

4.5.7 Tackifier

When wetting topsoil piles with water does not prevent wind erosion, the Contractor shall temporarily suspend topsoil handling operations and apply a tackifier to topsoil stockpiles at the rate recommended by the manufacturer.

Should construction traffic, cattle grazing, heavy rains, or other related construction activity disturb the tackified topsoil piles and create a potential for wind erosion, additional tackifier shall be applied by the Contractor.

4.6 Stringing

The objective of stringing is to place the line pipe along the construction right-of-way for bending and welding in an expedient and efficient manner.

The Contractor shall utilize one or more of the following mitigation measures as applicable and when necessary to reduce compaction on the working side of the right-of-way or as directed by BakkenLink. However, all work shall be conducted in accordance with applicable permits.

- prohibiting access by certain vehicles;
- using only machinery possessing low ground pressure (tracks or extra-wide tires);
- limiting access and thus minimizing the frequency of all vehicle traffic;
- digging ditches to improve surface drainage;
- using timber riprap, matting, or geotextile fabric overlain with soil; and
- stopping construction for a period of time.

4.7 Trenching

The objective of trenching is to provide a ditch of sufficient depth and width with a bottom to continuously support the pipeline. During trenching operations, the following mitigation measures shall be implemented unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Subsoil shall be segregated from topsoil in separate, distinct rows with a separation that shall limit any admixing of topsoil and subsoil during handling.

- Gaps must be left in the spoil piles that coincide with breaks in the strung pipe to facilitate natural drainage patterns and to allow the passage of livestock or wildlife.
- Trenching operations shall be followed as closely as practicable by lower in and backfill operations to minimize the length of time the ditch is open.
- Construction debris (e.g., welding debris) and other garbage shall not be deposited in the ditch.

Should blasting be necessary for removal of rock, the following mitigation measures may be implemented:

- The Contractor shall use non-electric initiation systems for all blasting operations. If required by the blasting plan, blasting will be monitored for vibration levels and peak particle velocity. This work shall be performed by a third-party vibration monitoring consultant hired by and reporting to the Constructor Representative. The Contractor shall arrange for detonations to be carried out in cooperation with this consultant.
- Prior to using explosives, the Contractor shall advise residents of the immediate area, in order to prevent any risk of accidents or undue disturbances.
- No blasting shall be done without approval of the Constructor Representative. Prior to any detonation of explosives in the vicinity of a loaded line, dwelling, structure, overhead or underground utility, farm operation, or public crossings, a minimum of 48 hours notice shall be given to the Constructor Representative, in order that the appropriate people can be notified and the upstream and downstream mainline valves can be staffed.
- The Contractor shall obtain all necessary permits and shall comply with all legal requirements in connection with the use, storage, and transportation of explosives.
- Blasting mats or subsoil may be piled over the trench line to prevent rock from being blown outside the construction right-of-way.
- Each blasting location shall be cleared and cleaned up before and after all blasting operations.
- Blasting shall be carried out during regular, daylight working hours.
- The Contractor shall at all times protect his workers and the public from any injury or harm that might arise from drilling dust and the use of explosives.
- Only workers thoroughly experienced in handling explosives shall be permitted to supervise, handle, haul, load or shoot explosives. In those jurisdictions where the licensing of blasters is mandatory, the Contractor shall provide the Constructor Representative with proof of the required certification for every person so required.
- The drilling pattern shall be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) in order to use as much as

possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications.

- Blasting testing of surface-water resources and water wells within 150 feet of the centerline will be performed in compliance with all applicable permits.

4.7.1 Trench Dewatering/Well Points

The Contractor shall make all reasonable efforts to discharge trench water in a manner that avoids damage to adjacent agricultural land, crops, and pasture. Damage includes, but is not limited to, the inundation of crops for more than 24 hours, deposition of sediment in ditches, and the deposition of gravel in fields or pastures.

If trench dewatering is necessary in an area where salt damage to adjacent crops is evident, the Environmental Inspector shall conduct a field conductivity test on the trench water before it is discharged. If the conductivity of the trench water is determined to potentially affect soil quality, it shall not be discharged to areas where salt damage to crops is evident, but shall be directed as feasible so that water flows over a well vegetated, non-cropland area or through an energy dissipater and sediment barrier, then directed to nearby ditches or brackish wetlands or waterbodies.

When pumping water from the trench for any reason, the Contractor shall ensure that adequate pumping capacity and sufficient hose is available to permit dewatering as follows:

- No heavily silt-laden trench water shall be allowed to enter a waterbody or wetland directly but shall instead be diverted through a well vegetated area, a geotextile filter bag, or a permeable berm (straw bale or BakkenLink approved equivalent).
- Trench water shall not be disposed of in a manner which could damage crops or interfere with the functioning of underground drainage systems.

The Contractor shall screen the intake hose and keep the hose either one foot off the bottom of the trench or in a container to minimize entrainment of sediment.

4.8 Welding, Field Joint Coating, and Lowering In

The objectives of welding, field joint coating, and lowering in are to provide continuous segments of pipeline, to provide corrosion protection to the weld areas of the pipeline, and to place the pipeline in the center of the trench, without stress, at the required depth of cover. The following mitigation measures shall be followed during pipe welding, field joint coating, and lowering in, unless otherwise specified by BakkenLink in response to site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Shavings produced during beveling of the line pipe are to be removed immediately following this operation to ensure that livestock and wildlife do not ingest this material. When welding operations create a continuous line of pipe that may be left in the right-of-way for an extended period of time due to construction or weather constraints, a gap in the welded pipe shall be provided to allow for access at farm road crossings and for passage of livestock and wildlife.
- Prior to the application of epoxy powder, urethane epoxy, or other approved pipe coatings, a tarp shall be placed underneath the pipe to collect any overspray of epoxy powder and liquid drippings. Excess powder, liquid, or other hazardous materials (e.g. brushes, rollers, gloves) shall be continuously collected and removed from the construction right-of-way and disposed of in a manner appropriate for these materials.

4.9 Padding and Backfilling

The objective of padding and backfilling is to cover the pipe with material that is not detrimental to the pipeline and pipeline coating. The following mitigative measures shall be utilized during backfilling, unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Excessive water accumulated in the trench shall be eliminated prior to backfilling.
- In the event it becomes necessary to pump water from open trenches, the Contractor shall pump the water and discharge it in accordance with the requirements of the Stormwater Pollution Prevention Plan (SWPPP) in order to avoid damaging adjacent agricultural land, crops, and pasture. Detail 5 and Detail 6 provide typical examples of dewatering structures.
- If it is impossible to avoid water-related damages (including inundation of crops for more than 24 hours, deposition of sediment in ditches and other water courses, and the deposition of gravel in fields, pastures, and any water courses), BakkenLink shall reasonably compensate the landowners for the damage and/or shall correct the damage so as to restore the land, crops, pasture, water courses, etc. to their pre-construction condition.
- All pumping of water shall comply with existing drainage laws and local ordinances relating to such activities and provisions of the Clean Water Act.
- Prior to backfilling, all drain tile shall be permanently repaired, inspected, and the repair documented as described in Section 5.5.
- Prior to backfilling, trench breakers shall be installed on slopes where necessary to minimize the potential for water movement down the ditch and potential subsequent erosion.
- During backfill, the stockpiled subsoil shall be placed back into the trench before replacing the topsoil.
- Topsoil shall not be utilized for padding the pipe.

- Backfill shall be compacted to a minimum of 90% of pre-existing conditions where the trench line crosses tracks of wheel irrigation systems (pivots).
- To reduce the potential for ditch line subsidence, spoil shall be replaced and compacted by backhoe bucket or by the wheels or tracks of equipment traversing down the trench.
- The lesser of 4 feet or the actual depth of topsoil cover, shall not be backfilled with soil containing rocks of any greater concentration or size than existed prior to pipeline construction in the pipeline trench, bore pits, or other excavations.

4.10 Cleanup

The objective of cleanup activities shall be to prepare the right-of-way and other disturbed areas to approximate pre-activity ground contours where appropriate and to replace spoil and stockpiled material in a manner which preserves soil capability and quality to a degree reasonably equivalent to the original or that of representative undisturbed land. The following mitigation measures shall be utilized during cleanup, unless otherwise approved or directed by BakkenLink based on specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Cleanup shall occur immediately following backfilling operations when weather or seasonal conditions allow.
- All garbage and construction debris (e.g., lathing, ribbon, welding rods, pipe bevel shavings, pipe spacer ropes, end caps, pipe skids) shall be collected and disposed of at approved disposal sites.
- The right-of-way shall be re-contoured with spoil material to approximate pre-construction contours and as necessary to limit erosion and subsidence. Loading of slopes with unconsolidated spoil material shall be avoided during slope re-contouring. Topsoil shall be replaced after re-contouring of the grade with subsoil. The topsoil shall be replaced on the subsoil storage area and over the trench so that after settling occurs, the topsoil's approximate original depth and contour (with an allowance for settling) shall be achieved.
- Subsoil shall not be placed on top of topsoil.
- Surface drainage shall be restored and re-contoured to conform to the adjacent land drainage system.
- Erosion control structures such as permanent slope breakers and cross ditches shall be installed on steep slopes where necessary to control erosion by diverting surface run-off from the right-of-way to stable and vegetated off right-of-way areas.
- During cleanup, temporary sediment barriers such as silt fence and hay bale diversions will be removed; accumulated sediment will re-contoured with the rest of the ROW; and permanent erosion controls will be installed as necessary.

- After construction, all temporary access shall be returned to prior construction conditions unless specifically agreed with the landowner or otherwise specified by BakkenLink.
- Warning signs, aerial markers, and cathodic protection test leads shall be installed in locations that shall not impair farming operations and are acceptable to the landowner.
- All bridges, fences and culverts existing prior to construction shall be restored to meet or exceed approximate pre-construction conditions. Caution shall be utilized when re-establishing culverts to ensure that drainage is not improved to a point that would be detrimental to existing waterbodies and wetlands.
- All temporary gates installed during construction shall be replaced with permanent fence unless otherwise requested by the landowner.

4.11 Reclamation and Revegetation

The objectives of reclamation and revegetation are to return the disturbed areas to approximately pre-construction use and capability. This involves the treatment of soil as necessary to preserve approximate pre-construction capability and the stabilization of the work surface in a manner consistent with the initial land use.

The following mitigation measures will be utilized unless otherwise approved or directed by BakkenLink based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

4.11.1 Relieving Compaction

- Compacted cropland compacted shall be ripped a minimum of 3 passes at least 18 inches deep and all pasture shall be ripped or chiseled a minimum of three passes at least 12 inches deep before replacing topsoil.
- Areas of the construction right-of-way that were stripped for topsoil salvage shall be ripped a minimum of 3 passes (in cross patterns, as practical) prior to topsoil replacement. The approximate depth of ripping shall be 18 inches (or a lesser depth if damage may occur to existing drain tile systems). After ripping, the subsoil surface shall be graded smooth and any subsoil clumps broken up (disc and harrow) in an effort to avoid topsoil mixing.
- The de-compacted construction right-of-way shall be tested by the Contractor at regular intervals for compaction in agricultural and residential areas. Tests shall be conducted on the same soil type under similar moisture conditions in undisturbed areas immediately adjacent to the right-of-way to approximate pre-construction conditions. Penetrometers or other appropriate devices shall be used to conduct tests

- Topsoil shall be replaced to pre-existing depths once ripping and discing of subsoil is complete up to a maximum of 12 inches. Topsoil compaction on cultivated fields shall be alleviated by cultivation.
- If there is any dispute between the landowner and BakkenLink as to what areas need to be ripped or chiseled, the depth at which compacted areas should be ripped or chiseled, or the necessity or rates of lime and fertilizer application, the appropriate NRCS shall be consulted by BakkenLink and the landowner.

Plowing under of organic matter including wood chips and manure, or planting of a green crop such as alfalfa to decrease soil bulk density and improve soil structure or any other measures in consultation with the Natural Resource Conservation Service (NCRS) shall be considered if mechanical relief of compaction is deemed not satisfactory.

In the first year after construction, BakkenLink will inspect the ROW to identify areas of erosion or settling. Subsequently, BakkenLink will monitor erosion and settling through aerial patrols, which are part of BakkenLink's Integrity Management Plan, and through landowner reporting. Landowner reporting will be facilitated through use of BakkenLink's toll-free telephone number, which will be made available to all landowners on the ROW. Landowner reporting also may be facilitated through contact with BakkenLink's field offices.

BakkenLink plans to minimize impacts on soil productivity that may result from construction activities, but recognizes that some short- to long-term decreases in agricultural productivity are possible. BakkenLink recognizes its responsibility to restore agricultural productivity on the pipeline ROW and to compensate landowners for demonstrated decreases in productivity that may result from any degradation of agricultural soils along the ROW.

4.11.2 Rock Removal

- On agricultural land, rocks that are exposed on the surface due to construction activity shall be removed from the right-of-way prior to and after topsoil replacement This effort will result in an equivalent quantity, size and distribution of rocks to that found on adjacent lands.
- Clearing of rocks may be carried out with a mechanical rock picker or by manual means, provided that preservation of topsoil is assured. Rock removed from the right-of-way shall be hauled off the landowner's premises or disposed of on the landowner's premises at a location that is mutually acceptable to the landowner and to BakkenLink.

4.11.3 Soil Additives

If site-specific conditions warrant and if agreed to by the landowner, the Contractor shall apply amendments (fertilizer and soil pH modifier materials and formulations) commonly used for agricultural soils in the area and in accordance with written recommendations from the local soil

conservation authority, land management agencies, or landowner. Amendments shall be incorporated into the normal plow layer as soon as possible after application.

4.11.4 Seeding

- The final seed mix shall be based on input from the local Natural Resource Conservation Service and the availability of seed at the time of reclamation. The landowner may request specific seeding requirements during easement negotiations.
- Certificates of seed analysis are required for all seed mixes to limit the introduction of noxious weeds.
- Seed not utilized within 12 months of seed testing shall be approved by BakkenLink prior to use. Seeding shall follow cleanup and topsoil replacement as closely as possible. Seed shall be applied to all disturbed surfaces (except cultivated fields unless requested by the landowner) as indicated on the construction drawings
- If mulch was applied prior to seeding for temporary erosion control, the Contractor shall remove and dispose of the excess mulch prior to seedbed preparation to ensure that seedbed preparation equipment and seed drills do not become plugged with excess mulch; and to support an adequate seedbed; and to ensure that seed incorporation or soil packing equipment can operate without becoming plugged with mulch.
- The Contractor may evenly re-apply and anchor (straw crimp) the removed temporary mulch on the construction right-of-way following seeding.
- Identified seeding areas shall be seeded at a rate appropriate for the region and stability of the reclaimed surface. Seeding rates shall be based on pure live seed.
- Weather conditions, construction right-of-way constraints, site access, and soil type shall influence the seeding method to be used (i.e., drill seeding versus broadcast seeding). All areas seeded by the Contractor, except for temporary cover crops, shall be drill seeded unless the right-of-way is too steep to facilitate drill seeding. Temporary cover crop seed shall be broadcast.
- The Contractor shall delay seeding as necessary until the soil is in the appropriate condition for drill seeding.
- The Contractor shall use a Truax brand or equivalent-type drill seeder equipped with a cultipacker designed and equipped to apply grass and grass-legume seed mixtures with mechanisms such as seed box agitators to allow even distribution of all species in each seed mix, with an adjustable metering mechanism to accurately deliver the specified seeding rate and with a mechanism such as depth bands to accurately place the seed at the specified depth.

- The Contractor shall operate drill seeders at an appropriate speed so the specified seeding rate and depth is maintained.
- The Contractor shall calibrate drill seeders so that the specified seeding rate is planted. The row spacing on drill seeders shall not exceed 8 inches.
- The Contractor shall plant seed at depths consistent with the local or regional agricultural practices.
- Broadcast or hydro seeding, used in lieu of drilling, shall utilize double the recommended seeding rates. Where seed is broadcast, the Contractor shall use a harrow, cultipacker, or other equipment immediately following broadcasting to incorporate the seed to the specified depth and to firm the seedbed.
- The Contractor shall delay broadcast seeding during high wind conditions if even distribution of seed is impeded.
- The Contractor shall hand rake all areas that are too steep or otherwise cannot be safely harrowed or cultipacked in order to incorporate the broadcast seed to the specified depth.
- Hydro seeding may be used, on a limited basis, where the slope is too steep or soil conditions do not warrant conventional seeding methods. Fertilizer, where specified, may be included in the seed, virgin wood fiber, tackifier, and water mixture. When hydro-seeding, virgin wood fiber shall be applied at the rate of approximately 3,000 pounds per acre on an air-dry weight basis as necessary to provide at least 75% ground cover. Tackifier shall consist of biodegradable, vegetable-based material and shall be applied at the rate recommended by the manufacturer. The seed, mulch, and tackifier slurry shall be applied so that it forms a uniform, mat-like covering of the ground.
- BakkenLink shall work with landowners to discourage intense livestock grazing of the construction right-of-way during the first growing season by utilization of temporary fencing or deferred grazing, or increased grazing rotation frequency.

4.11.5 Permanent Erosion and Sediment Control

The Contractor shall restore all existing landowner soil conservation improvements and structures disturbed by pipeline construction to the approximate pre-construction line and grade. Soil conservation improvements and structures include, but are not limited to, grassed waterways, toe walls, drop inlets, grade control works, terraces, levees, and farm ponds.

4.11.5.1 Trench Breakers

The Contractor shall install trench breakers in steep terrain where necessary to limit the potential for trench line erosion and at the base of slopes adjacent to waterbodies and wetlands.

Trench breakers shall be constructed of materials such as sand bags, sand/cement bags, bentonite bags, or other suitable materials by the Contractor (Detail 7). The Contractor shall not use topsoil in trench breakers.

4.11.5.2 Permanent Slope Breakers (Water Bars)

Permanent slope breakers (water bars) shall be constructed of soil or, in some instances, sand bags.

The Contractor shall construct permanent slope breakers on the construction right-of-way where necessary to limit erosion, except in cultivated and residential areas. Slope breakers shall divert surface runoff to adjacent stable vegetated areas or to energy-dissipating devices as shown on Detail 3. In general, permanent slope breakers should be installed immediately downslope of all trench breakers. Permanent slope breakers shall be installed as specified on the construction drawings or generally with a minimum spacing as shown on the following table:

Slope (%)	Spacing (feet)
5 - 15	300
>15 – 30	200
>30	100

The gradient (fall) for each slope breaker shall be two percent to four percent unless otherwise approved by BakkenLink based on site-specific conditions.

The Contractor shall construct slope breakers to divert surface flow to a stable, well-vegetated area. In the absence of a stable area, the Contractor shall construct appropriate energy-dissipating devices at the end of the slope breaker and beyond the area disturbed by construction.

4.11.5.3 Mulching

The Contractor shall apply mulch on all areas with high erosion potential and on slopes greater than 8 percent unless otherwise approved by BakkenLink based on site-specific conditions or circumstances. The Contractor shall spread mulch uniformly over the area to cover at least 75 percent of the ground surface at an approximate rate of 2 tons per acre of straw or its equivalent. The Environmental Inspector may reduce the application rate or forego mulching an area altogether if there is an adequate cover of rock or organic debris to protect the slope from erosion.

Mulch application includes straw mulch or hydro mulch and tackifier. The Contractor shall not apply mulch in cultivated areas unless deemed necessary by BakkenLink.

The Contractor shall use mulch that is free of noxious weeds.

The Contractor shall apply mulch immediately following seeding. The Contractor shall not apply mulch in wetlands.

If a mulch blower is used, the majority of strands of the mulching material shall not be shredded to less than 8 inches in length to allow anchoring. The Contractor shall anchor mulch immediately after application to minimize loss by wind and water.

When anchoring (straw crimping) by mechanical means, the Contractor shall use a tool specifically designed for mulch anchoring with flat, notched disks to properly crimp the mulch to a depth of 2 to 3 inches. A regular farm disk shall not be used to crimp mulch. The crimping of mulch shall be performed across the slope of the ground, not parallel to it. In addition, in areas of steep terrain, tracked vehicles may be used as a means of crimping mulch (equipment running up and down the hill to leave crimps perpendicular to the slope), provided they leave adequate coverage of mulch.

In soils possessing high erosion potential, the Contractor may be required to make two passes with the mulch-crimping tool; passes must be as perpendicular to the others as possible.

When anchoring with liquid mulch binders (tackifiers), the Contractor shall use a biodegradable tackifier derived from a vegetable-based, organic source. The Contractor shall apply mulch binders at rates recommended by the manufacturer.

The Contractor shall limit the use of tackifiers for anchoring straw and the use of hydromulch and tackifier to areas that are too steep or rocky to safely or effectively operate mechanical mulch-anchoring tools. No asphalt-based tackifiers shall be used on the Project.

4.11.5.4 Erosion Control Matting

Erosion control matting shall be applied where shown on the construction drawings as shown on Detail 4. The Contractor shall anchor the erosion control matting with staples or other approved devices.

The Contractor shall use erosion control matting made of biodegradable, natural fiber such as straw or coir (coconut fiber).

The Contractor shall prepare the soil surface and install the erosion control matting to ensure it is stable and the matting makes uniform contact with the soil of the slope face or stream bank with no bridging of rills, gullies, or other low areas.

4.11.5.5 Riprap and Stream Bank Stabilization

Disturbed banks of streambeds and waterbodies shall be restored to their approximate original contours unless otherwise directed. Erosion protection shall be applied as specified in the construction drawings.

Most restored banks will be protected through the use of flexible channel liners.

If the original stream bank is excessively steep and unstable and/or flow conditions are severe, a more stable final contour may be specified and alternate stabilization measures may be installed.

Alternate stabilization measures may consist of rock riprap, bio-stabilization, or engineered structures such as brush layering, logwalls, cribwalls, or vegetated geo-grids.

Stream bank riprap structures shall consist of a layer of stone underlain with approved filter fabric or a gravel filter blanket. Riprap shall extend from the stabilized streambed to the top of the stream bank. Native rock shall be utilized wherever practicable.

4.11.6 Fences

Upon completion of all backfilling, cleanup, and restoration, including mulching and seeding of the construction right-of-way, permanent repairs shall be made to all fences by using either the original material or good quality new material similar to existing fences.

Historic fences shall be carefully reassembled by hand from the original material. Where the original material has deteriorated to a state that makes it unsalvageable, replacement material similar to the original shall be used if possible.

4.11.7 Farm Terraces

BakkenLink will work with landowners and farm service agencies to ensure restoration of farm terraces to their pre-construction function. BakkenLink may elect to negotiate a fair settlement with the landowner to employ a local land leveling contractor to restore the terrace.

Before any groundwork is performed in areas with farm terraces, BakkenLink will conduct a civil survey and photograph each terrace from two to three perspectives to document the location and contours of each terrace. Both the channel contour and the terrace berm will be surveyed within the construction right-of-way and up to 100 feet on either side of the ROW boundaries. The pre-construction survey and photographs will provide a baseline to ensure the proper restoration of the terrace following construction.

The Contractor will maintain the pre-disturbance drainage of water along the terrace channel and will install temporary flume pipe for this purpose. As necessary, temporary erosion control measures such as water bars and sediment barriers will be installed and maintained throughout construction to reduce the potential for soil erosion along or off the construction ROW.

Following installation of the pipe, the trench will be backfilled, and the Contractor will restore the terrace contours as agreed to with the landowner.

Should the landowner agree to have a local contractor restore the terraces, the Contractor will backfill the trench and restore the terrace using typical compaction methods for pipeline construction with the understanding that the landowner's contractor will re-excavate the location and re-install the terrace utilizing land levelling equipment and special compaction methods.

Should the landowner desire the Contractor to restore the terraces, the pipeline contractor will compact the trench before the terrace berm is replaced. Following restoration of the terraces, final contours and grades will be re-surveyed and documented with survey notes. Photographs will be taken from a minimum of two or three perspectives to document that the cross-section profile matches the adjacent undisturbed grades. BakkenLink will perform post-construction monitoring and inspection with the landowner's concurrence. Should the terraces require further work, BakkenLink will either compensate the landowner to perform the work or arrange for a local contractor to perform the work.

4.11.8 Right-of-Way and Pipeline Markers

Upon completion of all backfilling, cleanup and restoration, including mulching and seeding of the construction right-of-way, and during the time when the Contractor is making permanent repairs to fences, the Contractor shall install pipeline markers on each side of all roads, railroads, fence lines, stream crossings, and other areas where the pipeline markers do not conflict with intended land use.

4.12 Pasture and Range Lands

The following mitigation measures shall be implemented in addition to the requirements previously stated in Sections 4.1 thru 4.11 unless otherwise approved by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Access across the right-of-way during construction shall be provided at locations requested by landowners, if practicable.
- Shavings produced during pipe bevel operations are to be removed immediately to ensure that livestock and wildlife do not ingest this material.
- Litter and garbage shall be collected and removed from the construction site at the end of the day's activities.
- Temporary gates shall be installed at fence lines for access to the construction right-of-way. These gates shall remain closed at all times. Upon completion of construction, the temporary gates shall be removed and the permanent fence replaced.
- Feeding or harassment of livestock or wildlife is prohibited.
- Construction personnel shall not be permitted to have firearms or pets on the construction right-of-way.
- All food and wastes shall be stored and secured in vehicles or appropriate facilities.
- Areas of disturbance in native range shall be seeded with a native seed mix after topsoil replacement.
- Improved pasture shall be seeded with a seed mix approved by individual landowners.

4.13 Forested Lands

Mitigation measures are required to ensure that pipeline construction activities have a minimal impact on forested lands.

Clearing, grubbing, and grading of trees, brush, and stumps shall be performed in accordance with the following mitigation measures in addition to the requirements previously stated in Sections 4.1 thru 4.11 unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. BakkenLink will address mitigation, reclamation and

remediation measures with individual landowners and comply with any applicable state requirements. These measures include non-vegetative remediation to reverse impacts on windbreaks, shelterbelts, and living snow fences. Where the pipeline follows an existing ROW in forested areas, BakkenLink attempted to route the pipeline as close as practical to the existing ROW. All work shall be conducted in accordance with applicable permits.

- Prior to the start of clearing activity, right-of-way boundaries, including pre-approved temporary workspaces, shall be clearly staked to prevent disturbance of unauthorized areas.
- If trees are to be removed from the construction right-of-way, BakkenLink shall consult with the landowner or landowner's designate to see if there are trees of commercial or other value to the landowner. Timber shall be salvaged as per landowner request.
- If there are trees of commercial or other value to the landowner, BakkenLink shall allow the landowner the right to retain ownership of the trees with the disposition of the trees to be negotiated prior to the commencement of land clearing and included in the easement agreement.
- If not performed by the landowner, the construction right-of-way Contractor may salvage all marketable timber from designated areas.
- Tree stumps shall be grubbed to a maximum of 5 feet on either side of the trench line and where necessary for grading a level surface for pipeline construction equipment to operate safely.
- BakkenLink shall follow the landowner's or landowner designee's desires as stated in the easement agreement regarding the disposal of trees, brush, and stumps of no value to the landowner by burning, burial, etc., or complete removal from any affected property.
- Timber salvage operations shall use cut-off-type saw equipment. Felling shall be undertaken in a manner that minimizes butt shatter, breakage, and off ROW disturbance. Skidders or alternate equipment shall be used to transport salvaged logs to stacking sites.
- Trees shall be felled to fall toward the center line of the right-of-way to avoid breaking trees and branches off ROW. Leaners (felled trees that inadvertently fall into adjacent undisturbed vegetation) shall be salvaged.
- Trees and slash falling outside the right-of-way shall be recovered and disposed..
- Salvaged logs shall be limbed and topped before removal from the construction right-of-way. Log decks (if required) shall be oriented to best facilitate loading by picker trucks and be located adjacent to the working side of the right-of-way, where possible.
- The Contractor shall not be allowed to dispose of woody debris in wooded areas along the pipeline right-of-way.
- Pruning of branches hanging over the right-of-way shall be done only when necessary for construction. Any branch that is broken or seriously damaged should be cut off near its fork and the collar of the branch preserved.

- All tree wastes, stumps, tree crowns, brushes, branches, and other forest debris shall be either burned, chipped (using a mobile chipper), or removed from the right-of-way according to BakkenLink instructions contained in the specific mitigation measures. Burial of this waste material on the site by the Contractor shall require the landowner's authorization. Chips must not be spread over cultivated land. However, they may be spread and incorporated with mineral soil over the forest floor at a density that shall not prevent revegetation of grass.
- Stump removal and brush clearing shall be done with bulldozers equipped with brush rakes to preserve organic matter.
- Decking sites shall be established: (1) approximately 2000 feet apart in timbered areas; (2) on sites located on approved temporary workspace in existing cleared areas; (3) in non-merchantable stands of timber; or (4) if no other options are available, in merchantable timber stands. Deck sites shall be appropriately sized to accommodate the loading equipment.
- If the landowner does not want the timber, the Contractor shall remove decked timber from the construction right-of-way and transport it to a designated all-weather access point or mill

4.14 Residential and Commercial/Industrial Areas

4.14.1 Residential and Commercial Areas

The principal measures that shall be used to mitigate impacts on existing residential and commercial areas include the following unless otherwise directed or approved by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- notifying landowners prior to construction;
- posting warning signs as appropriate;
- reducing the width of construction right-of-way, if practicable, by eliminating the construction equipment passing lane, reducing the size of work crews, or utilizing the "stove pipe" or "drag section" construction techniques;
- removing fences, sheds, and other improvements as necessary for protection from construction activities;
- to the extent possible, preserving mature trees and landscaping while ensuring the safe operation of construction equipment;
- fencing the edge of the construction work area adjacent to a residence for a distance of 100 feet on either side of the residence to ensure that construction equipment and materials, including the spoil pile, remain within the construction work area;
- limiting the hours during which operations with high-decibel noise levels (i.e., drilling and boring) can be conducted;
- limiting dust impact through prearranged work hours and by utilizing dust minimization techniques;

- ensuring that construction proceeds quickly through such areas, thus minimizing exposure to nuisance effects such as noise and dust;
- maintaining access and traffic flow during construction activities, particularly for emergency vehicles;
- cleaning up construction trash and debris daily;
- fencing or plating open ditches during non-construction activities;
- if the pipeline centerline is within 25 feet of a residence, ensuring that the trench is not excavated until the pipe is ready for installation and that the trench shall be backfilled immediately after pipe installation; and
- immediately after backfilling the trench, restoring all lawn areas, shrubs, specialized landscaping, fences, and other structures within the construction work area to its pre-construction appearance or the requirements of the landowner. Restoration work shall be done by personnel familiar with local horticultural and turf establishment practices.
- to the extent possible, preserving mature trees and landscaping while ensuring the safe operation of construction equipment;

4.14.2 Site-Specific Plans

For any commercial/industrial building closer than 25 feet to the construction work area, BakkenLink shall prepare a site-specific construction plan. The plan shall include:

- a description of construction techniques to be used;
- a dimensioned site plan that shows, at a minimum:
  - the location of the residence or commercial/industrial area in relation to the new pipeline;
  - the edge of the construction work area;
  - the edge of the new permanent construction right-of-way; and
  - other nearby topographical obstacles including landscaping, trees, structures, roads, parking areas, ditches, and streams; and
- a description of how BakkenLink would ensure that the trench is not excavated until the pipe is ready for installation and that the trench is backfilled immediately after pipe installation.

4.14.3 Landowner Complaint Resolution Procedure

BakkenLink shall implement a landowner complaint procedure as follows:

- Landowners should first contact the construction spread office to express their concern over restoration or mitigation of environmental damages on their property. The Construction Manager or his designated representative shall respond to the landowner within 24 hours of receipt of the phone call.

- If the landowner has not received a response or is not satisfied with the response, he can contact BakkenLink's representative at Don Metzger at 701-390-7392. The landowner should expect a response within 48 hours.

4.15 Operations and Maintenance

Operations and maintenance programs, such as vegetation management, pipeline maintenance, integrity surveys, and hydrostatic testing, may have an impact on the final reclamation of the right-of-way. To ensure the integrity of the facility and land surface reclamation of the right-of-way is maintained after completion of construction and that regulatory requirements are adhered to during operations, the following measures shall be implemented unless otherwise directed by BakkenLink in response to site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- BakkenLink shall monitor the pipeline right-of-way and all stream crossings for erosion or other potential problems that could affect the integrity of the pipeline. Any erosion identified shall be reclaimed as expediently as practicable by BakkenLink or by compensating to the landowner to reclaim the area.
- Trench depressions on ditch line that may interfere with natural drainage, vegetation establishment, or land use shall be repaired as expediently as practicable by BakkenLink or by compensating the landowner to repair the area.
- Post-construction monitoring inspections shall be conducted after the first growing season to determine the success of revegetation. Areas which have not been successfully re-established shall be revegetated by BakkenLink or by compensation of the landowner to reseed the area. If, after the first growing season, revegetation is successful, no additional monitoring shall be conducted.
- In non-agricultural areas, revegetation shall be considered successful if, upon visual survey, the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands.
- In agricultural areas, revegetation shall be considered successful if crop yields are similar to adjacent undisturbed portions of the same field.
- Restoration shall be considered successful if the surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless requested otherwise by the landowner or land managing agency), revegetation is successful, and drainage has been restored.
- Weed control measures shall be implemented as required by any applicable plan and in conjunction with the landowner.
- BakkenLink shall be responsible for correcting tile line or irrigation system repairs that fail, provided those repairs were made by BakkenLink. BakkenLink shall not be responsible for tile line or irrigation system repairs which BakkenLink compensated the landowner to perform.

- When requested by owners in cultivated land, BakkenLink shall monitor the yield of land impacted by construction with the help of agricultural specialists. If yield deficiencies are indicated compared to yields on unaffected land, BakkenLink will compensate the landowner for reduced yields and shall implement procedures to return the land to equivalent capability.
- In residential areas, landowners may use the right-of-way provided they do not interfere with the rights granted to BakkenLink. Trees, bushes, structures, including houses, tool sheds, garages, poles, guy wires, catch basins, swimming pools, trailers, leaching fields, septic tanks, and any other objects not easily removable, shall not be permitted on the permanent construction right-of-way without the written permission of BakkenLink, because they could impair access for maintenance of the pipeline.
- BakkenLink shall maintain communication with the landowner and tenant throughout the operating life of the pipeline to allow expedient communication of issues and problems as they occur. BakkenLink shall provide the landowner with corporate contact information for these purposes. BakkenLink shall work with landowners to prevent excessive erosion on lands disturbed by construction. Reasonable methods shall be implemented to control erosion. These may not be implemented if the property across which the pipeline is constructed is bare cropland which the landowner intends to leave bare until the next crop is planted.
- If the landowner and BakkenLink cannot agree upon a reasonable method to control erosion on the landowner's property, the recommendations of the appropriate NRCS office shall be considered by BakkenLink and the landowner.

5.0 DRAIN TILE SYSTEMS

5.1 General

If underground drainage tile is damaged by the pipeline installation, it shall be repaired in a manner that ensures the tile line's proper operating condition at the point of repair. BakkenLink may elect to negotiate a fair settlement with the affected county or landowner for repair of the damaged drain tile. In the event the landowner chooses to have the damaged tile repaired by BakkenLink, the Contractor shall follow these guidelines and procedures to identify the location of drain tiles, to mitigate damages to drain tiles prior to and during construction, to repair drain tiles damaged during installation of the pipeline, to inspect the proper repair of drain tiles, and to provide post-construction monitoring to determine any impacts caused by repair of drain tiles. Since all public and private drain tile systems are unique, i.e., varying age, depth of cover, type of material, geometry on the land, etc., it is not possible to develop a standard procedure for resolving each county’s or landowner’s drain tile issues. These guidelines provide a basis on which to develop site specific methodology to mitigate damage and to repair drain tiles affected by construction of the Project. Actual measures will be developed based on site-specific information unique to specific installations. However, all work will be conducted in accordance with applicable permits.

5.2 Identification and Classification of Drain Tile Systems

Personnel shall attempt to identify and classify existing drain tile systems by meeting with local public officials and county engineers, and individual private landowners and tenants.

5.2.1 Publicly Owned Drain Tiles

Personnel shall identify and meet with the responsible county or local authority responsible for publicly owned drain tiles. Publicly owned drain tiles shall be identified and documented on the Project's 1" = 2000' USGS quad strip maps and additional data collected for input into an electronic spreadsheet by county, township, range, and section; responsible agency; and size, type, and depth of cover (if known). This data shall be cross-referenced to the centerline survey to be completed by BakkenLink. Additionally, any public records including maps or easement instruments on the drain tiles shall be acquired as well as any requirements of the local authority for installation of the pipeline.

5.2.2 Privately Owned Drain Tiles

Right-of-way agents shall meet with landowners and tenants of privately owned land along the route. As a minimum, the right-of-way agents shall ascertain the data concerning drain tiles outlined in a landowner questionnaire. The questionnaire requests data concerning: type of drain tile system; size, type of material, and depth of cover; preference for repair of drain tiles; and identification of local drain tile contractors. These data shall be collected into an electronic spreadsheet for utilization by right-of-way personnel in negotiating payments for easements and damages and by engineering or construction personnel for inclusion in specifications for the construction Contractor.

5.3 Mitigation of Damage to Drain Tile Systems

BakkenLink shall undertake mitigation measures to reduce damage to publicly and privately owned drain tile systems prior to and during installation of the pipeline.

5.3.1 Non-interference with Drain Tile

The Project shall be installed at a depth of cover and elevation so as not to interfere with the elevation and grade of existing drain tiles where practicable. Where not practicable, BakkenLink shall pursue alternative mitigation measures mutually acceptable to the landowner and jurisdictional agencies. Typically, the pipeline shall be installed below the elevation of drain tiles with a minimum clearance of 12 inches.

5.3.2 Non-disturbance of Drain Tile Mains

Publicly owned and privately owned drain tile mains shall be identified through the processes identified in Section 5.2. Drain tile mains are essential to the overall drainage system of a land area and if disturbed, may

require excessive pumping/dewatering of the pipe trench unless temporarily repaired and maintained until permanently repaired.

BakkenLink shall review drain tile mains and consider their size, flow rate, type of material, depth of cover, and geographic location. If determined to be practicable and reasonable for construction, the drain tile main shall not be cut and repaired during mainline installation (a pipe section shall be left out and installed by a tie-in crew without damaging the drain tile main).

5.3.3 Relocation or Replacement of Existing Drain Tiles Prior to Construction

In many instances, drain tile systems that have been installed after the installation of adjacent existing pipelines were installed with “headers” parallel to the existing pipeline with periodic jumpovers. The distance of these headers from the existing pipeline may vary.

Some of these drain tile headers may be most effectively relocated and/or replaced to the east of the Project. The existing header will be capped and made into a single drain. This could reduce the number of drain tile crossings on a particular landowner’s property by a significant quantity, thereby reducing the risk that repairs will fail.

5.3.4 Future Drain Tiles/Systems

BakkenLink shall attempt to determine where public agencies and private landowners or tenants are proposing to install drain tile systems in the future. These locations shall be input into an electronic spreadsheet by county, township, range, and section; landowner or responsible public agency; and proposed size and depth of cover. BakkenLink shall endeavor to construct the pipeline at a depth and elevation to accommodate the future installation of the proposed drain tile systems.

5.3.5 Other Mitigation Measures

Other mitigation measures that may be implemented during installation of the pipeline are as follows:

- not removing topsoil from the working side of the construction right-of-way to prevent crushing of drain tile by heavy equipment;
- spreading ditch and spoil side topsoil (not subsoil) over the working side to provide additional soil depth to protect existing drain tiles;
- restricting the work of the pipe lower in crew if ground conditions are too wet to adequately support the heavy equipment;
- limiting travel of heavy equipment the working lane of the construction right-of-way where possible;
- limiting travel of heavy equipment to one pass over the drain tile per work crew where possible; and

- removing and replacing topsoil during drain tile replacement should tile be crushed on the working side of the right-of-way.

5.4 Responsibility for Repair of Drain Tile Systems

Temporary and permanent drain tile repairs shall be the responsibility of the Contractor. The physical repairs shall be made by qualified and experienced drain tile repair personnel.

5.4.1 Local Drain Tile Contractor Repair

BakkenLink shall identify and qualify local drain tile contractors in the geographical area of the pipeline route from interviews with local public officials, landowners, tenants, and drain tile contractors. The preferred responsibility for permanent repair of drain tiles shall be for the pipeline Contractor to subcontract the supervision and repair to local reputable drain tile contractors acceptable to the landowners and tenants.

5.4.2 Pipeline Contractor Repair

In the event local drain tile contractors are not available to subcontract the supervision and repair, permanent repair shall be made with the Contractor's supervision, equipment, and labor.

5.4.3 Landowner/Tenant Repair

The landowner or tenant may agree to take responsibility for the permanent repair of his drain tiles if not precluded by regulatory agency. The landowner or tenant shall be requested to ensure his ability to coordinate and complete the drain tile repair in a timely manner to allow the pipeline Contractor to completely backfill the damaged drain tile for repair by landowner/tenant in the immediate future. BakkenLink shall require that its representative be present to ensure the permanent drain tile repairs are made in accordance with the minimum requirements of this manual.

5.5 Drain Tile Repairs

The Contractor shall endeavour to locate all tile lines within the construction right-of-way prior to and during installation so repairs can be made if necessary.

5.5.1 Temporary Repairs During Construction

Drain tiles damaged or cut during the excavation of the trench shall be marked with a lath and ribbon in the spoil bank. Care shall be taken to locate markers where the chance of disturbance shall be minimized and a written record maintained of each drain tile crossing. A work crew following the pipeline trench crew shall complete a temporary repair to allow continuing flow. If a drain tile line shall not be temporarily repaired, the open ends of the drain tile shall be screened to prevent entry of foreign materials and small animals.

5.5.2 Permanent Repairs

Permanent repairs shall be made for all drain tiles damaged by installation of the pipeline.

5.5.2.1 Ditch Line Only Repairs

If water is flowing through a damaged tile line, the tile line shall be immediately and temporarily repaired until such time that permanent repairs can be made. If tile lines are dry and water is not flowing, temporary repairs are not required if the permanent repair is made within 7 days of the time damage

occurred. The temporary repair shall be removed just prior to lowering in the pipeline.

Drain tiles must be permanently repaired before the pipeline trench is backfilled and within 14 days of construction completion, weather and soil conditions permitting. All tile lines shall be repaired with materials of the same or better quality as that which was damaged. The drain tile marker shall not be removed until the tile repairs have been inspected, approved, and accepted by BakkenLink's inspectors, the county inspectors, where applicable, and the landowner or tenant.

5.5.2.2 Ditch Line and Temporary Work Space Repairs

Prior to making the permanent drain tile repair, the Contractor shall probe a segmented sewer rod with a plug that is not more than 15% smaller than the internal diameter of the drain tile to determine if additional damage has occurred to the drain tile. If the probe does not freely insert into the drain tile across the temporary workspace of pipeline construction, the Contractor shall excavate, expose, and repair the damaged drain tile to its original or better condition.

5.6 Inspection/Acceptance of Drain Tile Repairs

Drain tile repairs shall be inspected by BakkenLink construction inspectors, county inspectors, as applicable, and the landowner or tenant or his representative.

BakkenLink shall designate inspector(s) for the sole purpose and responsibility for inspection of all repairs of drain tiles. These inspectors shall be, if possible, employed from local drain tile installation contractors, local farmers with extensive drain tile experience, or previously employed or retired employees of local jurisdictions familiar with drain tile installation and repair. In the event that a sufficient quantity of inspectors from these sources is not available, BakkenLink shall conduct in-the-field training seminars on drain tile repair for additional inspection personnel.

Inspection personnel shall observe the permanent repair of all drain tiles to ensure the replacement drain tile is: (1) the proper size and type; (2) installed at the proper grade; (3) properly supported and backfill beneath the drain tile is properly placed and compacted; and (4) properly tied into the existing drain tile. The inspection shall be documented on the Drain Tile Inspection Report Form.

A drain tile repair shall not be accepted until BakkenLink's construction inspector and the landowner or tenant or designated representative approves the inspection form.

6.0 WETLAND CROSSINGS

6.1 General

Aboveground facilities shall not be located in a wetland, except where the location of such facilities outside of wetlands would preclude compliance with US Department of Transportation pipeline safety regulations.

Wetland boundaries shall be clearly marked in the field with signs and/or highly visible flagging during construction.

In the event a waterbody crossing is located within or adjacent to a wetland crossing, the measures of both Section 6 - Wetland Crossings and Section 7 - Waterbodies and Riparian Lands shall be implemented to the extent practicable.

A dry wetland typically has groundwater level some depth below the surface. Trench excavations typically are stable and normal in width. Equipment can traverse the wetland without the support of mats or timber riprap.

A standard wetland environment typically has soils that are saturated and non-cohesive. Difficult trenching conditions are likely resulting in excessively wide trenches. In these wetland environment types, supplemental support in the form of timber riprap or prefabricated equipment mats may be required for construction equipment to safely and efficiently operate.

A flooded wetland involves the presence of standing water over much of the wetland area. Equipment typically cannot traverse the wetland and must generally move around that portion of the area. Access is typically limited to marsh backhoes or equipment working from flexifloats or equivalents.

BakkenLink may allow modification of the following specifications as necessary to accommodate site-specific conditions or procedures. Any modifications must still comply with all applicable regulations and permits.

6.2 Easement and Workspace

The Contractor shall maintain wetland boundary markers during construction in all areas and until permanent seeding is complete in non-cultivated areas.

The width of the construction right-of-way shall be reduced to 75 feet or less in standard wetlands unless non-cohesive soil conditions require utilization of a greater width.

The Contractor shall locate extra work areas (such as staging areas and additional spoil storage areas) shall be at least 100 feet away from wetland boundaries, where topographic conditions permit.

The Contractor shall limit clearing of vegetation between extra work areas and the edge of the wetland to the construction right-of-way and limit the size of extra work areas to the minimum needed to construct the wetland crossing.

6.3 Vehicle Access and Equipment Crossing

The only access roads, other than the construction right-of-way, that the Contractor shall use in wetlands are those existing public roads and private roads acquired by BakkenLink from the landowner shown on the construction drawings.

To the extent practicable, the Contractor's construction equipment operating in saturated wetlands or wetlands with standing water shall be limited to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way.

If equipment must operate within a wetland containing standing water or saturated soils, the Contractor shall use the following methods for equipment access unless otherwise approved by BakkenLink based on site-specific conditions:

- wide-track or balloon-tire construction equipment; and
- conventional equipment operated from timber and slash (riprap) cleared from the right-of-way, timber mats, or prefabricated equipment mats.

6.4 Temporary Erosion and Sediment Control

The Contractor shall install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all standard wetland crossings, as necessary, to prevent sediment flow into the wetland. Sediment barriers must be properly maintained by the Contractor throughout construction and reinstalled as necessary. In the travel lane, these may incorporate removable sediment barriers or driveable berms. Removable sediment barriers can be removed during the construction day, but shall be re-installed after construction has stopped for the day or when heavy precipitation is imminent. The Contractor shall maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. The Contractor shall not install sediment barriers at wetlands designated as "dry" unless otherwise specified by BakkenLink.

Where standard wetlands are adjacent to the construction right-of-way, the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to prevent a sediment flow into the wetland.

6.5 Wetland Crossing Procedures

The following general mitigation procedures shall be followed by the Contractor in all wetlands unless otherwise approved or directed by BakkenLink based on site-specific conditions. All work shall be conducted in accordance with applicable permits.

- limit the duration of construction-related disturbance within wetlands to the extent practicable;
- use no more than two layers of timber riprap to stabilize the construction right-of-way;
- cut vegetation off at ground level leaving existing root systems in place and remove it from the wetland for disposal;
- limit pulling of tree stumps and grading activities to directly over the trench line unless safety concerns require the removal of stumps from the working-side of the construction ROW;
- segregate a maximum of 12 inches of topsoil from the area disturbed by trenching in dry wetlands, where practicable;
- restore topsoil to its approximate original stratum, after backfilling is complete;
- dewater the trench in a manner to prevent erosion and heavily silt-laden flowing directly into any wetland or waterbody;
- remove all timber riprap and prefabricated equipment mats upon completion of construction;
- locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable;
- prohibit storing hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities in a wetland, or within 100 feet of any wetland boundary;
- perform all equipment maintenance and repairs upland locations at least 100 feet from waterbodies and wetlands;
- avoid parking equipment overnight within 100 feet of a watercourse or wetland;
- prohibit washing equipment in streams or wetlands;
- install trench breakers and/or seal the trench to maintain the original wetland hydrology, where the pipeline trench may drain a wetland;
- attempt to refuel all construction equipment in an upland area at least 100 feet from a wetland boundary (otherwise follow the procedures outlined in Section 3); and
- avoid sand blasting in wetlands to the extent practicable. If sandblasting is performed within a wetland, the Contractor shall place a tarp or suitable material in such a way as to collect as much waste shot as possible and

dispose of the collected waste. The Contractor shall clean up all visible deposits of wastes and dispose of the waste at an approved disposal facility.

Specific procedures for each type of wetland crossing method are listed below and shall be designated on the construction drawings but may be modified depending on site conditions at the time of construction. All work shall be conducted in accordance with applicable permits.

6.5.1 Dry Wetland Crossing Method

Topsoil shall be segregated. Pipe stringing and fabrication may occur within the wetland adjacent to the trench line or adjacent to the wetland in a designated extra workspace.

The dry wetland crossing procedure as depicted in Detail 8 shall be used where this type of wetland is identified on the construction drawings. The following are exceptions to standard wetland crossing methods:

- The width of the construction right-of-way for upland construction is maintained through the wetland.
- Where extra work areas (such as staging areas and additional spoil storage areas) are designated on the construction drawings, they may be placed no closer than 100 feet from the wetland's edge.
- If the wetland is cultivated, the topsoil shall be stripped using the trench and spoil side method at the same depth as the adjacent upland areas.
- Seeding requirements for agricultural lands shall be applied to farmed wetlands.

6.5.2 Standard Wetland Crossing Method

Topsoil stripping is impracticable due to the saturated nature of the soil. Pipe stringing and fabrication may occur within the wetland adjacent to the trench line or adjacent to the wetland in a designated extra workspace. Based upon the length of a standard wetland crossing and presence of sufficient water to float the pipe, the Contractor may elect to install a standard wetland crossing utilizing the “push/pull” method.

The standard wetland crossing procedure as depicted in Detail 8 shall be used where this type of wetland is identified on the construction drawings.

Procedures unique to standard wetlands include:

- limiting construction right-of-way width to a maximum of 75 feet unless site conditions warrant a wider width;
- utilizing low-ground-pressure construction equipment or support equipment on timber riprap or timber mats; and

- installing sediment barriers across the entire right-of-way where the right-of-way enters and exits the wetland.

6.5.3 Flooded Push/Pull Wetland Crossing Method

Where standing surface water or high groundwater levels make trenching difficult, trench widths up to 35 feet are common. Topsoil stripping is impossible due to the flooded conditions. Pipe stringing and fabrication is required adjacent to the wetland in a designated extra workspace. Using floatation devices, the pipe string is pushed and pulled from the extra workspace to the trench.

The Push/Pull wetland crossing procedure as depicted in Detail 9 shall be used where water is sufficient to float the pipeline in the trench and other site conditions allow.

Clean metal barrels or Styrofoam floats may be used to assist in the flotation of the pipe. Metal banding shall be used to secure the barrels or floats to the pipe. All barrels, floats, and banding shall be recovered and removed upon completion of lower in. Backfill shall not be allowed before recovery of barrels, floats, and banding.

6.6 Restoration and Reclamation

All timber riprap, timber mats, and prefabricated equipment mats and other construction debris shall be removed upon completion of construction. As much as is feasible, the Contractor shall replace topsoil and restore original contours with no crown over the trench. Any excess spoil shall be removed from the wetland. The Contractor shall stabilize wetland edges and adjacent upland areas by establishing permanent erosion control measures and revegetation, as applicable, during final clean up.

In the absence of detailed revegetation plans or until the appropriate seeding season for permanent wetland vegetation in standard wetlands, the Contractor shall apply a temporary cover crop of annual ryegrass or oats on the construction right-of-way at a rate adequate for germination and ground cover unless standing water is present. The Contractor shall apply the temporary cover crop during final cleanup. For farmed wetlands, the Contractor shall apply seeding requirements for agricultural lands or as required by the landowner.

The Contractor shall not use fertilizer, lime, or mulch in wetlands unless required in writing by the appropriate land management agency.

All wetland areas within conservation lands or easements will be restored to a level consistent with any additional criteria established by the relevant managing agency.

7.0 WATERBODIES AND RIPARIAN AREAS

7.1 General

The Contractor shall comply with requirements of all permits issued for the waterbody crossings by federal, state or local agencies.

Waterbody includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

- Minor Waterbody includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of construction.
- Intermediate Waterbody includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of construction.
- Major Waterbody includes all waterbodies greater than 100 feet wide at the water's edge at the time of construction.

In the event a waterbody crossing is located within or adjacent to a wetland crossing, the Contractor, to the extent practicable, shall implement the provisions of both Section 6 - Wetland Crossings and Section 7 - Waterbodies and Riparian Areas.

The Contractor shall supply and install advisory signs in a readily visible location along the construction right-of-way at a distance of approximately 100 feet on each side of the crossing and on all roads which provide direct construction access to waterbody crossing sites. Signs shall be supplied, installed, maintained, and then removed upon completion of the Project. Additionally, signs shall be supplied and installed by the Contractor on all intermediate and major waterbodies accessible to recreational boaters warning boaters of pipeline construction operations.

The Contractor shall not store hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating within 100 feet of any waterbody. The Contractor shall not refuel construction equipment within 100 feet of any waterbody. If the Contractor must refuel construction equipment within 100 feet of a waterbody, it must be done in accordance with the requirements outlined in Section 3. All equipment maintenance and repairs will be performed in upland locations at least 100 feet from waterbodies and wetlands. All equipment parked overnight shall be at least 100 feet from a watercourse or wetland, if possible. Equipment shall not be washed in streams or wetlands.

Throughout construction, the Contractor shall maintain adequate flow rates to protect aquatic life and to prevent the interruption of existing downstream uses.

BakkenLink may allow modification of the following specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits. BakkenLink will complete site-specific

crossing plans for certain waterbody crossings if required by the applicable regulatory agencies during federal or state permitting processes.

7.2 Easement and Work Space

The permanent easement, temporary work space, additional temporary work space, and any special restrictions shall be depicted on the construction drawings. The work shall be contained within these areas and be limited in size to the minimum required to construct the waterbody crossing.

The Contractor shall locate all extra work areas (such as staging areas and additional spoil storage areas) at least 10 feet from the water's edge if practicable.

At all waterbody crossings, the Contractor shall install flagging across the construction right-of-way at least 10 feet from the water's edge prior to clearing and ensure that riparian cover is maintained where practicable during construction.

7.3 Vehicle Access and Equipment Crossings

The Contractor shall inspect equipment for fluid leaks prior to entering or crossing over waterbodies.

Equipment bridges shall be installed at all flowing waterbodies. Equipment crossings shall be constructed as described in Details 15, 16 and/or 17.

Equipment crossings shall be perpendicular to drainage bottoms wherever possible.

Erosion and sediment control barriers will be installed and maintained around vehicle access points as necessary to prevent sediment from reaching the waterway.

The Contractor shall be responsible for the installation, maintenance, and removal of all temporary access crossings including portable bridges, bridges made from timber or mats, flumes, culverts, sand bags, subsoil, coarse granular material, and riprap.

The Contractor shall ensure that culverts and flumes are sized and installed of sufficient diameter to accommodate the existing flow of water and those that may potentially be created by sudden runoffs. Flumes shall be installed with the inlet and outlet at natural grade if possible.

Where bridges, culverts or flumes are installed across the work area, the Contractor shall be responsible for maintaining them (e.g. preventing collapse, clogging or tilting). All flumes and culverts shall be removed as soon as possible upon completion of construction.

The width of the temporary access road across culverts and flumes and the design of the approaches and ramps shall be adequate for the size of vehicle and equipment access required. The ramps shall be of sufficient depth and constructed to prevent collapse of the flumes, and the approaches on both sides of the flume shall be feathered.

Where culverts are installed for access, the culvert shall be of sufficient length to convey the stream flow through the construction zone.

The Contractor shall maintain equipment bridges to prevent soil from entering the waterbody.

7.4 Waterbody Crossing Methods

Construction methods pertinent to waterbody crossings are presented below. Selection of the most appropriate method at each crossing shall be depicted on the construction drawings but may be amended or changed based on site-specific conditions (i.e., environmental sensitivity of the waterbody, depth, and rate of flow, subsurface soil conditions, and the expected time and duration of construction) at the time of crossing. Construction will involve dry-ditch techniques at crossings where the timing of construction does not adequately protect environmentally sensitive waterbodies, as determined by the appropriate regulatory authority. Where required, horizontal directional drilling (HDD) will be used at designated major and sensitive waterbodies crossings. Each waterbody crossing shall be accomplished using one of the following construction methods:

- Non-flowing Open Cut Crossing Method - (Detail 10)
- Flowing Open Cut Crossing Method – Minor, Intermediate or Major Waterbody - (Detail 11)
- Flowing Stream Crossing – Dry Flume Method - (Detail 12)
- Flowing Stream Crossing – Dry Dam-and-Pump Method - (Detail 13)
- Horizontal Directional Drill Crossing - (Details 14a and 14b)
- Horizontal Bore Crossing - (Detail 20)

In conjunction with the appropriate jurisdictional agency, BakkenLink will develop specific crossing plans for major water bodies that contain recreationally or commercially important fisheries, or are classified as special use. BakkenLink will consult with state fisheries agencies with respect to applicable construction windows for each crossing and develop specific construction and crossing methods for open cuts in conjunction with USACE permitting and USFWS consultation.

7.4.1 Non-flowing Open Cut Crossing Method

The Contractor shall utilize the Non-flowing Open Cut Crossing Method (Detail 10) for all waterbody crossings (ditches, gullies, drains, swales, etc.) with no perceptible flow at the time of construction. Should site conditions change and the waterbody is flowing at the time of

construction, the Contractor shall install the crossing utilizing the Flowing Open Cut Crossing Method (Detail 11) unless otherwise approved by BakkenLink.

7.4.2 Flowing Open Cut Crossing Method of Minor, Intermediate, and Major Waterbodies

For minor waterbody crossings, except where the flume method is used, the Contractor shall complete construction in the waterbody (not including blasting, if required) as shown on Detail 11 within 24 hours if practicable.

For intermediate waterbodies, the Contractor shall attempt to complete trenching and backfill work within the waterbody (not including blasting if required) within 48 hours if practicable as shown on Detail 11.

The Contractor shall construct each major waterbody crossing in accordance with a site-specific plan as shown in the construction drawings. The Contractor shall complete in-stream construction activities as expediently as practicable.

7.4.3 Flowing Stream Crossing – Dry Flume Method

Where required, the Contractor shall utilize the Flowing Open Cut Crossing – Dry Flume Method as shown on Detail 12 with the following "dry ditch" techniques:

- Flume pipe shall be installed after blasting (if necessary), but before any trenching.
- Sand bag, sand bag and plastic sheeting diversion structure, or equivalent shall be used to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required in order to achieve an effective seal).
- Flume pipe(s) shall be aligned to prevent bank erosion and streambed scour.
- Flume pipe shall not be removed during trenching, pipe laying, or backfilling activities, or initial streambed restoration efforts.
- All flume pipes and dams that are not also part of the equipment bridge shall be removed as soon as final clean up of the stream bed and bank is complete.

7.4.4 Flowing Stream Crossing – Dry Dam-and-Pump Method

Where specified in the construction drawings, the Contractor shall utilize the Flowing Open Cut Crossing – Dry Dam-and-Pump Method as shown on Detail 13. The dam-and-pump crossing method shall meet the following performance criteria:

- sufficient pumps to maintain 1.5 times the flow present in the stream at the time of construction;

- at least one back up pump available on site;
- dams constructed with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
- screen pump intakes installed;
- streambed scour prevented at pump discharge; and
- dam and pumps shall be monitored to ensure proper operation throughout the waterbody crossing.

7.4.5 Horizontal Directional Drill Crossings

Where required, the horizontal directional drill method as shown on Details 14a and 14b shall be utilized for designated major and sensitive waterbodies. The Contractor shall construct each directional drill waterbody crossing in accordance with a site specific plan as shown in the construction drawings.

Drilling fluids and additives utilized during implementation of a directional drill shall be non-toxic to the aquatic environment.

The Contractor shall develop a contingency plan to address a frac-out during a directional drill. The plan shall include instructions for monitoring during the directional drill and mitigation in the event that there is a release of drilling fluids. Additionally, the waterbody shall be monitored downstream by the Contractor for any signs of drilling fluid.

The Contractor shall dispose of all drill cuttings and drilling mud at a BakkenLink-approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by BakkenLink or hauling to an approved licensed landfill or other site approved by BakkenLink.

7.4.6 Horizontal Bore Crossings

Where required, the horizontal bore method as shown on Detail 20 shall be utilized for crossing waterbodies. The Contractor shall construct each horizontal bore waterbody crossing in accordance with a site specific plan as shown in the construction drawings.

7.5 Clearing

Except where rock is encountered and at non-flowing open cut crossings, all necessary equipment and materials for pipe installation must be on site and assembled prior to commencing trenching in a waterbody. All staging areas for materials and equipment shall be located at least 10 feet from the waterbody edge. The Contractor shall preserve as much vegetation as possible along the waterbody banks while allowing for safe equipment operation.

Clearing and grubbing for temporary vehicle access and equipment crossings shall be carefully controlled to minimize sediment entering the waterbody from the construction right-of-way.

Clearing and grading shall be performed on both sides of the waterbody prior to initiating any trenching work. All trees shall be felled away from watercourses.

Plant debris or soil inadvertently deposited within the high water mark of waterbodies shall be promptly removed in a manner that minimizes disturbance of the waterbody bed and bank. Excess floatable debris shall be removed above the high water mark from areas immediately above crossings.

Vegetation adjacent to waterbody crossings by horizontal directional drill or boring methods shall not be disturbed except by hand clearing as necessary for drilling operations.

7.6 Grading

The construction right-of-way adjacent to the waterbody shall be graded so that soil is pushed away from the waterbody rather than towards it whenever possible.

In order to minimize disturbance to woody riparian vegetation within extra workspaces adjacent to the construction right-of-way at waterbody crossings, the Contractor shall minimize grading and grubbing of waterbody banks. To the extent practicable, grubbing shall be limited to the ditch line plus an appropriate width to accommodate safe vehicle access and the crossing.

7.7 Temporary Erosion and Sediment Control

The Contractor shall install and maintain sediment barriers across the entire construction right-of-way at all flowing waterbody crossings.

The Contractor shall install sediment barriers immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete.

Where waterbodies are adjacent to the construction right-of-way, the Contractor shall install and maintain sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way.

7.8 Trenching

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

All equipment and materials shall be on site before trenching in the active channel of all minor waterbodies containing state-designated fisheries, and in

intermediate and major waterbodies. All activities shall proceed in an orderly manner without delays until the trench is backfilled and the stream banks stabilized. The Contractor shall not begin in-stream activity until the in-stream pipe section is complete and ready to be installed in the waterbody.

The Contractor shall use trench plugs at the end of the excavated trench to prevent the diversion of water into upland portions of the pipeline trench and to keep any accumulated upland trench water out of the waterbody. Trench plugs must be of sufficient size to withstand upslope water pressure.

The Contractor shall conduct as many in-stream activities as possible from the banks of the waterbodies. The Contractor shall limit the use of equipment operating in waterbodies to that needed to construct each crossing.

The Contractor shall place all spoil from minor and intermediate waterbody crossings and upland spoil from major waterbody crossings in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas. No trench spoil, including spoil from the portion of the trench across the stream channel, shall be stored within a waterbody unless the crossing cannot be reasonably completed without doing so.

The Contractor shall install and maintain sediment barriers around spoil piles to prevent the flow of spoil into the waterbody.

Spoil removed during ditching shall be used to backfill the trench usually with a backhoe, clamshell, or a dragline working from the waterbody bank. Sand, gravel, rockshield, or fill padding shall be placed around the pipe where rock is present in the channel bottom.

7.9 Pipe Installation

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

A "free stress" pipe profile shall be used at all minor, intermediate, and major waterbodies with gradually sloping stream banks. The "box bend" pipe profile shall be used for intermittent and major waterbodies with steep stream banks.

The trench shall be closely inspected to confirm that the specified cover and adequate bottom support can be achieved, and shall require BakkenLink approval prior to the pipe being installed. Such inspections shall be performed by visual inspection and/or measurement by a BakkenLink representative. In rock trench, the ditch shall be adequately padded with clean granular material to provide continuous support for the pipe.

The pipe shall be pulled into position or lowered into the trench and shall, where necessary, be held down by suitable negative buoyancy control, as-built recorded and backfilled immediately to prevent the pipe from floating.

The Contractor shall provide sufficient approved lifting equipment to perform the pipe installation in a safe and efficient manner. As the coated pipe is lowered in,

it shall be prevented from swinging or rubbing against the sides of the trench. Only properly manufactured slings, belts, and cradles suitable for handling coated pipe shall be used. All pipes shall be inspected for coating flaws and/or damage as it is being lowered into the trench. Any damage to the pipe or coating shall be repaired.

7.10 Backfilling

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

Trench spoil excavated from waterbodies shall be used to backfill the trench across waterbodies.

After lowering in is complete, but before backfilling, the line shall be re-inspected to ensure that no skids, brush, stumps, trees, boulders, or other debris is in the trench. If discovered, such materials or debris shall be removed from the trench prior to backfilling.

For each major waterbody crossed, the Contractor shall install a trench breaker at the base of slopes near the waterbody unless otherwise directed by BakkenLink based on site specific conditions. The base of slopes at intermittent waterbodies shall be assessed on site and trench breakers installed only where necessary.

Slurred muck or debris shall not be used for backfill. At locations where the excavated native material is not acceptable for backfill or must be supplemented, the Contractor shall provide granular material approved by BakkenLink.

If specified in the construction drawings, the top of the backfill in the stream shall be armored with rock riprap or bio-stabilization materials as appropriate.

7.11 Stabilization and Restoration of Stream Banks and Slopes

The Contractor will restore the contours of the bed and banks of waterways immediately after pipe installation and backfill, except over the travel lane. Travel lanes and bridges may stay in place until hydrostatic testing and cleanup are complete. All materials used to support construction activities will be removed from waterbodies and wetlands, including, but not limited to, flumes, mats, plastic sheeting, and sandbags.

The stream bank contour shall be re-established. All debris shall be removed from the streambed and banks. Stream banks shall be stabilized and temporary sediment barriers shall be installed within 24 hours of completing the crossing if practicable.

Approach slopes shall be graded to an acceptable slope for the particular soil type and surface run off controlled by installation of permanent slope breakers. Where considered necessary, the integrity of the slope breakers shall be ensured by lining with erosion control blankets.

Immediately following reconstruction of the stream banks, the Contractor shall install seed and flexible channel liners on waterbody banks as shown in Detail 18.

If the original stream bank is excessively steep and unstable or flow conditions are severe, or if specified on the construction drawings, the banks shall be stabilized with rock riprap, gabions, stabilizing cribs, or bio-stabilization measures to protect backfill prior to reestablishing vegetation.

Stream bank riprap structures shall consist of a layer of stone, underlain with approved filter fabric or a gravel filter blanket in accordance with Detail 19. Riprap shall extend from the stabilized streambed to the top of the stream bank. Where practicable, native rock shall be utilized.

Bio-stabilization techniques which may be considered for specific crossings are shown in Details 21 and 22.

The Contractor shall remove equipment bridges as soon as possible after final clean up.

8.0 HYDROSTATIC TESTING

8.1 Testing Equipment Location

The Contractor shall provide for the safety of all pipeline construction personnel and the general public during hydrostatic test operations by placing warning signs in populated areas.

The Contractor shall locate hydrostatic test manifolds 100 feet outside wetlands and riparian areas to the maximum extent practicable.

8.2 Test Water Source and Discharge Locations

BakkenLink is responsible for acquiring all permits required by federal, state and local agencies for procurement of water and for the discharge of water used in the hydrostatic testing operation. BakkenLink shall provide the Contractor with a copy of the appropriate withdrawal/discharge permits for hydrostatic test water. The Contractor shall keep water withdrawal/discharge permits on site at all times during testing operations.

Any water obtained or discharged shall be in compliance with permit notice requirements and with sufficient notice for BakkenLink's Testing Inspector to make water sample arrangements prior to obtaining or discharging water. BakkenLink will obtain water samples for analysis from each source before filling the pipeline. In addition, water samples will be taken prior to discharge of the water, as required by state and federal permits.

In some instances sufficient quantities of water may not be available from the permitted water sources at the time of testing. Withdrawal rates may be limited as stated by the permit. Under no circumstances shall an alternate water source be used without prior authorization from BakkenLink.

The Contractor shall be responsible for obtaining any required water analyses from each source to be used in sufficient time to have a lab analysis performed prior to any filling operations. The sample bottle shall be sterilized prior to filling with the water sample. The analysis shall determine the pH value and total suspended solids. Each bottle shall be marked with:

- source of water with pipeline station number;
- date taken;
- laboratory order number; and
- name of person taking sample.

Staging/work areas for filling the pipeline with water will be located a minimum of 100 feet from the waterbody or wetland boundary if topographic conditions permit. The Contractor will install temporary sediment filter devices adjacent to all streams to prevent sediments from leaving the construction site.

The Contractor shall screen the intake hose to prevent the entrainment of fish or debris. The hose shall be kept at least 1 foot off the bottom of the waterbody. Refueling of construction equipment shall be conducted a minimum distance of 100 feet from the stream or a wetland. Pumps used for hydrostatic testing within 100 feet of any waterbody or wetland shall be operated and refueled in accordance with Section 3.

During hydrostatic test water withdrawals, the Contractor will maintain adequate flow rates in the waterbody to protect aquatic life and provide for downstream uses, in compliance with regulatory and permit requirements.

The Contractor shall not use chemicals in the test water. The Contractor shall not discharge any water containing oil or other substances that are in sufficient amounts as to create a visible color film or sheen on the surface of the receiving water.

Selected road, railroad, and river crossing pipe sections may be specified to be pre-tested for a minimum of 4 hours. The water for pre-testing of any road and railroad crossings shall be hauled by a tanker truck from an approved water source. Water for pre-testing of a river crossing may be hauled or taken from the respective river if it is an approved water source. Since the volume of water utilized in these pre-tests shall be relatively small, the water shall be discharged overland along the construction right-of-way and allowed to soak into the ground utilizing erosion and sediment control mitigative measures.

Selection of final test water sources will be determined based on site conditions at the time of construction and applicable permits.

8.3 Filling the Pipeline

After final positioning of the pipe, the Contractor shall fill the pipe with water. Pipe ends shall not be restrained during the fill. The fill pump shall be set on a

metal catch pan of sufficient dimensions to contain all leaking lubricants or fuel and prevent them from entering the water source. The suction inlet must be placed in a screened enclosure located at a depth that shall not allow air to be drawn in with the water. The screened enclosure shall be such that the fill water is free of organic or particulate matter.

The Contractor shall provide a filter of the backflushing or cartridge type with a means of cleaning without disconnecting the piping. The filter shall have the specifications of 100 mesh screen. If the cartridge type is used, a sufficient quantity of cartridges shall be on hand at the filter location. The Contractor shall install the filter between the fill pump and the test header. The Contractor shall be responsible for keeping the backflush valve on the filter closed during the filling operation. The Contractor shall be responsible for the proper disposal of materials backflushed from the filter or filter cartridges. The Contractor shall not be allowed to backflush the filter into the stream or other water source.

8.4 Dewatering the Pipeline

The Contractor shall comply with state-issued NPDES permits for discharging test water.

The Contractor shall not discharge any water containing oil or other substances that are in sufficient amounts as to create a visible color film on the surface of the receiving water.

The Contractor shall not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and local permitting agencies grant written permission. To avoid impacts from introduced species, no inter-basin transfers (discharge) of hydrostatic test water will occur.

The discharge operation will be monitored and water samples will be taken prior to the beginning of the discharge to ensure that it complies with the Project and permit requirements. If required by state permits, additional water quality testing will be conducted during discharge, in accordance with permit conditions.

The Contractor shall calculate, record, and provide to BakkenLink the day, date, time, location, total volume, maximum rate, and methods of all water discharged to the ground or to surface water in association with hydrostatic testing.

The Contractor shall regulate the pig velocity discharge rate (3000 gpm maximum), use energy dissipation devices, and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive stream flow. Water must be disposed of using good engineering judgment so that all federal, state, and local environmental standards are met. Dewatering lines shall be of sufficient strength and be securely supported and tied down at the discharge end to prevent whipping during this operation.

To reduce the velocity of the discharge, The Contractor shall utilize an energy-dissipating device described as follows:

8.4.1 Splash Pup

A splash pup consists of a piece of large diameter pipe (usually over 20" outside diameter) of variable length with both ends partially blocked that is welded perpendicularly to the discharge pipe. As the discharge hits against the inside wall of the pup, the velocity is rapidly reduced and the water is allowed to flow out either end. A variation of the splash pup concept, commonly called a diffuser, incorporates the same design, but with capped ends and numerous holes punched in the pup to diffuse the energy.

8.4.2 Splash Plate

The splash plate is a quarter section of 36-inch pipe welded to a flat plate and attached to the end of a 6-inch discharge pipe. The velocity is reduced by directing the discharge stream into the air as it exits the pipe. This device is also effective for most overland discharge.

8.4.3 Plastic Liner

In areas where highly erodible soils exist or in any low flow drainage channel, it is a common practice to use layers of visqueen (or any of the new construction fabrics currently available) to line the receiving channel for a short distance. One anchoring method may consist of a small load of rocks to keep the fabric in place during the discharge. Additional mitigation or protection measures, such as the use of plastic sheeting or other material to prevent scour, will be used as necessary to prevent excessive sedimentation during dewatering.

8.4.4 Straw Bale Dewatering Structure

Straw bale dewatering structures are designed to dissipate and remove sediment from the water being discharged. Straw bale structures are used for on land discharge of wash water and hydrostatic test water and in combination with other energy dissipating devices for high volume discharges. A straw bale dewatering structure is shown In Detail 6. A dewatering filter bags may be sued as an alternative to show bale dewatering structures. A dewatering filter bag is shown in Detail 5.

Appendix XIV

Hydrostatic Test Plan

1.0 Introduction

This Hydrostatic Test Plan (Plan) identifies measures to be taken by BakkenLink Pipeline, LLC (BakkenLink) and its contractors to ensure pipeline integrity and conform to regulatory requirements. The Plan will be carried out in accordance with the federal, state and local agency regulations. Measures identified in this Plan apply to work within the project area defined as the right-of-way and other areas used during hydrostatic pressure testing of the pipeline and facilities. BakkenLink and its contractor personnel will be thoroughly familiar with this Plan and its contents prior to initiating hydro-testing operations on the project.

1.1 Purpose

The purpose of this Plan is to define the necessary measures that are to be implemented during pipeline integrity testing to ensure the safety of pipeline construction personnel and the general public. This Plan describes safety standards and practices that will be implemented during construction of the project to minimize health, safety, and environmental (particularly water quality) concerns related to hydro-testing procedures throughout the project.

2.0 Hydrostatic Testing Procedures

The following procedures would be implemented by the Contractor during hydrostatic testing operations. This section of the Plan describes pre-testing requirements, the typical sequence of activities associated with the hydrostatic testing operations, and notifications required by BakkenLink and its Contractor.

BakkenLink will be responsible for securing the necessary permits and approvals from the governing authorities for the use of, and disposal of test water. BakkenLink will also comply with the rules and regulations from any relevant agencies. BakkenLink will provide the contractor with a copy of the withdrawal and discharge permits and the contractor will keep copies onsite at all times during the testing operations.

2.1 Water Discharge and Use Regulations

The hydrostatic test water discharge locations for this project will be selected to avoid direct discharge into wetlands or waterways. If this becomes unavoidable, alternate water discharge method will be vetted with the appropriate agencies, the required permits will be attained, and best practices procedures will be used. If the water discharge has to be made into streams, ephemeral drainages, or wetlands, BakkenLink's Environmental Inspector on site will ensure that any required water sampling will be performed in accordance with state regulations for water quality sampling procedures. The contractor will notify BakkenLink's Inspector at least 72 hours prior to obtaining water and/or discharging water. Analysis of the samples would be in accordance with permit requirements. Test water will not be discharged onto USACE land.

2.2 Facility Segments and Potential Water Uses

The pipeline will be constructed in three (3) segments. The pipeline segments will be hydrostatically tested once each segment is installed and mechanically completed. Construction will begin in the fourth quarter of 2014. The hydrostatic test segments are broken down as shown in Table 2-1 below. Three (3) Horizontal Directional Drills (HDDs) will be employed to install pipe in sensitive areas. Additionally, hydrostatic testing will occur for each HDD fabricated pipe string prior to its pull through the hole. The

HDDs are provided in Table 2-2 Below. The approximate locations, length and estimated volumes of water for the pipeline segments and HDD segments as well as the proposed discharge locations are also provided in the tables.

Table 2-1. Pipeline Segments and Hydrostatic Test Water Requirements

Seg. #	Pipeline Sections	Approx. MP		Segment length (ft)	Water Volume (gal)	Source	Proposed Discharge Locations (MP)
1	Dry Creek to South Lake	0	22.8	120,384	1,161,217	TBD	MP 0
2	Lake Sakakawea	22.8	25.6	14,784	140,278	TBD	MP 25.6
3	North Lake to Beaver Lodge	25.6	37.1	60,720	585,702	TBD	MP 37.1
	Total			**195,888**	**1,887,201**		

Table 2-2. HDD Segments and Hydrostatic Test Water Requirements

HDD Sections	Approx. MP	Segment length (ft)	Water Volume (gal)	Source	Proposed Discharge Locations (MP)
Lake Sakakawea – North Bluff	25.6	3,050	28,940	TBD	26.17
Lake Sakakawea – South Bluff	22.01	3,767	35,743	TBD	22.01
United States Forest Service	20.24	4,183	39,690	TBD	20.24
Totals		**11,000**	**104,373**		

All water obtained, used and discharged during the construction and testing of the pipeline will be pursuant to government regulations and appropriate permits. These sources will be further refined as the project develops.

2.3 Pumps

If pumps for hydrostatic testing are to be used within 100 feet of any waterbody or wetland, secondary containment measures (such as bermed depressions lined with plastic sheeting, plastic troughs, or other containment structure) would be implemented to prevent any spilled fuels or oils from reaching the waterbody or wetland, in accordance with BakkenLink's Spill Prevention, Containment and Countermeasures (SPCC) Plan and Construction Mitigation and Reclamation Plan (CMRP).

2.4 Safety Measures

The Contractor will be responsible for the safety of pipeline construction personnel and the general public during hydrostatic testing. The contractor will develop a site specific test plan for each test section and at minimum address the following safety measures:

- Place warning signs in or near populated areas.
- Restrict access to the area involving the hydrostatic test (i.e. test shelter, manifolds, pressure pumps, instruments, etc.) to only those personnel engaged in the testing operations.
- Prohibit major pipeline work not directly associated with the test operations around the pipeline sections being tested.

- Provide and maintain a reliable transportation and communication system during the test operations whereby personnel directly involved in the test will be able to communicate test status or issues that develop during the test.
- Check hoses, fittings, connectors and valves for proper pressure rating.
- Restrain and secure fill and discharge lines/hoses.

2.5 Test Sections and Pressures

Each pipeline section will be pressure tested to prove its integrity and substantiate the Maximum Allowable Operating Pressure (MAOP). All pressure tests will meet the requirements of 49 CFR Part 195, Subpart E. The minimum test pressure will be 1850 psig. The maximum pressure will be limited to 95% of the Specified Minimum Yield Strength (SMYS) of the steel, which is 2408 psig.

2.7 Cleaning the Pipeline

Upon completion of the pipe lowering and backfilling operations and prior to filling the pipeline segment for a hydrostatic test, the pipeline will be cleaned of any residual construction debris and particles by running multiple combinations of abrasive and swab pigs such that all mill scale, dirt, dust, and other solid or liquid materials are removed from the pipe. Cleaning activities will be governed by BakkenLink's general pipeline construction specifications.

2.8 Testing the Pipeline

The duration of the test will be not less than 8 hours as specified in 49 CFR Part 195.304. The pressure will be maintained at or above the minimum test pressure at all points in the pipeline segment. Temperature and pressure will be allowed to stabilize prior to beginning the test period. Temperature and pressure will be recorded every 30 minutes in a manner approved by BakkenLink. The test will be accepted upon proof of no leakage when no pressure changes are detected over the test period where changes cannot be attributed to temperature affects. In the event of a leak during testing, the leak would be repaired and the above test repeated until a satisfactory test is obtained on the segment.

2.9 Depressurizing the Pipeline

After the test has been presented by the contractor as a successful test and accepted by BakkenLink's Inspector; the pipeline would be depressurized as soon as practical.

2.10 Dewatering the Pipeline

Discharge points will be selected to avoid waterways and wetlands. Landowners and/or land management agency will be consulted when finalizing discharge points. All discharge points would utilize discharge dispersion devices provided in BakkenLink's construction typical drawings. The devices are designed to capture discharge water to limit erosion, scour, and filter contaminants. These devices are typically constructed of geotextile fabric, silt fence/filter cloth and straw bales. The rate of discharge will be monitored to prevent the device from being ineffective or overwhelmed by the volume of water.

3.0 Records

In accordance with applicable regulations and BakkenLink's pipeline construction specifications, the contractor will maintain complete and comprehensive records of all hydrostatic tests and of related activities such as filling, pressuring, stabilizing, dewatering, etc. Records will be clearly identified with respect to the specific piping systems to which they apply and records will be accurately dated. In addition to the general requirements above such forms will, at a minimum, include:

- Date and time of test
- Identification of piping system

- Test medium pressure and duration
- Automatic 24 hour pressure-time and temperature-time recording chart, including manual recording of pressure gauge readings at each additional station, test medium temperature at definite time intervals
- Test medium temperature at definite time intervals
- Summary of leaks and repair methods
- Names and company affiliation of persons recording the test data
- Pressure and temperature recorder charts showing the date and time stop and start of recording
- Weather conditions during testing
- Elevation variations, whenever significant for the particular test (over 100' for liquids line)
- Calibration certificates for dead weight gauges and records of field calibrations of pressure and temperature instruments
- Make, style number, and condition of pigs used in filling and dewatering and any remarks pertinent to any phase of the test
- Results of the hydrostatic test will be provided to the BLM upon request at the conclusion of the project

Appendix XV

Unanticipated Discovery Plan

Appendix XV

Unanticipated Discoveries Plan for Cultural Resources and Human Remains

Guidelines for Unanticipated Discovery of Cultural Resources and Human Remains

Introduction

Pursuant to the regulatory requirements of Section 106 of the National Historic Preservation Act (NHPA) (16 United States Code [U.S.C.] 470) and its implementing regulation 36 Code of Federal Regulations (CFR) 800 (as amended August 5, 2004), and Section 3(d) (U.S.C. Part 3002) of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. Part 3001-3013), the Archaeological Resource Protection Act (ARPA) (Public Law 96-95, 16 U.S.C. 470aa-mm); North Dakota Century Code (NDCC) 27; NDCC §55-02-07; and the administrative rules in the North Dakota Administrative Code (NDAC) Chapter 40-02-03, BakkenLink Pipeline LLC (BakkenLink) has established the following procedures to be followed by BakkenLink personnel and their contractors in the event previously unrecorded and unanticipated cultural resources or human remains are found during construction of the BakkenLink Dry Creek to Beaver Lodge Project (Project). This document serves as the primary guidance tool for BakkenLink and its contractors so they can comply with federal and state laws and regulations.

Cultural resources include locations of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral history. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include locations (sites or places) of traditional, religious, and cultural importance to specified social and/or cultural groups.

A cultural resource discovery could consist of, but is not limited to:

- Prehistoric features (e.g., hearths, occupational surfaces, middens, charcoal stains)
- Prehistoric artifacts (e.g., debitage, projectile points)
- Historic features (e.g., wells, trails, foundations, cisterns)
- Historic artifacts (e.g., pottery, pipes, glass beads, shell)
- Burials and funerary items (including, but not limited to skeletal remains, headstones, coffin wood fragments, burial goods [e.g., pipes, pottery, ornaments])

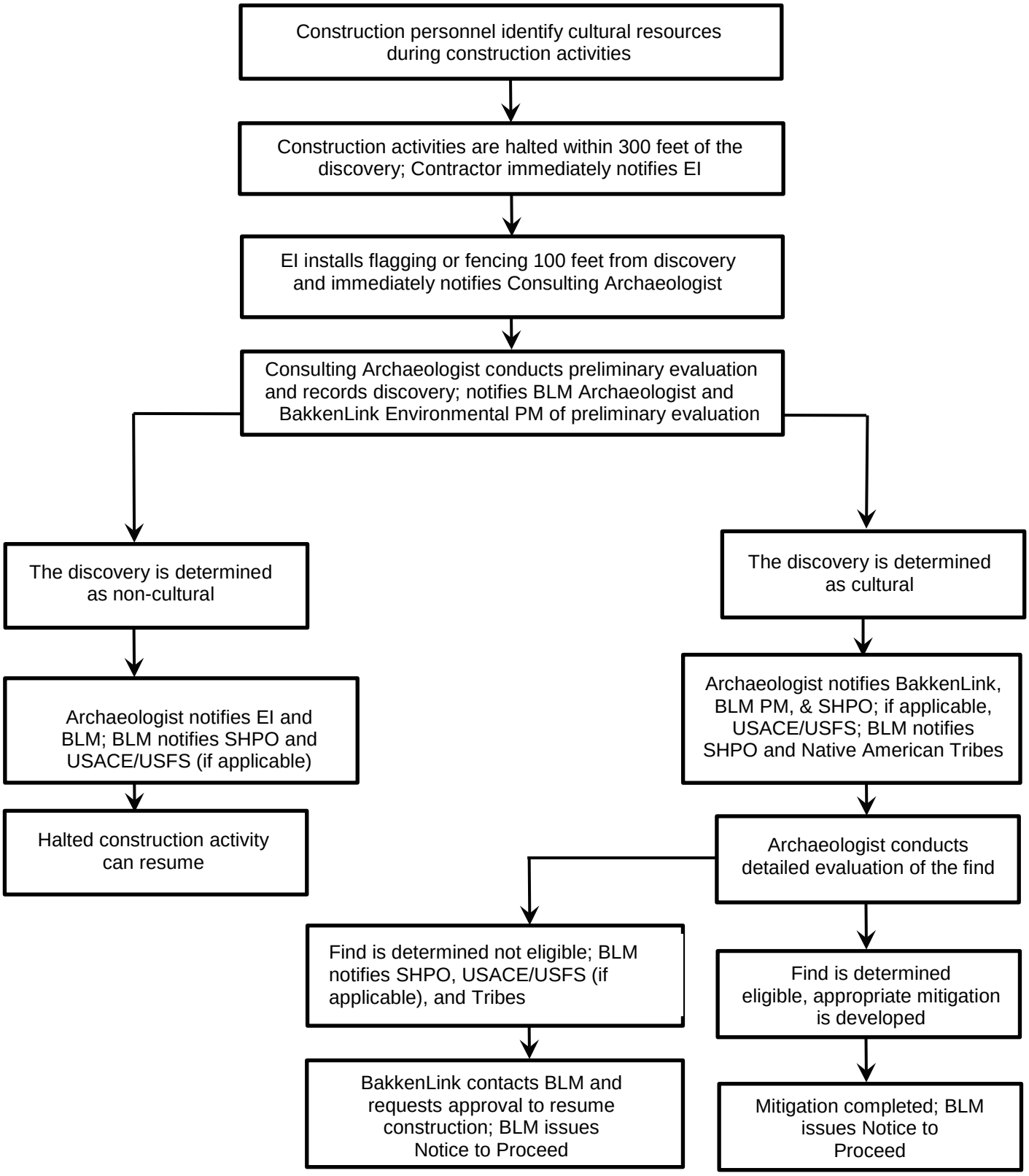
Unanticipated Discoveries Plan

A. <u>Discovery of Cultural Material</u>

The procedures for the discovery of cultural material are detailed below and also are shown on **Figure 1**.

- In the event construction personnel or the archaeological monitor identify a previously unrecorded cultural resource during construction activities, the Contractor will immediately cease work within a 300-foot radius of the discovery to protect the integrity of the find, and immediately notify the Environmental Inspector (EI). No cultural material will be moved from its original location.
- The EI will immediately notify BakkenLink's Environmental Project Manager, who will coordinate with the Consulting Archaeologist. The Consulting Archaeologist will travel to the location of the discovery to conduct a preliminary evaluation of the find.
- The EI will install temporary flagging or fencing approximately 100 feet from the discovery to provide a sufficient buffer and to protect the discovery itself from additional disturbance. No fencing will be installed outside of the ROW without prior approval from the landowner (if on private land).

Figure 1
Procedures for Unanticipated Discovery of Cultural Resources



- The Consulting Archaeologist will document the find using the appropriate North Dakota Cultural Resource Survey (NDCRS) form within 48 hours of the discovery, and will consult with the North Dakota State Historic Preservation Officer (SHPO), to determine if the discovery qualifies as a an archaeological site and if the site is potentially eligible for listing in the National Register of Historic Places (NRHP). The Consulting Archaeologist will notify BakkenLink' Environmental Project Manager and the Bureau of Land Management (BLM) Archaeologist of the preliminary evaluation of the significance of the find within 72 hours, or sooner if possible.
- If the discovery is determined by the BLM and SHPO, in consultation with the federal land managing agency Archaeologist, as appropriate, and Native American Tribes, as non-cultural or determined to be an isolated find or a site that is not eligible for the NRHP, the BLM Archaeologist will provide written notification to BakkenLink that construction can resume, and the Consulting Archaeologist will notify the EI that construction can resume. The EI will have the authority to remove the stop-work order and resume construction activities. Within 5 business days of the discovery, the Consulting Archaeologist will submit a letter report summarizing the findings to the BLM Archaeologist.
- If the discovery is determined by the BLM Archaeologist and SHPO, in consultation with the federal land managing agency Archaeologist, as appropriate, and Native American Tribes to be a site that is potentially eligible for the NRHP, the Consulting Archaeologist will notify BakkenLink's Environmental Project Manager and the BLM Project Manager, and the procedures outlined below in Section B, "Discovery of Potentially Significant Materials" will be followed. If the discovery is determined to be human remains, the procedures outlined below in Section D, "Discovery of Human Remains," will be followed.

B. <u>Discovery of Potentially NRHP-Eligible Cultural Material</u>

As previously discussed in Section A, the EI will ensure that the appropriate measures have been taken to protect and secure the discovery from additional disturbance. The procedures for the discovery of potentially significant cultural material are detailed below and also are shown on **Figure 1**.

- In addition to the BLM Project Manager and BakkenLink's Environmental Project Manager, the Consulting Archaeologist will notify SHPO, and if applicable the U.S. Forest Service (USFS) Archaeologist and the U.S. Army Corps of Engineer (USACE) Archaeologist within 24 hours of determination of the site's potential significance. If the site is associated with prehistoric or historic Native American culture, the BLM Archaeologist will immediately notify the Native American Tribes participating in the consultation efforts for the Project.

- The Consulting Archaeologist will be provided 3 days to conduct a detailed assessment and evaluation of the significance of the find assuming that it is safe to do so. If due to safety reasons, the significance of the find cannot be determined in 3 days an extension will be given so that the proper safety mechanisms can be put in place. The Consulting Archaeologist will provide recommendations regarding the NRHP eligibility and the potential adverse effects associated with construction activities. Within 3 days of completing the assessment and evaluation, the Consulting Archaeologist will provide the findings to the BLM Archaeologist, SHPO, and federal land managing agency Archaeologist, as appropriate.
- If the find is determined by the BLM Archaeologist and federal land managing Archaeologist, as appropriate, in consultation with SHPO, to be eligible for listing in the NRHP and at risk of being adversely affected by construction activities, BakkenLink will request mitigation recommendations from the BLM who in turn will consult with the federal land managing agency Archaeologist (as appropriate), SHPO, and Native American Tribes. If needed, a mitigation or treatment plan will be developed by the Consulting Archaeologist and submitted to the BLM Archaeologist within 3 days of the determination. The mitigation or treatment plan

will take into consideration any safety issues that may be present near the discovery. The BLM Archaeologist will forward the treatment plan to the federal land managing agency Archaeologist, as appropriate, SHPO, and interested Native American Tribes, who in consultation will have 5 business days to review and approve the plan. Mitigation may include:

- Variance request to reroute around the site;
- Site visits by the BLM, SHPO, Native American tribes, and other applicable parties;
- Data recovery, which may include the systematic professional excavation of the site; or
- Other mitigation (in lieu of data recovery) determined by the BLM Archaeologist through consultation with the SHPO, Native American tribes, and other applicable parties.

▪ Mitigation will commence immediately after approval of the mitigation or treatment plan by the BLM Archaeologist, SHPO, and federal land managing agency Archaeologist (if applicable). All necessary permits will be issued by the federal land managing agency in consultation with the BLM prior to the commencement of mitigation. No construction activities in the area of the discovery will be resumed until treatment has been completed and the BLM Project Manager has issued a Notice to Proceed. If the site does not qualify as an historic property, BakkenLink will consult with the BLM, SHPO, and other applicable parties, and will request approval to resume construction activities. BLM will provide written notice that construction activities can resume at the discovery location.

C. Discovery of Underwater Cultural Material(s) and Visual Inspection of the Lake Crossing

Construction activities for the lake crossing, that include lowering the pipe and pulling the pipe across the lake bottom, have the potential for underwater inadvertent discoveries. Commercial divers will be trained to identify cultural material(s) that may require additional investigation by a Consulting Archaeologist. The role of the commercial diver will be to observe the lowering of the pipe, take measurements concerning pipe depth, and observe the underwater construction for the possibility of an inadvertent discovery from a safe distance. A commercial diver will make a video recording of the closed trench of the lake crossing after all construction activity has been completed. This video will be made available to the public upon request.

If BakkenLink discovers potential cultural material(s), such as sonar image or visual confirmation of stone features and/or artifacts, during construction of the lake crossing, BakkenLink will:

▪ Immediately cease lake bottom disturbing activities within the area of the discovery and immediately notify the EI. No cultural materials will be transported from its original location unless directed to do so by the BLM Archaeologist in consultation with SHPO.

▪ The EI will notify BakkenLink's Environmental Project Manager who will coordinate with the Consulting Archaeologist and the BLM Archaeologist regarding the preliminary evaluation of the find. If the discovery is determined by the Consulting Archaeologist, in consultation with the BLM Archaeologist, as non-cultural or determined to be an isolated find or site of no significance, the Consulting Archaeologist will immediately notify the EI that construction can resume. The EI will have the authority to remove the stop-work order and resume construction activities. Within 5 business days, the Consulting Archaeologist will submit a letter report summarizing the findings to the BLM Archaeologist.

▪ If the discovery is determined by the Consulting Archaeologist, in consultation with the BLM Archaeologist, as a potentially significant site, the Consulting Archaeologist will notify BakkenLink's Environmental Project Manager and the BLM Project Manager, and the procedures outlined below in Section B, "Discovery of Potentially Significant Materials", will be followed. If the discovery is determined to be human remains, the procedures outlined

below in Section D, “Discovery of Human Remains” will be followed. If necessary, a trained underwater archaeologist will be used to investigate the inadvertent discovery.

D. Discovery of Human Remains

BakkenLink will comply with relevant federal laws and the NDCC 23-06-27 and accompanying administrative rules (NDAC 40-02-03). In addition, the Advisory Council on Historic Preservation’s Policy Statement on the Treatment of Burial Sites (2007) also will be taken into account to assure that the remains are treated with dignity and respect. Procedures for the discovery of human remains are detailed below and also are shown on **Figure 2**.

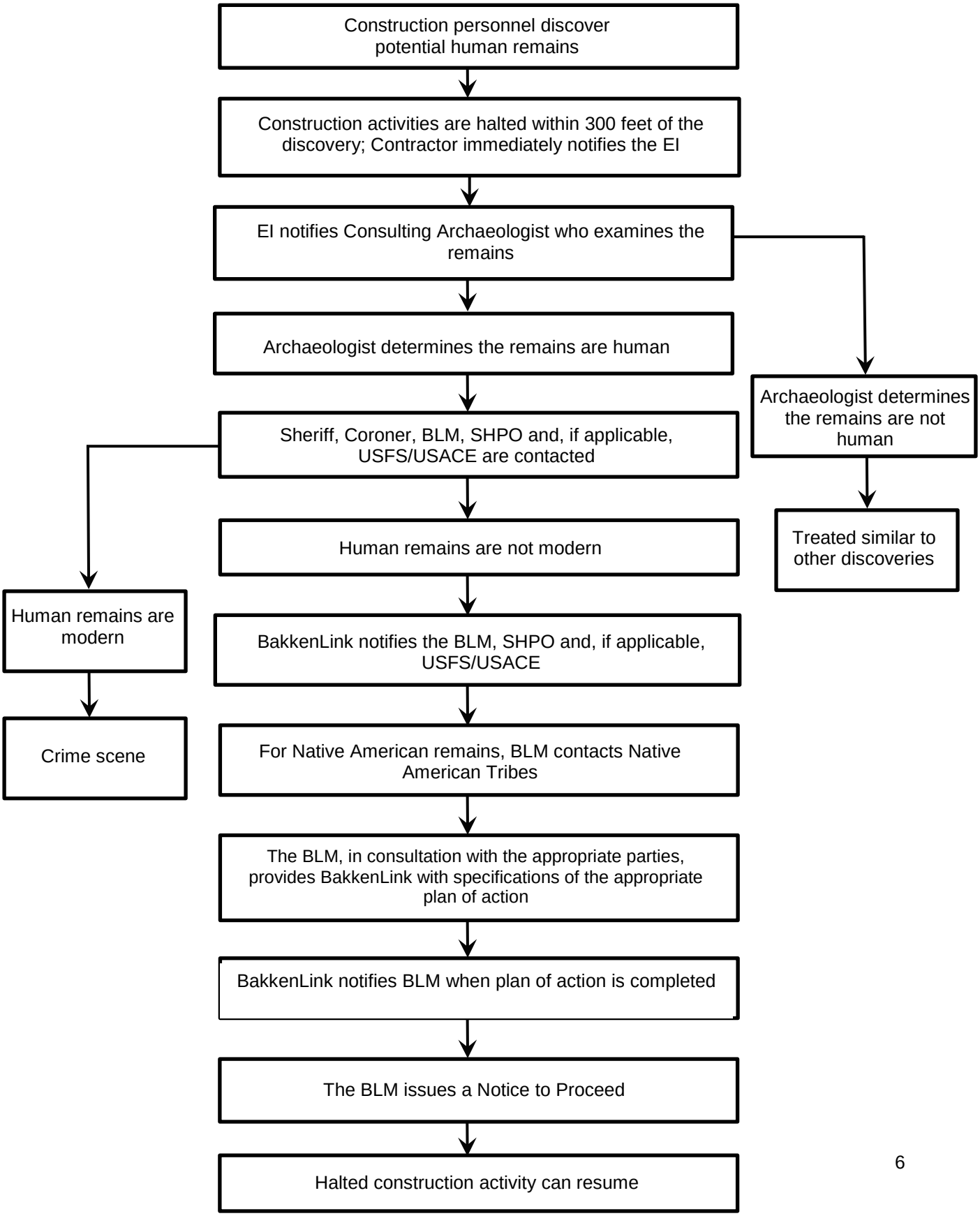
The following three bullet items will be followed regardless of land ownership:

- If human remains are encountered during construction, all construction activities will cease immediately within a 300-foot radius of the remains, and the Contractor will immediately notify the EI. The EI will notify the Consulting Archaeologist, who will examine the remains.
- If the remains are determined to be non-human and are associated with cultural material, the procedures outlined in Section A will be followed.
- If the remains are determined to be human, the EI will immediately contact the BLM Project Manager, BLM Archaeologist, and BakkenLink Environmental Project Manager. The remains will be left in place, and the EI will erect exclusionary fencing in a 50-foot radius around the discovery. In the event of adverse weather conditions, the remains will be covered with protective, waterproof material. Vehicle traffic will be prohibited from passing through the area, and, if necessary, a guard will be posted at the site.

For Human Remains Found on Non-federal Land

- BakkenLink’ Environmental Project Manager will immediately notify the county sheriff of the find, and will request that the sheriff contact the county coroner. If the sheriff or coroner determines that the remains are modern and constitute a law enforcement issue, all further work will be at the direction of the country sheriff, including notification that construction can resume.
- If the sheriff or coroner determines that the remains are not a law enforcement issue, the BLM Archaeologist in coordination with the SHPO will consult with BakkenLink, Native American Tribes, and other applicable parties regarding treatment of the remains. The BLM Archaeologist will ensure that appropriate treatment of the human remains is carried out by BakkenLink prior to construction activities being resumed in the area of the discovery. Treatment may involve excavation of the remains, documentation, and consultation. Construction activities will not resume until the BLM Project Manager has issued a Notice to Proceed.

Figure 2
Procedures for the Unanticipated Discovery of Human Remains



For Human Remains Found on Federal Land

- If the remains are found on USFS land, the USFS Archaeologist will be immediately notified by the BLM Archaeologist. For discovery of remains on USACE land, the BLM Archaeologist will immediately notify the USACE Archaeologist.
- Further treatment of the remains will be at the direction of the BLM Archaeologist, in consultation with the applicable federal agency Archaeologist, including determination of whether the remains are modern and constitute a law enforcement issue or are not modern. If the remains are modern, the BLM Archaeologist will be responsible for contacting the county sheriff, and will request that the sheriff contact the coroner. All further work will be at the direction of the country sheriff, including notification that construction can resume.
- If the remains are not modern, the BLM Archaeologist in coordination with the federal land managing agency Archaeologist, as appropriate, and SHPO will consult with BakkenLink and interested Native American Tribes regarding treatment of the remains. The BLM Archaeologist will ensure that appropriate treatment of the human remains is carried out by BakkenLink prior to construction activities being resumed in the area of the discovery. Treatment may involve excavation of the remains, documentation, and consultation. All necessary permits will be issued by the federal land managing agency in consultation with the BLM. Construction activities will not resume until the BLM Project Manager has issued a Notice to Proceed.

For Native American Human Remains Found on Federal Lands

- For Native American human remains, funerary objects, and objects of cultural patrimony, the BLM will comply with the requirements of NAGPRA for discovery situations on a case-by-case basis in accordance with 43 CFR 10. All of the Native American Tribes involved in the government-to-government consultation efforts for the Project will be notified immediately of the discovery, and every effort will be m made to identify the Tribe with cultural affinity to the remains. The applicable federal agency (USFS or USACE) will be notified of the discovery.
- Within 7 business days of the discovery, an action plan will be written by the Consulting Archaeologist in coordination with the BLM Archaeologist and interested Native American Tribe(s) participating in the consultation efforts. The applicable federal agency (USFS or USACE) also will be involved in preparation of the action plan. Treatment and handling of the human remains will take place immediately following completion and approval of the plan. All necessary permits will be issued by the federal land managing agency in consultation with BLM and the affected tribes.
- Construction activities within the 300-foot radius buffer area will not resume until the remains have been appropriately treated in accordance with the action plan, and the BLM Project Manager has issued a Notice to Proceed.

Table 1 lists the federal, state, and local agency contact information in the event of an unanticipated discovery.

Table 1 Federal, State, and Local Agency Contact Information [WILL UPDATE AND FILL IN BEFORE START OF CONSTRUCTION]

Name	Title/Agency	Phone	E-mail
Bureau of Land Management			
Lowell Hassler	Project Manager	406-538-1909 (direct) 701-290-4235 (cell)	lhassler@blm.gov
Shannon Gilbert	Project Archaeologist	406-683-8029 (direct)	sgilbert@blm.gov

Table 1 Federal, State, and Local Agency Contact Information [WILL UPDATE AND FILL IN BEFORE START OF CONSTRUCTION]

Name	Title/Agency	Phone	E-mail
BakkenLink Corporation			
?	Project Manager	?	?
Stantec			
?	Environmental Inspector	?	?
Archaeological Consultant			
?	Cultural Resource Manager		
?	Consulting Archaeologist		
State Historic Preservation Office			
Claudia Berg	Director, State Historical Society of North Dakota	701-328-2672 (direct)	cberg@**nd**.gov
Paul Picha	State Archaeologist, State Historical Society of North Dakota	(701) 328-3574	ppicha@nd.gov
U.S. Forest Service			
Liv Fetterman	Archaeologist	701-250-4443 x 108 (office) 701-516-4009 (cell)	lfetterman@fs.fed.us
U.S. Army Corps of Engineers			
David Cain	Archaeologist	(701)654-7706	David.Cain2@usace.army.mil
County Sheriff			
Ron Rankin	McKenzie County Sheriff	701-444-3654 x 1420	
Scott Busching	Williams County Sheriff	701-577-7700	

Appendix XVI

Spill Prevention, Containment, and Countermeasure Plan (SPCC)

Spill Prevention, Containment, and Countermeasure Plan for Construction of the BakkenLink Pipeline LLC

February 2014

Spill Prevention, Containment, and Countermeasure Plan for Construction of the BakkenLink Pipeline LLC February 2014

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1.0 Introduction

BakkenLink Pipeline LLC (BakkenLink) has prepared this Spill Prevention, Containment, and Countermeasure (SPCC) Plan to be implemented during construction of the BakkenLink Pipeline Project (Project). This SPCC Plan outlines specific preventive measures to be followed to reduce the likelihood of an accidental release of a hazardous or regulated liquid during construction activities. This SPCC Plan also sets forth procedures and response actions in the event of an actual release.

This SPCC Plan restricts the location of fuel storage, refueling activities, and construction equipment maintenance along the construction right-of-way and provides procedures, materials, and lines of communication to facilitate the prevention, containment, and cleanup of spills during construction activities. It also sets forth minimum standards for handling and storing regulated substances. The goal of the SPCC Plan is to minimize the potential for a spill of these materials, to contain any spillage to the smallest area possible, and to protect areas that are considered environmentally sensitive (e.g. streams, groundwater wells, wetlands, etc.). This SPCC Plan does not certify the Contractor or individuals as licensed waste haulers.

Measures and procedures defined in this SPCC Plan will be implemented by indepent Contractors and construction inspectors hired by BakkenLink. These Contractors and inspectors will have day-to-day responsibility to ensure compliance with this SPCC. BakkenLink, by completing the Delegation of Authority Form (following page), grants authority to the named parties to act on its behalf on matters pertaining to this SPCC. Any signed Delegation of Authority form shall be kept with this SPCC at all times.

Delegation of Authority Form

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Spill Prevention Control and Countermeasure plan, at the _____ construction site. The designee is authorized to sign any reports, storm water pollution prevention plans and all other documents required by the permit.

_____ (name of person or position)
_____ (company)
_____ (address)
_____ (city, state, zip)
_____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in _____ (Reference State Permit), and that the designee above meets the definition of a "duly authorized representative" as set forth in _____ (Reference State Permit).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____

Company: _____

Title: _____

Signature: _____ **Date:** _____

2.0 Regulated Materials Storage and Handling

Table 1 presents typical vehicle and equipment fuels, lubricants, and hazardous materials stored or used during construction, and briefly describes the location, typical quantities, and usual methods of storage. Storage methods and quantities vary with length of construction segment, time of year, and type of terrain.

Table 1
Typical Fuel, Lubricants, and Hazardous Materials

Fluid Uses	Fluids	Typical Quantity	Method of Storage	Storage Location
Fuels	Diesel	5,000 to 10,000 gallons	Tanks or Tankers	Contractor Yard Warehouse
	Gasoline	5,000 to 10,000 gallons	Tanks or Tankers, 5-Gallon Containers, Pick-up Tanks	Contractor Yard Warehouse
Lubricants	Engine Oil	<100 gallons	Bulk Storage Retail Packaging	Contractor Yard Warehouse Service Trucks
	Transmission/Drive Train Oil	<50 gallons	Retail Packaging on Service Trucks	Contractor Yard Warehouse Service Trucks
	Hydraulic Oil	<100 gallons	Bulk Storage Retail Packaging	Contractor Yard Warehouse Service Trucks
	Gear Oil	<50 gallons	Retail Packaging on Service Trucks	Contractor Yard Warehouse Service Trucks
	Lubricating Grease	<25 gallons	Tubes stored in paper cases	Contractor Yard Warehouse Service Trucks
Coolants, Hydraulic Fluids, Other	Ethylene Glycol	<100 gallons	Bulk Storage Retail Packaging	Contractor Yard Warehouse Service Trucks
	Propylene Glycol	<100 gallons	Bulk Storage Retail Packaging	Contractor Yard Warehouse Service Trucks
	Power Steering Fluid	<50 gallons	Retail Packaging on Service Trucks	Contractor Yard Warehouse Service Trucks
	Brake Fluid	<50 gallons	Retail Packaging on Service Trucks	Contractor Yard Warehouse Service Trucks
	Propane	25-100 gallons	Pressurized Tanks	Contractor Yard Warehouse Welding Trucks

3.0 Preventive Measures

BakkenLink will ensure that all practicable measures are implemented to minimize the potential for and consequences of a spill during construction of the Project and related facilities. BakkenLink intends to comply with applicable environmental and safety laws and regulations and to provide training and equipment designed to prevent pollution. The Contractor will ensure that a copy of this SPCC Plan is available onsite to all construction crew members. In addition, Contractors will ensure that construction crew members are properly trained in handling fuels to prevent spills and to effectively contain spills, and that equipment required to implement the provisions of this SPCC Plan are available on site.

BakkenLink will provide training on the provisions of this SPCC Plan to Construction and Inspection personnel.

3.1 Staging Areas/Work Yards

Fuel and hazardous liquid storage will require secondary containment structures as described below:

- The Contractor will construct temporary liners and seamless berms around aboveground bulk tanks so that in the event of a leak or spill, liquids will be contained and collected in specified areas that are isolated from water bodies. Storage tanks will not be placed in areas subject to periodic flooding and washout.

- The Contractor will visually inspect aboveground tanks frequently and whenever the tank is refilled. The Contractor will maintain inspection records for every tank.

- Secondary containment structures must be constructed so that no outlet is provided and any spill will be contained within the containment structure. Accumulated rainwater may be removed if authorized by an Environmental Inspector. Accumulated water that has a visible sheen will be collected for proper storage and disposal.

- The Contractor will remove secondary containment structures at the conclusion of the Project. The Contractor is also responsible for returning the storage impoundment area to its original ground contours and appearance upon completion of the Project.

- Fuels and lubricants will be stored only at designated staging areas and in proper service vehicles. The storage area will be at least 100 feet away from the edge of a wetland or waterbody, at least 200 feet away from a private water supply well, and at least 400 feet away from a municipal water supply well, unless a larger buffer is required by governing agencies.

- Storage containers will display labels that identify the contents of the container and whether the contents are hazardous. Appropriate labels will identify the specific hazard (flammable, toxic, etc) will be affixed to the containers and readily visible. The Contractor shall maintain and furnish on demand to BakkenLink copies of all Material Safety Data Sheets.

- To the extent practicable, Contractors will conduct routine equipment maintenance such as oil changes in staging areas and will dispose of waste oil in a proper manner (e.g. place in labeled, sealed containers and transport to a recycling facility).

- The Contractor will correct visible leaks in tanks as soon as possible.

- Drain valves on temporary storage tanks will be locked to prevent accidental or unauthorized discharges from tanks.

- Fuel nozzles shall be equipped with functional automatic shut-off valves.

- Drivers of tank trucks shall be responsible for spill prevention during tank truck unloading. Procedures for loading and unloading tank trucks will meet the minimum requirements established by the Department of Transportation. Drivers will observe and control the fueling operations at all times to prevent overfilling.

- Prior to departure of a tank truck, outlets of the vehicle will be examined by the driver for leakage, and tightened, adjusted, or replaced as required to prevent liquid leakage while in transit.

- The Contractor shall stock a sufficient supply of sorbent and barrier materials at the construction staging area to allow the rapid containment and recovery of a spill. Sorbent and barrier materials will be utilized to contain runoff from spill areas.

- Shovels and labeled 55-gallon drums will be kept at each of the staging areas. If small quantities of soil become contaminated within a staging area, they will be collected and placed in the drums. Large quantities of contaminated soil will be collected using heavy equipment and stored in drums or other suitable containers prior to disposal. Disposal of contaminated soil will be in accordance with applicable state and federal regulations. Typical disposal methods will include transporting the soil to a licensed disposal or treatment facility or thin-spreading in compliance with state guidelines.

3.2 Right-of-Way

The following preventive measures apply to refueling and lubrication activities within the construction right-of-way:

- Refueling and lubricating of construction equipment will be restricted to upland areas located at least 100 feet from stream channels and wetlands, at least 200 feet from private water supply wells, and at least 400 feet from municipal water supply wells. Where this is not feasible, the equipment will be fueled and lubricated by designated personnel with specific training in refueling, lubricating, and spill containment and cleanup.

- Fuel trucks transporting fuel to construction areas shall travel only on approved access roads.

- Equipment shall not be washed in streams.

- Fuel and service trucks shall carry a minimum of 20 lbs. of suitable commercial sorbent and barrier materials.

3.3 Vulnerable Aquifer Areas

The Contractor's Construction Superintendent or designated Spill Coordinator must immediately notify the BakkenLink Representative and the Environmental Inspector of any release or spill of a petroleum product or hazardous liquid, regardless of volume. The Spill Coordinator shall implement the following response actions:

- Follow spill containment response actions described in Section 4 below.

- Immediately excavate obviously impacted soils. Store and dispose of impacted soils in accordance with this SPCC Plan.

4.0 Spill Response

The response action priorities upon discovery of a spill are to protect the safety of personnel and the public, minimize environmental impacts, and control costs associated with cleanup and restoration. Key actions immediately following discovery of a spill are:

- Assess the safety of the situation, both in the immediate vicinity and for the surrounding public.
- Remove sources of ignition if it is safe to do so.
- Shut off the source of the spill if it is safe to do so.

The person discovering a spill shall promptly notify the Spill Coordinator, the Environmental Inspector, and the Construction Superintendent. The Spill Coordinator shall implement spill control measures as described below.

4.1 Land Spill Response

Implement the following response actions for spills on land:

- Construct berms using available equipment and/or deploy barrier materials to contain the spill.
- Apply sorbent materials to the spill area.
- Minimize traffic on contaminated soils.
- Excavate contaminated soils and vegetation and transport to a licensed and approved treatment or disposal facility.

4.2 Wetland or Waterbody Spill Response

Implement the following response actions for spills in or near a wetland or waterbody:

- Implement the response actions described in Section 4.1 in shoreland areas. Excavate trenches if necessary to create collection sumps to prevent liquids from entering wetlands or waterbodies.
- If a spill occurs into a stream, lake, or other waterbodies containing standing or flowing water, the BakkenLink Representative shall notify the National Response Center immediately.
- Secure the services of an Emergency Response Contractor (see Appendix B) if required to assist with containment and cleanup of the spill.
- Deploy booms, curtains, and sorbents to minimize the spread of the spill.

- Use skimmer pumps and holding tanks to remove released materials from the water surface.

- Excavate contaminated soils from wetlands and place on plastic sheeting in an approved containment area located at least 100 feet from the wetland and waterbodies. Cover stockpiled soil with plastic sheeting. Remove stockpiles as soon as practicable and transport to a licensed and approved treatment or disposal facility.

- Restore the contaminated area in accordance with recommendations from site remediation specialists and as required by state guidelines.

4.3 Field Coordinator

Subject to approval by BakkenLink, the Contractor shall appoint a Field Coordinator who will be responsible for reporting of spills, coordinating Contractor personnel for spill cleanup, completing subsequent site investigations, and preparing incident reports. The Field Coordinator will report to the designated BakkenLink Representative and the Environmental Inspector. The BakkenLink Representative will contact and report to state and federal agencies as required.

5.0 Unanticipated Discovery of Hazardous Materials

Soil contamination, not directly resulting from construction of the pipeline, may be encountered during construction of the BakkenLink pipeline. Locations where contamination may be present include:

- Third party pipeline crossings;
- Oil and natural gas processing facilities;
- Injection/disposal wells;
- Undocumented disposal/dump sites; and
- Agricultural equipment refueling, pesticide/herbicide loading areas, and storage areas.

Identification and recognition of existing contamination is the first step in the response action. During construction, indicators of possible contamination include, but are not limited to:

- Gasoline smells or other odors which emanate when the earth is disturbed;
- Stained or discolored earth in contrast with adjoining soil;
- Oily residue intermixed with earth;
- Sheen on groundwater;
- Fill material containing debris other than construction-related items;
- Household trash covered by earth or industrial waste debris;
- Rusted barrels and containers;
- Cinders and other combustion products like ash; and
- Structures such as asbestos cement (transite) pipe, abandoned oil & gas lines, and underground storage tanks also require special handling when disturbed.

When unanticipated soil contamination is discovered in the right-of-way (ROW), especially if it will be excavated, the appropriate response actions will need to be performed to address the contamination. The following are the major steps that should be taken when contamination is discovered:

- Recognize that the area may be contaminated with hazardous materials;
- Secure the site to protect workers and the public;

- Do not allow the prime contractor, subcontractor, or other personnel to handle or disturb the contaminated material or the surrounding soil;

- Notify the Environmental Inspector(s) and construction manager(s).

The Environmental Inspector will in turn notify the proper authorities (North Dakota Department of Health (NDDH) contact information is given in Section 7). Reporting procedures are similar to those employed if a spill has occurred.

In no instance will an effort be made to characterize the contamination or begin remedial action(s), including hauling and disposal of the contaminated soil, until the NDDH has made a determination as to the appropriate action(s) to take. The Contractor shall make every effort to limit the spread of contamination and shall employ mitigation or protection measures to prevent the contamination from reaching a water supply well, surface water, stockpiled material, and other construction areas.

6.0 Training

BakkenLink will provide spill prevention and response training and safety training to its supervisory and inspection personnel. In addition, training will be required of all construction personnel. Training will be required before construction personnel are allowed to enter the ROW. The training program will be designed to improve awareness of safety requirements, pollution control laws, proper operation and maintenance of equipment, and implementation of spill response actions.

7.0 Reporting Procedures

BakkenLink will prepare a Spill Report Form (Appendix A) and notify state and federal agencies as required in the event of a release. These agencies may include but are not necessarily limited to:

National Response Center (Washington, D.C.)
Phone: 800-424-8802 (24 hours)

North Dakota Department of Health
Division of Emergency Management
24-hour State Notification (State Radio)
In-State Phone: 800-472-2121; Outside North Dakota 701-328-2121

North Dakota Division of Water Quality
Phone: 701-328-5210

BakkenLink will coordinate with these agencies regarding contacting additional parties or agencies.

Appendix A

Spill Report Form

Spill Report Form
BakkenLink Pipeline LLC

Date/Time of Spill:_____ Date/Time of Spill Discovery_____

Name and Title of Discoverer:_____
Legal Description of spill location and milepost:_____
Type, estimated volume, and manufacturer's name:_____
Media in which the release exists (circle): sand silt clay upland wetland waterbody other_____
Topography and surface conditions:_____
Proximity to wetlands or waterbodies (including ditches):_____
Proximity to private or public water supply wells:_____
Directions from nearest community:_____
Weather conditions at the time of release:_____
Describe the causes and circumstances resulting in the spill:_____
_____
_____
Describe the extent of observed contamination, both horizontal and vertical (i.e. spill stained soil in a 5-foot radius to a depth of 1 inch):_____
_____
Describe immediate spill control and cleanup methods used and implementation schedule:_____
_____
Location of excavated/stockpiled contaminated soil:_____
Describe the extent of spill-related injuries and remaining risk to human health and the environment:_____
_____
Name, company, and telephone number of responsible party (Contractor):_____
_____
Current status of cleanup actions:_____

Name and Company for the following:
Construction Superintendent:_____
Field Coordinator:_____
BakkenLink Representative:_____
Environmental Inspector:_____
Chief Inspector:_____

Government agencies notified:
Agency:_____ Date:_____
Agency:_____ Date:_____
Agency:_____ Date:_____

Landowner Notified:_____ Date:_____

Form Complete By:_____ Date:_____

Field Coordinator must complete this form for any spill, regardless of size, and submit the form to the BakkenLink Representative and Environmental Inspector within 24 hours of the occurrence. Any spill to water shall be reported IMMEDIATELY.

Appendix B

Emergency Response Contractors

Emergency Response Contractors
BakkenLink Pipeline Project

The Contractor must dispose of all wastes according to applicable state and local requirements. A listing of potential Emergency Spill Response contractors is listed below. This list was developed from state-wide databases and represents firms operating at the time the database was queried. This list is presented as a service to the user and does not represent a recommendation by the state agencies or BakkenLink. It is the user's responsibility to assure that the emergency response contractor is properly licensed. Selection of an Emergency Response Contractor is subject to approval by BakkenLink.

North Dakota Contractors

United States Environmental Services 4490 Sims Street Dickinson, ND 58601	701-872-2122 888-279-9930
Earthmovers Inc. 708A – 38th Street NW Fargo, ND 58102	701-852-4560 800-373-5259
Western Plains Consulting 1102 S Washington St. Suite 210 Bismarck, ND 58504	701-221-3113 888-821-3113

Out-of-State Contractors

Bay West Environmental 5 Empire Drive St. Paul, MN 55103	651-291-0456 800-279-0456
Clean Harbors National Response Center	800-645-8265
Hulcher Services Inc. 2300 Willis Miller Drive Hudson, WI 54016	715-386-5770 800-637-5471
OSI Environmental 300 Fayal Road Eveleth, MN 55734	800-777-8542
Veolia Environmental Services Emergency Response Center	800-688-4005
West Central Environmental Consultants 14 Green River Road, PO Box 594 Morris, MN 56267	320-589-2039 800-422-8356

Appendix C

Licensed Waste Disposal Facilities

Licensed Waste Disposal Facilities
BakkenLink Pipeline Project

The Contractor must dispose of all wastes according to applicable state and local requirements. Licensed disposal facilities in the State of North Dakota are listed below. This list was developed from state-wide databases and represents facilities operating at the time the database was queried. This list is presented as a service to the user and does not represent a recommendation by the state agencies or BakkenLink. It is the Contractor's responsibility to assure that the facility is properly licensed.

North Dakota Facilities

Bismarck Municipal Landfill 2111 N 52nd Street Bismarck, ND 58506	701-355-1700
Dakota Landfill 7972 129th Avenue SE Gwinner, ND 58040	701-678-2306
Dickinson Municipal Landfill 3389 Energy Drive Dickinson, ND 58601	701-456-7783
Dishon Disposal Williston, ND 58801	701-572-9079
Fargo Municipal Landfill 4501 7th Avenue N. Fargo, ND 58102	701-241-1449
Grand Forks Municipal Landfill 724 North 47th Street Grand Forks, ND 58206	701-738-8740
Indian Hills Disposal 14070 43rd Street NW Williston, ND 58801	701-774-8514
Jahner Sanitation 7971 32ne Avenue SE Wishek, ND 58495	701-452-2666
Jamestown Municipal Landfill 8980 35th Street SE Jamestown, ND 58401	701-252-5900
McDaniel Landfill, Inc. 12300 247th Avenue Sawyer, ND 58781	701-624-5250

McKenzie County Sanitary Landfill 2491 132nd Avenue NW Watford City, ND 58854	701-5863445
Mercer County Regional Landfill 5251 County Road 26 Hazen, ND 58545	701-748-5839
Minot Municipal Landfill 3100 20th Avenue SW Minot, ND 58701	701-857-4140
Noonan Landfill Noonan, ND 58765	701-838-1182
Prairie Disposal Tioga, ND 58852	800-490-2160
Sawyer Disposal Services 12400 247th Avenue SE Sawyer, ND 58781	701-624-5622
Williston Municipal Landfill 5176 134th Avenue NW Williston, ND 58801	701-577-6368

Appendix XVII

Stormwater Pollution Prevention Plan (SWPPP)

Storm Water Pollution Prevention Plan (SWPPP)

BakkenLink Pipeline LLC

MCKENZIE AND WILLIAMS COUNTIES, NORTH DAKOTA

NDPDES Permit #NDR-10-000

August 2014

Storm Water Pollution Prevention Plan (SWPPP) BakkenLink Pipeline LLC

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APPENDICES

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Appendix B Notice of Termination
Appendix C Inspection Log
Appendix D Delegation of Authority
Appendix E Corrective Action Log

1.0 Introduction

BakkenLink Pipeline LLC is proposing to build, own, and operate an approximately 34-mile long pipeline for the transportation of crude oil from existing and proposed truck receipt locations and pipeline gathering receipt stations. The proposed pipeline will be constructed in portions of McKenzie and Williams counties, North Dakota (Figure 1).

1.1 Plan Purpose/Objectives

The Storm Water Pollution Prevention Plan (SWPPP) shall identify potential sources of pollution, which may reasonably be expected to affect the quality of storm water discharges from construction of the pipeline. The SWPPP shall describe and ensure the implementation of mitigation or protection measures, which will be used to reduce the pollutants in storm water discharges associated with construction activity at the construction site and to assure compliance with the terms and conditions of this permit.

The SWPPP shall:

- Be completed prior to initiating construction activities and updated as appropriate; and
- Provide for compliance with the terms and schedule of the SWPPP beginning with the initiation of construction activities.
- For the purposes of this plan, runoff management is defined as practices that divert, infiltrate, reuse, or treat storm water runoff, and not practices that limit exposure of potential pollutants to direct rainfall or runoff. The purpose of the SWPPP is to:
- Identify sources of pollutants associated with construction activities that may affect the quality of storm water runoff from construction sites; and
- To identify storm water management practices to abate pollutants in storm water discharges from the construction site, both during and after construction.

This SWPPP has been designed to outline the specific measures implemented at the construction site for minimizing potential pollutants that may otherwise impact storm water runoff during construction. Mitigation or protection measures are used to prevent or minimize the discharge of pollutants. Specific mitigation or protection measures for minimizing runoff and erosion are described in Sections 4 and 5 of this SWPPP. Mitigation or protection measures should be employed to properly cover and store materials, minimize contact of materials with rainfall and runoff, minimize waste, properly dispose of waste, and recycle where possible.

1.2 Facility Conformance and Regulatory Compliance

This SWPPP has been developed in compliance with Standard Conditions provided at 40 CFR 122.41 and as defined at 40 CFR 122.26. Enforcement of these provisions is delegated to the North Dakota Department of Health (NDDH) for activity within the State of North Dakota. The NDDH authorizes permits to discharge under the North Dakota Pollution Discharge Elimination System (NDPDES) rules found in Chapter 33-16-01 promulgated under Chapter 61-28 of the North Dakota Century Code. Further information regarding the requirements of the NDPDES can be found at http://www.ndhealth.gov/WQ/Storm/Construction/ConstructionHome.htm.

Together with inspection reports, maintenance reports, and data records for the construction activities, this SWPPP shall be retained at the construction site during construction. In addition, a record of revisions to the SWPPP (Appendix A) shall be retained at the construction site.

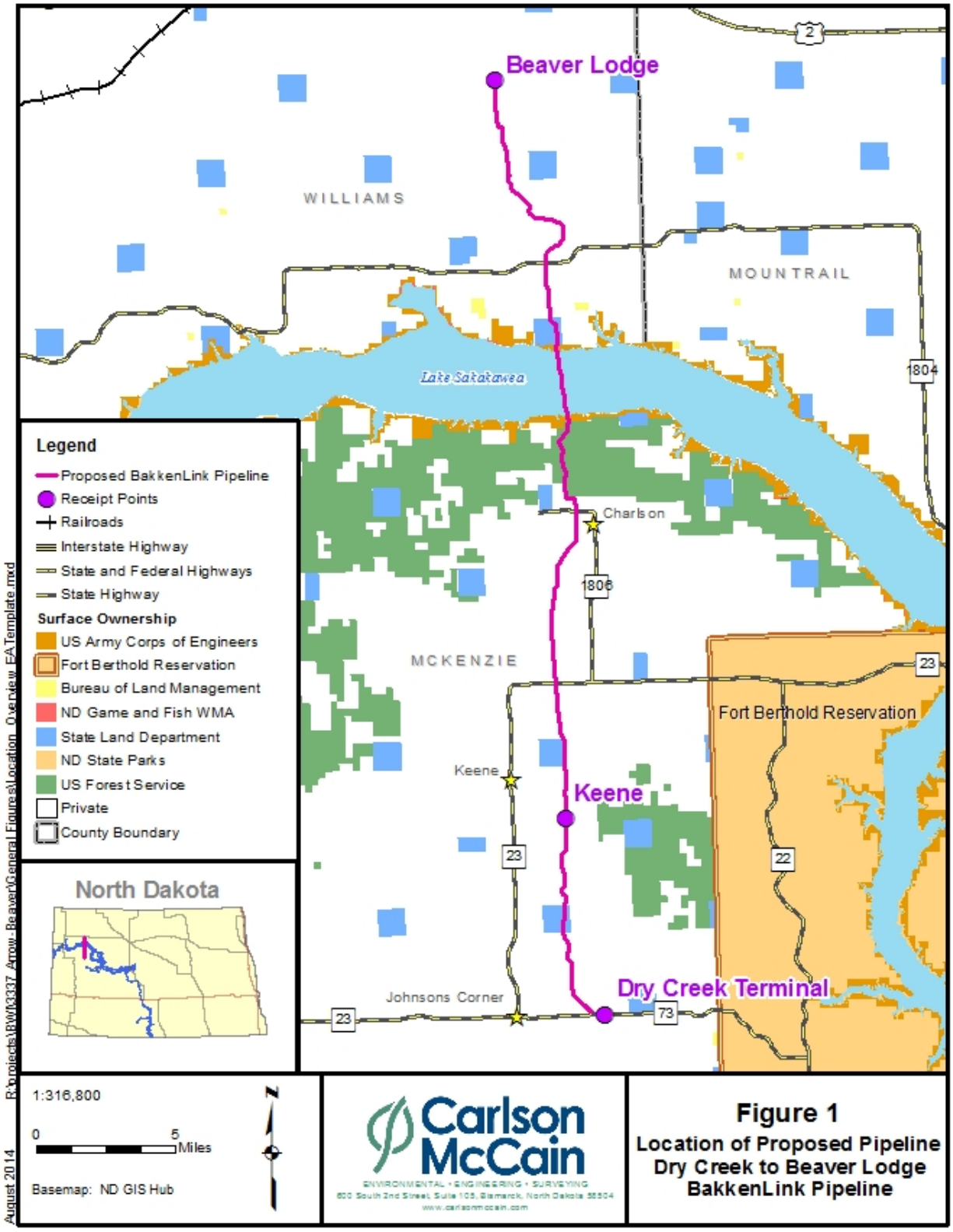


Figure 1. Location Map.

Reports and records will be made available, upon request, for a period of at least three (3) years following final site stabilization. Further information on record keeping is provided in Section 10 of this SWPPP.

Conformance with the requirements of this SWPPP includes timely inspections, proper maintenance, record keeping, tracking, and documentation. Required maintenance will be conducted as soon as practicable before the next anticipated storm event. If existing mitigation or protection measures need to be modified or additional mitigation or protection measures are necessary, corrections will be completed before the next anticipated storm event.

1.3 Termination Clause

This SWPPP will cease to be valid within thirty (30) days after:

- Final stabilization of the entire site;
- Another operator has assumed control of the unstabilized areas of the site; or
- Temporary stabilization has been completed and control has been transferred to the property owner.

A Notice of Termination (NOT) will be filed with the NDDH upon completion of any of the above criteria. A copy of the NOT is included as Appendix B.

2.0 Responsible Party/Signatory Certification

BakkenLink has prepared this SWPPP in compliance with the requirements of the NDPDES General Permit for Discharges for Large and Small Construction Activities (Permit Number NDR 10-1000) as administered by the NDDH. BakkenLink is responsible for implementing the provisions of this operational control over the construction plans and specifications, including the ability to make modifications to those plans and specifications, or day-to-day operational control of those, which are necessary to ensure compliance with the SWPPP for the site or other permit conditions.

Operator
BakkenLink Pipeline LLC
333 Clay Street, Suite 4060
Houston, Texas 77002
Off 713.800.7994
Fax 281.833.8281

Project Manager
Darren Snow
BakkenLink Pipeline LLC
2101 46th Ave SE
Mandan, ND 58554
Ph: 701-751-3401

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____ **Title:** _____

Signature: _____ **Date:** _____

3.0 Delegation of Authority

BakkenLink will own and operate the pipeline; however, construction of the pipeline will be performed by independent Contractors and construction inspectors hired by BakkenLink. These Contractors and inspectors will have day-to-day responsibility to ensure compliance with this SWPPP. BakkenLink, by completing the Delegation of Authority Form (following page), grants authority to the named parties to act on its behalf on matters pertaining to this SWPPP. Any signed Delegation of Authority form shall be kept with this SWPPP at all times.

Delegation of Authority Form

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the _____ construction site. The designee is authorized to sign any reports, storm water pollution prevention plans and all other documents required by the permit.

_____ (name of person or position)
_____ (company)
_____ (address)
_____ (city, state, zip)
_____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in _____ (Reference State Permit), and that the designee above meets the definition of a "duly authorized representative" as set forth in _____ (Reference State Permit).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____

Company: _____

Title: _____

Signature: _____ **Date:** _____

4.0 Project Description

The project consists of a pipeline transportation system to transport crude oil from existing and proposed truck stations and gathering systems located in McKenzie and Williams Counties. The pipeline will be installed within a defined right-of-way (ROW). The temporary construction ROW will be 100 feet wide. The temporary construction ROW may be reduced in some areas as necessary to avoid impacts to environmentally sensitive areas. The pipeline is proposed to be constructed in rural areas with no established storm water drainage systems. Local roads are predominantly gravel/clay. Several major paved roads exist in the area.

Generally, the permanent pipeline ROW will be 50 feet wide, with the pipeline centered within that ROW. The location of the pipeline within the permanent ROW may vary depending on terrain, the presence of other existing facilities, and landowner requests.

Additional temporary workspace will be required at certain locations (e.g. road, railroad, and river crossings). These workspace areas may vary in size depending on the feature being crossed and crossing construction method(s).

Equipment and pipe storage areas will also be required. These areas may not be located adjacent to the proposed ROW. Off-site material storage areas (also including overburden and stockpiles of dirt, borrow areas, etc.), used solely by the permitted project, are considered a part of the project and shall be subject to the same control requirements as the ROW.

4.1 Sequence of Construction Activity

Pipeline construction is much like a moving assembly line. The construction activities will occur in the general order listed and include, but are not limited to, the following:

- Clearing
- Grading
- Stringing
- Bending
- Welding
- Ditching (excavation)
- Laying pipe
- Backfill
- Tie-ins
- Clean up

In general, construction will proceed along the pipeline in one continuous operation. As construction proceeds along a spread, construction at any single point along the pipeline, from initial surveying and clearing, to backfilling and finish grading is anticipated to last about six to ten weeks. Different phases of construction may occur at multiple locations at the same time. The entire process will be coordinated in such a manner as to minimize the total time an individual tract is disturbed, exposed to erosion, or temporarily precluded from its normal use.

4.2 Construction Site Estimates

Total disturbed acres (assume 100-foot temporary ROW) = 412 acres
Temporary workspace acres = ~10 acres
Storage yard(s) acres (assume two yards @ 40 acres each) = 80 acres

4.3 Soils, Slopes, Vegetation, and Drainage Patterns

The pipeline route traverses varying terrain, from nearly level cropland to rugged badlands. The construction ROW will be cleared and graded (where necessary) to provide a relatively level surface for construction equipment, a sufficiently wide workspace for the passage of heavy equipment, and safety for pipeline workers. The construction contractor will limit ground disturbance wherever possible. Natural features will be retained to the maximum extent possible. Native vegetation, especially trees, is to be retained to the maximum extent possible.

To avoid soil mixing, topsoil will be removed and segregated from underlying subsoil. Topsoil will be stored separately from subsoil and protected from construction-related activities. Topsoil is typically stored at the far edge of the ROW on the opposite side of the trench from where construction machinery does its work.

Once the pipeline is installed, the trench will be backfilled and then compacted while grading. Disturbed areas will be restored to their original contours and condition to the extent practical, unless landowner consent is obtained to do otherwise. After grading is complete and during the process of backfilling, final stabilization measures will be taken to ensure minimal erosion. In general, the ROW will revert to the previous land use after construction is completed and during operation of the pipeline.

The general flow of storm water will remain the same throughout the project. Measures will be taken to ensure the minimal amount of erosion possible, as well as the least impact on the receiving bodies of water.

4.5 Receiving Waters

A comprehensive wetland and waterbody delineation survey has been conducted along the entire route. The proposed pipeline will cross wetlands and intermittent and perennial waterbodies. The location of delineated wetlands and waterbodies are indicated on the construction drawings. In general, the following practices will be observed at these locations:

- In wetland or riparian zones, the Contractor will install sediment control structures along the construction right-of-way edges prior to vegetation removal where practicable.
- Where waterbodies or wetlands are adjacent to the construction right-of-way, the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way.
- Sediment barriers will be installed across the entire ROW immediately upslope of the wetland boundary at all standard (saturated or standing water) wetland crossings as necessary to prevent sediment flow into the wetland. Sediment control barriers are not required at “dry” wetlands.
- Sediment barriers will be installed across the entire ROW immediately upslope of any flowing waterbody or impoundment.

5.0 Erosion and Sediment Control Mitigation or Protection Measures

Erosion and sediment controls include stabilization practices, as well as structural controls. General structural practices may include, but are not limited to, silt fences, earth dikes, drainage swales, sediment traps, check dams, reinforced soil retaining systems, gabions, temporary or permanent sediment basins and flow diversion. Typical erosion control details are included in Appendix C. Temporary erosion and sediment control measures shall be installed immediately after initial disturbance of the soil, maintained throughout construction (on a daily basis), and reinstalled as necessary until replaced by permanent erosion control structures or restoration of the construction ROW is complete.

Specifications and configurations for erosion and sediment control measures may be modified by BakkenLink as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

The intent of the mitigation or protection measures is to prevent any damage due to transported sediments or adding any erosion burden by diverting storm water runoff into sensitive areas. The intent is not to vegetate areas that are not naturally vegetated, but to prevent the increase of erosion rates over and above what is caused by natural drainage in the area. In general:

- Construction-phase erosion and sediment controls should be designed to retain sediment on-site to the maximum extent practicable.
- All control measures must be properly selected, installed, and maintained in accordance with the manufacturer's specifications and good engineering practices. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the permittee must replace or modify the control for site situations.
- If sediments escape the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize off-site impacts.
- Sediment must be removed from sediment traps or sedimentation ponds when design capacity has been reduced by 50%.
- Litter, construction debris, and construction chemicals exposed to storm water shall be prevented from becoming a pollutant source for storm water discharges (e.g., screening outfalls, picked up daily, etc.).
- Ensure that silt fences are intact and that there are no gaps at the fence-ground interface or tears along the length of the fence. If gaps or tears are found, they should be repaired or the fabric should be replaced immediately. Accumulated sediments should be removed from the fence base when the sediment reaches one-third to one-half the height of the fence.
- Large debris, trash, and leaves should be removed from check dams (hay bales).

The center of a check dam should always be lower than its edges. If erosion or heavy flows cause the edges of a dam to fall to a height equal to or below the height of the center, repairs should be made immediately. Accumulated sediment should be removed from the upstream side of a check dam when the sediment has reached a height of approximately one-half the original height of the dam (measured at the center).

Sediment control barriers shall be placed so as not to hinder construction operations. If silt fence or straw bale sediment barriers (in lieu of drivable berms) are placed across the entire construction ROW, a provision shall be made for temporary traffic flow through a gap for

vehicles and equipment to pass within the structure. Immediately following each day's shutdown of construction activities, a row of straw bales or a section of silt fence shall be placed across the upgradient side of the gap with sufficient overlap at each end of the barrier gap to eliminate sediment bypass flow, followed by bales tightly fitted to fill the gap. Following completion of the equipment crossing, the gap shall be closed using silt fence or straw bale sediment barrier.

The Contractor shall remove sediment barriers, except those needed for permanent erosion and sediment control, during cleanup of the construction right-of-way. The following sections describe erosion and sediment goals to be considered during construction and practices expected to be implemented to achieve those goals during construction.

5.1 Run-on Protection

The pipeline ROW will be graded to provide relatively flat surfaces that facilitate the movement and maneuvering of heavy equipment. Natural drainage swales will be utilized to the extent possible when planning locations to intercept, divert and convey storm water and runoff around the ROW. Some minor contouring may be necessary to enhance the drainage and take advantage of the natural drainage characteristics of the terrain; however, to capture sediment transported by overland flow, some structural mitigation or protection measures may be installed. These include:

- Earthen dikes established on high side of location to intercept, divert and convey storm water and/or runoff around the project site.
- Trenching/ditching around high side of location to intercept, divert and convey surface runoff around the project site.

Drainage channels or ditches shall be used on a limited basis to provide drainage along the construction right-of-way and toe of cut slopes as well as to direct surface runoff across the construction right-of-way or away from disturbances and onto natural undisturbed ground. Channels or ditches shall be constructed by the Contractor during grading operations. Where there is inadequate vegetation at the channel or ditch outlet, sediment barriers, check berms, or other appropriate measures shall be used to control erosion.

5.2 Stabilizing Soils

The soils that generally will require stabilization are those used for berm construction and soil stockpiles. Stabilization methods include, but are not limited to, soil compaction and seeding of disturbed soil once backfilling and/or grading is complete. General stabilization practices may include, but are not limited to, establishment of temporary vegetation, establishment of permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other appropriate measures.

Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. Reseeding with an approved seed mix should be completed in areas (uncultivated) that have no traffic. Erosion control matting may be installed on slopes, as needed.

Interim stabilization practices are not expected to be needed or implemented during active construction. Wherever possible, existing vegetation will remain in place to minimize erosion potential. Final re-vegetation and stabilization of each disturbance area will occur once active construction is completed.

Topsoil piles should be stabilized as soon as practical after stripping is complete. Topsoil piles may be stabilized by seeding with an approved temporary seed mixture or by hydromulching.

Soil stockpile may be stabilized by wetting with water, or by the use of soil tackifiers. When wetting topsoil piles with water does not prevent wind erosion, the Contractor shall temporarily suspend topsoil handling operations and apply a tackifier to topsoil stockpiles at the rate recommended by the manufacturer. Should construction traffic, cattle grazing, heavy rains, or other related construction activity disturb the tackified topsoil piles and create a potential for wind erosion, additional tackifier shall be applied by the Contractor.

5.3 Slope Protection

Use berms to divert location flow from slopes to established drainages where practical. Minimize removal of existing vegetation on new locations. Use approved seed to reseed/vegetate existing locations in areas no longer traveled.

Trench breakers shall be installed in steep terrain where necessary to limit the potential for trench line erosion and at the base of slopes adjacent to waterbodies and wetlands. Trench breakers shall be constructed of materials such as sand bags, sand/cement bags, bentonite bags, or other suitable materials. The Contractor shall not use topsoil in trench breakers.

Permanent slope breakers (water bars) shall be constructed of soil or, in some instances, sand bags. The Contractor shall construct permanent slope breakers on the construction right-of-way where necessary to limit erosion, except in cultivated areas. Slope breakers shall divert surface runoff to adjacent stable vegetated areas or to energy-dissipating devices. In general, permanent slope breakers should be installed immediately downslope of all trench breakers. Permanent slope breakers shall be installed as specified on the construction drawings or generally with a minimum spacing as shown on the following table:

Slope (%)	Spacing (feet)
5 - 15	300
>15 – 30	200
>30	100

The gradient (fall) for each slope breaker shall be two percent to four percent unless otherwise approved by BakkenLink based on site-specific conditions.

Manufactured erosion control mats shall be installed across areas that have eroded and cannot be stabilized by normal seeding and mulching practices. Erosion control matting shall be made of biodegradable, natural fiber such as straw or coir (coconut fiber).

The Contractor shall prepare the soil surface and install the erosion control matting to ensure it is stable and the matting makes uniform contact with the soil of the slope face or waterbody bank with no bridging of rills, gullies, or other low areas. Mats shall be properly anchored.

5.4 Perimeter Controls and Sediment Barriers

The Contractor shall install silt fence or fiber rolls (wattles) as necessary to provide a sediment barrier. Sediment barriers should be installed at the lowest elevation of the location, at the boundary where disturbed (bare) soils meet undisturbed (vegetated) soils. Sediment barriers should be installed in ditches along the lower perimeter of locations. Straw bales may be installed as an alternative to silt fence or fiber rolls.

If none of the above mitigation or protection measures are effective, installation of systems that are more complex are required. This may include the construction of sediment traps or detention basins.

5.5 Construction Entrance/Exits

Accumulations of tracked and deposited sediment on paved roadways must be removed within 24 hours or sooner if required by local authorities.

5.6 Concrete Wash Water

Concrete wash water may not be discharged to any water of the state or allowed to drain onto adjacent properties. The Contractor shall designate an area for cement washout. The area must be sufficient to contain the wash water and residual cement.

5.7 Additional Mitigation or Protection Measures

Additional/optional mitigation or protection measures will be used as necessary when other methods are not effective. Mitigation or protection measures are subject to approval from the project engineer as well as permitting/land management agencies. Other mitigation or protection measures will be used site-wide to minimize pollutants in storm water from other potential sources in accordance with the control requirements. These include:

Waste Disposal – No solid materials, including building materials, shall be discharged to waters of the State. Solid materials refer to such items as boards, wrapping materials, bricks and concrete debris, and land clearing debris such as leaves and tree limbs, but do not include total suspended solids.

Off-Site Vehicle Tracking – Mitigation or protection measures will be used in the minimization of vehicle tracking of sediments off-site and minimization of dust generation. The construction site will have limited access. Gravel drives will be used at the entrances to undeveloped areas.

State/Local Sanitary Sewer, Septic System or Waste Disposal Regulations – All sanitary wastewater from temporary facilities located within the construction site (trailers, portable toilets, etc.) will be removed for disposal off-site by a contractor. No sanitary wastewater will be discharged from the construction site.

Storage of Construction and Waste Materials – Vehicle maintenance, repair, refueling, and cleaning will be performed in a designated area at the construction site in order to minimize the potential for contamination of storm water by oil and grease. Any waste oil collected during such activities will be collected in drums or other compatible oil container

and will be removed from the site. All waste collected from the site will be disposed of off-site at a registered waste disposal facility. There will be no on-site storage of gasoline or diesel for refueling vehicles.

5.8 Maintenance

Maintenance of the erosion and sediment control mitigation or protection measures will be conducted in a timely manner once the need for maintenance activities are deemed necessary. If during inspections, a mitigation or protection measures requiring maintenance is identified, the maintenance will be accomplished prior to the next anticipated storm event, or as necessary to maintain the continued effectiveness of the mitigation or protection measures. When maintenance of the mitigation or protection measures cannot be accomplished prior to the next storm event, the maintenance will be scheduled and performed as soon as practicable.

Except for sediment basins, all accumulated sediment shall be removed from structural controls when sediment deposits reach 1/3 to 1/2 the height of the control. For sediment basins, accumulated sediment shall be removed when the capacity has been reduced by 50%. All removed sediment deposits shall be property disposed of. Non-functioning controls shall be repaired, replaced, or supplemented with functional controls within 24 hours of discovery or as soon as field conditions

6.0 Good Housekeeping Mitigation or Protection Measures

Good housekeeping is used to maintain a clean and orderly workplace and to reduce the potential for accident spills or releases of materials that could contaminate storm water. Generally, the following general good housekeeping mitigation or protection measures will be used:

- Designate areas for equipment maintenance and repair. These areas must have provisions to contain any potential pollutants in an area that can be regularly removed and properly disposed.
- Establish proper equipment/vehicle fueling and maintenance practices (drip pans, spill kits).
- Spills that occur shall be cleaned up immediately and reported, as necessary.
- Designate equipment wash-down areas and provide appropriate control of wash water.
- Construction materials should be stored in designated areas until these materials are required and should be loaded and off-loaded in the designated areas.
- Each contractor and subcontractor is encouraged to bring to the job site only the material to be used that day.
- Large items should be placed next to their installation locations to minimize handling.
- Provide protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials. If such materials are used, these storage areas should be enclosed with temporary fencing where practical. Curbing/temporary berms can be provided to minimize storm water run-on onto storage areas.
- Provide waste receptacles at convenient locations and provide regular collection of wastes.
- Debris and waste should be properly disposed of according to the applicable federal, state, and local laws.
- Provide adequately maintained sanitary facilities.
- Contractors/subcontractors should be provided with a storage yard in which to park vehicles during off-hours.
- Drums and tanks will be clearly tagged and labeled.
- Tanks and equipment will be regularly inspected.

6.1 Material Handling and Waste Management

The Contractor shall keep the ROW policed of all trash and debris. Garbage will be stored in a dumpster and its contents disposed of according to local and state regulations at an approved facility. No burning or burying of garbage will be allowed.

Portable chemical toilets will be provided for construction personnel. Portable toilets shall not be located near drainage facilities or in areas that will collect/accumulate water. Sewage shall be disposed of according to local and state requirements

6.2 Material Staging Areas

The Contractor shall follow these guidelines at material staging areas:

- Store materials indoors when possible.

- Do not store any hazardous materials on the ground.
- Store bags and boxes on pallets under cover and liquids in drums under cover. Insure that all bags/boxes are completely covered when not being used.
- Store materials in their original packages with the original product labels. Have MSDS information available on site for all materials.
- Provide for proper containment in accordance with the Spill Prevention Control and Countermeasure (SPCC) Plan developed for the project.
- Store all products with sufficient space to allow for spill cleanup and emergency response access.

6.3 Equipment/Vehicle Fueling and Maintenance

Fuel will be delivered to the construction areas via steel tanks mounted in pick-up trucks or by bulk delivery trucks. Trucks shall be equipped with spill containment kits and tools. All personnel engaged in refueling operations on site will be required to attend all nozzles or transfers during the entire time fuel transfer is occurring.

Oil and oily wastes, such as crankcase oil, cans, rags, and paper dropped in oil and lubricants, can be best disposed of in proper receptacles or recycled. Waste oil for recycling should not be mixed with degreasers, solvents, antifreeze, or brake fluid. Dumping of these wastes in storm sewers and other drainage channels is illegal and could result in fines or job shutdown.

A further source of these pollutants is leaky vehicles. Proper maintenance of equipment and placing tarps/drip pans underneath vehicles parked for a period of one or more days will further reduce pollution by this source. Refer to the SPCC Plan prepared for further guidance.

6.4 Additional Mitigation or Protection Measures

Wash facilities will not be provided to clean mud/dirt from construction equipment/vehicles. If excessive mud is on vehicles, use shovels and or brooms to brush off prior to entering county roads.

7.0 Post-Construction Mitigation or Protection Measures

Post construction activities shall, at a minimum, include:

- Reseeding/restoration of areas not needed for agricultural operations.
- Drainage ditches, earthen dikes, drainage swales, and other sediment control and diversion structures shall remain in place. Those not made permanent should be made permanent prior to final stabilization of the project area.
- Any exposed slopes should be protected using already established mitigation or protection measures cited above.
- Reference is made to all of the above mitigation or protection measures specifications mentioned previously in this plan and they are hereby incorporated into this section of the plan.

Only certified, weed-free, seed will be used for reseeding. Once the points of disturbance have been re-contoured, broadcast seeding will be used as the application method for re-vegetation. If necessary, the seeded area will be lightly dragged after broadcasting the seed in order to get ¼- to ½-inch soil coverage and certified noxious weed-free mulch, composed of either annual grain residue or native hay, will be crimped into the soil. If seeding is done by drill seeding methods, the rates above will be reduced by 50%.

Final stabilization means that all soil-disturbing activities at the site have been completed and all soils must be stabilized by a uniform perennial vegetative cover with a density of 70 percent over the entire pervious surface area, or other equivalent means necessary to prevent soil failure under erosive conditions and;

a. All drainage ditches, constructed to drain water from the site after construction is complete,must be stabilized to preclude erosion;
b. All temporary synthetic, and structural erosion prevention and sediment control mitigation or protection measures (such as silt fence) must be removed as part of the site final stabilization; and
c. The permittee(s) must clean out all sediment from conveyances and from temporary sedimentation basins that will be used as permanent water quality management basins. Sediment must be stabilized to prevent it from being washed back into the basin, conveyances or drainage ways discharging off-site; or to surface waters. The cleanout of permanent basins must be sufficient to return the basin to design capacity.

8.0 Potential Sources of Pollution

The following substances listed below may be expected to be present on-site during construction:

- Concrete
- Detergents
- Paints (enamels and latex)
- Metal studs
- Fertilizers
- Fuels
- Cleaning solvent
- Lubricants
- Wood
- Pipe coatings/lubricants

The most economical and effective way to control pollutants other than sediment is to exercise good housekeeping practices and to require construction workers, planners, engineers, and developers to be aware of the need to comply with federal, state, and local regulations. The following sections discuss practices that will minimize the potential for pollutants to enter storm water discharges.

Petroleum products are commonly used during construction activities. These products are used as fuels and lubricants for vehicular operations, power tools, general operation, and equipment maintenance. These pollutants include oils and fuels such as gasoline, diesel oil, kerosene, lubricating oils, and grease. Most of these pollutants adhere to soil particles and other surfaces easily. One of the best practices of control is to retain sediments that contain oil, if any, on the construction site.

Soil erosion and sediment control practices can effectively accomplish this. Improved maintenance and safe storage facilities will reduce the potential for contaminating construction sites. Guidelines for storing construction related products are as follows:

- Clearly label all products.
- Keep tanks off the ground.
- Keep lids securely fastened.
- Post information for procedures in case of spills. Persons trained in handling spills should be on-site or on-call at all times.
- Keep materials for cleaning up spills on-site and easily available. Spills should be cleaned up immediately and the contaminated material properly disposed of.
- Specify a staging area for all vehicle maintenance activities. This area should be away from all drainage courses.
- During subcontractor or safety meetings, remind workers about proper storage and handling of materials.

8.1 Non-Storm Water Discharge Management

Allowable non-storm water discharges are:

- Air Conditioning condensate from vehicles on location,
- Discharges from fire-fighting activities,
- Uncontaminated ground water or spring water,
- Uncontaminated excavation dewatering, and
- Landscape irrigation.

9.0 Inspections

The project area will be regularly inspected by qualified personnel to ensure that mitigation or protection measures are maintained in good and effective order. Personnel shall receive training in the SWPPP plan, SWPPP Plan implementation and mitigation or protection measures purpose, construction, use and inspection.

Erosion and sediment control measures shall be inspected on a regular basis. Disturbed areas and storage areas that are exposed to rainfall or run-on must be inspected for evidence of, or the potential for, pollutants entering site runoff. Site access shall also be inspected to determine if sediment is being tracked onto adjacent roads.

During day-to-day operations, inspections will be conducted by construction personnel. Each location is normally visited at least once per week. An inspection shall be conducted at this time and any problems areas noted on the Inspection Log (Appendix D). If all mitigation or protection measures are in place and functioning properly, a negative report should be entered.

9.1 Inspection Schedule

Routine inspections will occur a minimum of once every 14 calendar days and within 24 hours of the end of a storm event of or greater than 0.5 inches of precipitation. The frequency of inspections will be reduced if:

- The entire site is temporarily stabilized;
- Runoff is unlikely due to winter conditions (e.g., site is covered with snow, ice, or the ground is frozen);
- Construction is occurring during a seasonal arid period.

Inspections must include all areas of the site disturbed by construction activity and areas used for storage of materials that are exposed to precipitation. Sedimentation and erosion control measures identified in the SWPPP must be inspected to ensure proper operation. Discharge locations must be inspected to ascertain whether erosion control measures are effective. . Locations where vehicles enter or exit the site must be inspected for evidence of off-site sediment tracking.

Based on inspection results, the site description and pollution prevention measures must be revised in this SWPPP if inadequacies are discovered. The inspection and plan review process must include timely implementation of any changes to the SWPPP within seven (7) calendar days after the inspection. If existing mitigation or protection measures need to be modified or if additional mitigation or protection measures are necessary, implementation shall be completed before the next anticipated storm event. If implementation of changes to mitigation or protection measures is not practical before the next anticipated storm event, modifications shall be implemented as soon as practical.

A waiver of the inspection requirements is available until one month before thawing conditions are expected to result in a discharge if all of the following requirements are met:

- Frozen conditions are anticipated to continue for more than one month;
- Land disturbance activities have been suspended; and

- Beginning and ending dates of the waiver period are documented in the SWPPP.

9.2 Inspection Report

The inspection reports should summarize the scope of inspections, names and qualifications of inspection personnel, the inspection dates, major observations, and remedial actions taken. These records shall be retained as part of the SWPPP for at least three (3) years after the date of inspection.

The Inspection Form describes what to look for during inspections and the types of maintenance measures to undertake. The checklist includes:

- Visual inspection
- Good housekeeping
- Site assessment

9.3 Corrective Action Log

If problems are encountered, the issue shall be promptly reported to the field superintendent or his designated representative. Corrected action shall be planned immediately and initiated as soon as feasible. Corrective actions shall be recorded on the Corrective Action Log included in Appendix E.

10.0 Recordkeeping and Training

10.1 Recordkeeping

The following records should be kept for a period of at least three (3) years from the date all site work has been completed:

- Dates of grading, construction activity, and stabilization;
- A copy of the letter from NDDH verifying the receipt of the complete Notice of Intent (NOI)/application;
- The signed and certified NOI form or permit application form;
- Inspection reports; and
- Date(s) when an area is either temporarily or permanently stabilized.

10.2 Training

SWPPP training sessions will be held prior to and during construction, as needed. Contractor construction supervisory personnel and construction inspectors are required to attend. Training topics will include the following items:

- General storm water and mitigation or protection measures awareness training for staff and subcontractors;
- Spill prevention and response, as described by the SPCC components of this SWPPP;
- Standard housekeeping measures;
- Materials handling procedures; and
- A review of the most recent inspection results and any resulting changes to storm water pollution prevention or new requirements.

11.0 Log of Changes to the SWPPP

Amendments to the SWPPP will be required if any of the following occur:

- There are changes to the plan of construction or operations that affect the quality of storm water runoff;
- There are changes in the requirements of the NDPDES that require changes within the SWPPP to meet these new permit conditions; and/or
- A revision is requested by the EPA, an EPA representative, or the NDDH.

Amendments and dates of the amendments shall be recorded on the Revision Record to the SWPPP in Appendix A.

Appendix A

Revision Record

Revision Record

Project Name:
SWMP Contact:

Amendment No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title(s)]

Appendix B

Notice of Termination

NOTICE OF TERMINATION TO CANCEL COVERAGE UNDER NDPDES GENERAL PERMIT FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY (NDR10-0000)

NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF WATER QUALITY
SFN 19146 (02/10)

FOR DEPT. USE ONLY

Date Received: ____/___/____

GENERAL INFORMATION

Name of Construction Project		Permit ID Number **NDR10-**	
Name of Owner of Construction Project	Contact Person Name (Mr / Ms)	Contact Phone No.	
Mailing Address	City	State/Province	Zip Code

Please indicate which condition has been met before submitting the NOT.

☐ The site has achieved final stabilization. In order to achieve final stabilization, one of the following conditions must be met. Please indictate which condition has been met.

☐ All soil disturbing activities are complete and all soils are stabilized by a uniform perennial vegetative cover with a density of 70 percent over the entire pervious surface area or other equivalent means necessary to prevent soil failure under erosive conditions. In addition, the following conditions have been met:

i. All drainage ditches which drain water from the site have been stabilized.

ii. All temporary synthetic and structural erosion prevention and sediment controls (e.g., silt fence) have been removed.

iii. Sediment has been removed from conveyances and temporary sediment basins used for permanent water quality management, and the sediment has been stabilized.

☐ For areas with an average annual rainfall of less than 20 inches, all soil disturbing activities at the site have been completed and temporary erosion control measures have been selected, designed and installed along with the appropriate seed base to provided erosion control for three years and achieve 70 percent vegetattive coverage within three years without active maintenance.

☐ For soil disturbing activities on agricultural land, the land is returned to its pre-disturbance agricultural use. Areas not used for agricultural activities such as buffer strips adjacent to waters of the state and areas not being returned to pre-disturbance agricultural use must meet the criteria above.

☐ Another operator/permittee has assumed control in accordance with the transfer provision over all areas of the site that have not achieved final stabilization.

☐ For residential construction, all lots have been sold with temporary erosion protection and down gradient perimeter controls installed; a homeowner fact sheet has been given to the homeowner(s); and all other lots have achieved final stabilization.

CERTIFICATION STATEMENT

Return Completed Form to:

North Dakota Department of Health
Division of Water Quality, 4th Floor
918 East Divide Avenue
Bismarck, ND 58501-1947

Telephone: 701.328.5210
Fax: 701.328.5200

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein. Based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Printed Name of Owner	Title
Signature of Owner	Date

(Attach additional pages if needed)

Appendix C

Typical Details

Appendix D

Inspection Record

SITE INSPECTION RECORD
NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF WATER QUALITY
SFN 19391

Permit Number: NDR10-_____

Instructions: Please fill out the inspection information below for the permit number referenced above. See example below:

Time & Date	**Name of Inspector**	**Date, Amount (inches), & Duration of Precipitation Event**	**Observations and actions taken:** Document incidents such as erosion, sediment accumulation, spills, SWPP – related maintenance, remediation, etc.
Example: 2:00 pm 7/2/2002	Example: John Smith	Example: 7/1/2002, 2 inches of rain, 5 hours	Example: Up to 20 inches of sediment captured behind silt fence on western edge of property – sediment needs to be removed. Silt fence on northern side is OK. Noticed small oil leak from fuel tank.

BakkenLink Pipeline LLC
Site Inspection Record - Construction

Project Name: BakkenLink Pipeline LLC

Coverage Number: _____

Inspector: _____ Date: _____ Time: _____

Precipitation Amount: _____ Date: _____

Areas Inspected (Choose Applicable):
- ☐ Active areas
- ☐ Stabilized areas with less than 70% cover
- ☐ Areas that have achieved final stabilization

Is there evidence of, or the potential for, pollutants entering drainage systems or waters of the state from:

Material Storage Areas	☐ Y	☐ N
Vehicle Maintenance Areas	☐ Y	☐ N

Observations / Corrective Actions:

_____

_____

_____

☐ Y ☐ N	Have all erosion and sediment controls and mitigation or protection measures identified in the plan been installed or implemented?
☐ Y ☐ N	Are erosion and sediment controls operating correctly and in serviceable condition?
☐ Y ☐ N	Are erosion and sediment controls operating consistently and effectively?
☐ Y ☐ N	Are there any devices similar to silt fence or fiber rolls where sediment has reached more than 1/3 the height of the device? (Removal and repairs must be made within 24 hours.)
☐ Y ☐ N	Are there any sediment basins where collected sediment has reduced the storage capacity by 1/2? (Drainage and removal must be completed within 72 hours.)
☐ Y ☐ N	Is there evidence of sediment deposits in surface waters, drainage ditches or other stormwater conveyance systems? (Removal and stabilization must be completed within 7 days unless prohibited by legal, regulatory or physical access constrains. All reasonable efforts must be made to obtain access. Once permission is granted, removal must take place within 7 days.)
☐ Y ☐ N ☐ NA	Is there evidence of sediment being tracked off-site by vehicles or equipment? (Sediment tracked or deposited on paved surfaces must be removed within 24 hours.)
☐ Y ☐ N	Is there evidence of sediment depositing off-site other than in surface waters, drainage ditches and stormwater conveyance systems? (Sediment must be recovered in a manner and frequency sufficient to minimize off-site impacts – for example, sediment could wash away during the next precipitation event.)
☐ Y ☐ N ☐ NA	Is stormwater flow distributed evenly over vegetative buffers?
☐ Y ☐ N ☐ NA	Is sediment accumulating in vegetative buffers?
☐ Y ☐ N ☐ NA	Are rills forming within vegetative buffers?
	(If vegetative buffers are silted covered, contain rills or are otherwise rendered ineffective, other erosion and sediment controls must be implemented. Eroded areas must be repaired and stabilized.)

☐ Y ☐ N	Are litter, debris, chemicals and parts being managed properly to minimize stormwater pollution?
☐ Y ☐ N	Are liquid or soluble materials like oil, fuel, paint, etc., properly stored to prevent spills, leaks or other discharges?
☐ Y ☐ N	Is there evidence of concrete wash water discharging to waters of the state, storm sewer systems or onto adjacent properties?
☐ Y ☐ N	Is there evidence of wastewater from processing operations or sanitary facilities (i.e., portable toilets) discharging from the site? (These types of discharges are not covered by the construction general permit, NDR10-0000. They must be stopped immediately if they are not covered by another type of permit. The following non-stormwater discharges are allowable if the appropriate prevention measures are in place: fire-fighting, fire hydrant flushing, potable water line flushing, infrequent building and equipment wash down without detergents, uncontaminated foundation drains, springs, lawn watering and air conditioning condensate. Please note that discharges from temporary dewatering activities, such as hydrostatic testing or disinfection of new pipelines may require coverage under the temporary dewatering general permit, NDG07-0000.)
☐ Y ☐ N	Is there evidence of wash water from tools or equipment draining to waters of the state, drainage ditches or storm sewer systems?
☐ Y ☐ N ☐ NA	Are permanent stormwater management measures (e.g., oil-water separators, rain gardens) functioning properly?

Corrective Actions and Schedule:

_____

_____

_____

Are mitigation or protection measures effective to minimize the discharge of sediment from the site? ☐ Y ☐ N

Do mitigation or protection measures need to be adjusted? ☐ Y ☐ N

Are additional mitigation or protection measures needed? ☐ Y ☐ N

Comments:

_____

_____

_____

List all spills, leaks or hose-breaks that have occurred since the last inspection:

-Size	-Location	-Was it reportable?	-Was it reported?
_____	_____	☐ Y ☐ N	☐ Y ☐ N
_____	_____	☐ Y ☐ N	☐ Y ☐ N
_____	_____	☐ Y ☐ N	☐ Y ☐ N

Were Spill Prevention Procedures adequate? ☐ Y ☐ N

What Spill Response Procedures were used?

Comments

Has the SWPP Plan been updated as a result of this inspection?	☐ Y	☐ N
Has the Site Map been updated as a result of this inspection?	☐ Y	☐ N

Appendix E

Corrective Action Log

Corrective Action Log

Project Name:
SWPPP Contact:

Inspection Date	Inspector Name(s)	Description of Mitigation or Protection Measures Deficiency	Corrective Action Needed (including planned date/responsible person)	Date Action Taken/Responsible person

Appendix XVIII

Summary of Protection Measures

Table 2-4 Summary of Environmental Protection Measures for the Project

Resource	Environmental Protection Measures As Design Features
Air Quality	Water or chemical soil binders would be used to control dust along the ROW and access roads during construction in accordance with federal, state, and local requirements.
Geology and Minerals	The HDD construction method would be used to avoid impacts to landslide areas associated with the bluffs on the north and southsides of Lake Sakakawea.
Soils	Soil erosion would be minimized by implementing procedures described in the Storm Water Pollution Prevention Plan (SWPPP), and the Construction, Mitigation, and Reclamation Plan (CMRP).
	If construction is planned during a storm event, vehicle traffic and equipment would be restricted to prevent excessive rutting.
	Use of temporary roads across agricultural lands may result in some compaction and seasonal loss of crops. When necessary, compacted soils would be disked following Project completion and landowners would be compensated for any crop loss.
	During reclamation, compacted areas (typically any area that received repeated traffic or three or more passes by heavy equipment) would be decompacted, to the depth of compaction, by subsoiling or ripping to the depth of compaction. This would help prepare the seed bed, encourage infiltration, and help to prevent accelerated runoff and erosion. Where topsoil has been salvaged and segregated, decompaction would occur prior to respreading topsoil. Scarification would be used only on shallow soils.
	Salvaged topsoil would be protected from wind and water erosion at all times. To ensure proper erosion control of topsoil piles, all sediment and erosion control measures would be inspected after large rain events and repairs would be performed as needed.
Water Resources and Wetlands	The SWPPP would be implemented to minimize storm water transport of sediment from disturbed areas to streams, wetlands, and Lake Sakakawea. All Project-related storm water and hydrostatic test water discharges would be in compliance with a NPDES permit.
	No aboveground facilities or staging areas would be constructed/located within wetlands, riparian areas, or other WUS.
	Biologists familiar with wetland and riparian area identification would post signs at the edges of the wetland/waterbody features prior to construction.
	ATWSs would be located a minimum of 50 feet outside wetland boundaries. Protection measures (including installation of erosion control devices) would be utilized at all wetland and waterbody crossings to minimize sedimentation. For areas where additional setbacks are deemed necessary to protect the resource, the applicability of the appropriate setback would be determined in consultation with agencies on a site-specific basis.
	No refueling or lubricating would occur within 100 feet of wetlands and/or perennial/intermittent waterbodies. Hazardous materials, chemicals, fuels, etc., would not be stored within 100 feet of wetlands or perennial/intermittent waterbodies.
	Application of herbicides or pesticides in the vicinity of wetlands and waterbodies would follow pesticide use protocol, label instructions, and restrictions outlined in the Noxious Weed and Aquatic Nuisance Species Control Plan.
	For dry crossings, topsoil within the trench line would be segregated from subsoil in wetland and riparian areas for use in reclamation as specified in the CMRP.
	For standard wetland or riparian area crossings, topsoil stripping is impractical due to the saturated nature of the soil as specified in the CMRP.

Table 2-4 Summary of Environmental Protection Measures for the Project

Resource	Environmental Protection Measures As Design Features
Water Resources and Wetlands (Continued)	Where crossings of wetland or riparian areas cannot be reasonably avoided, the construction ROW width would be reduced to approximately 75 feet or less in standard wetlands and measures would be taken to minimize impacts. The construction ROW width would be reduced to approximately 50 feet or less on all federal lands.
	To control aquatic nuisance species, equipment and boats would be washed to remove all vegetative matter and aquatic nuisance species prior to arrival at the construction site and after constructing through waterbody crossings (e.g., Lake Sakakawea), where water is evident.
	Water used for hydrostatic testing, dust control during construction, etc., would be obtained from municipal or other permitted water supply wells. The installation or abandonment of any wells is not anticipated. Surface water or non-permitted groundwater appropriation is not anticipated.
	Sensitive areas would be marked and flagged as an "environmental sensitive area."
	Pipeline crossings of any surface waterway would be scheduled at times of minimal rainfall to minimize the risk of construction-related sediment sources being washed into waterbodies or wetlands.
	If a Section 404 permit is obtained and mitigation is required, mitigation areas would need to be monitored for a minimum of 5 years. Annual reports would have to be submitted to the North Dakota USACE regulatory office. Successful performance criteria would need to be developed in a mitigation and monitoring plan that should be submitted with a completed 404 permit application. North Dakota USACE regulatory staff would be able to provide additional guidance as necessary.
Vegetation	Revegetation seed mixes would be developed in coordination with the local Natural Resources Conservation Service (NRCS) office or agencies and private landowner. All seed would be certified or registered by the State of North Dakota or the state of origin.
	Trees and shrubs would be replaced in accordance with the PSC's tree and shrub mitigation specifications. BakkenLink would coordinate with the appropriate agencies to identify efficient restoration and mitigation measures following construction.
	ROW monitoring of reclaimed areas would be conducted annually for 5 years following reclamation on USFS- and USACE-administered land and for 3 years following reclamation on private land. On USFS- and USACE-administered land, reclamation success would be based on the revegetation to 70 percent of the background cover as stipulated by the BLM and USFS (also a North Dakota Department of Health, Water Quality Division requirement). If, at anytime during the 5-year monitoring period, revegetation is successful, no additional monitoring would be conducted.
	Sensitive areas would be marked and flagged as an "environmental sensitive area."
Noxious Weeds	The Project's Noxious Weed and Aquatic Nuisance Species Control Plan would be implemented to minimize the spread of noxious weeds.
	Noxious weed monitoring and control would continue for any ROW over which BakkenLink would retain control over the land surface use after construction.
	ROW monitoring for noxious weeds and invasive species would be conducted following reclamation in conjunction with ROW monitoring of reclamation success. BakkenLink would be responsible for noxious weed control within the permanent ROW for the life of the Project.

Table 2-4 Summary of Environmental Protection Measures for the Project

Resource	Environmental Protection Measures As Design Features
Wildlife and Fisheries	Appropriate wildlife and fisheries protection measures would be implemented during all phases of construction in coordination with jurisdictional agencies.
	BakkenLink would construct escape ramps every 0.5 mile to reduce the potential for livestock and wildlife becoming trapped in the pipeline trench.
	To the extent practicable, mowing, clearing, and grubbing of the Project ROW would occur in the fall or winter (i.e., outside of migratory bird nesting season [February 1 through July 15]) to minimize disturbance to nesting birds.
	If construction occurs during migratory bird breeding season (February 1 to July 15), BakkenLink would conduct pre-construction surveys for active nests, including raptor nests, in order to avoid disrupting migratory birds during the breeding season. BakkenLink would have a qualified biologist survey the proposed route for nesting migratory birds within 5 days of any ground disturbing activity. To minimize impacts to migratory birds (including some game birds, waterfowl, and raptors), active nests would be avoided during construction and maintenance activities, in coordination with USFWS. If surveys or other available information indicate a potential for take of migratory birds, their eggs, or active nests, BakkenLink would suspend activities and contact the USFWS for further coordination on the extent of the impact and the long-term implications of the intended use of the Project on migratory bird populations.
	Any open posts (1.5-inch-diameter or greater), which may be utilized in pipeline construction or operation (such as markers, signs, stacks, etc.), would be permanently covered or filled with sand or gravel. This is necessary to prevent wildlife mortalities by entrapment.
	To avoid/minimize impacts to nesting bald eagles from construction activities, BakkenLink would: 1) maintain a minimum 0.5-mile buffer between the activity and any bald eagle nest if no landscape buffer exists; 2) maintain a minimum 660-foot buffer and landscape buffer or natural area between the activity and around the nest tree; and 3) avoid activities during the bald eagle nesting season (February 1 to July 15).
	To avoid/minimize impacts to golden eagles, BakkenLink would conduct surveys prior to any on-the-ground activities to determine the extent of any golden eagle breeding territories in the area that may be impacted by the Project. BakkenLink would conduct an aerial nest survey (preferably by helicopter) within 1 mile of the Project ROW to identify any occupied and unoccupied golden eagle nest sites in proximity to the Project area. Aerial surveys would be conducted between March 1 and May 15, before leaf-out, so that nests are visible and their status (active or inactive) can be determined. A nesting territory or inventoried habitat would be designated as unoccupied by golden eagles only after at least two complete aerial surveys in a single breeding season. Aerial surveys would include the following: 1. Due to the ability to hover and facilitate observations of the ground, helicopters are preferred over fixed-wing aircraft, although small aircraft also may be used. BakkenLink would report any golden eagle nests, as well as other nests of any other raptors found during the survey. Where possible, BakkenLink would utilize two observers to conduct the surveys. 2. BakkenLink would record any observations of golden eagle nest sites using a global positioning system (GPS). The date, location, nest condition, activity status, and habitat would be recorded for each sighting. 3. BakkenLink would share the qualifications of the biologist(s) conducting the survey, method of survey, and results of the survey with the USFWS.

Table 2-4 Summary of Environmental Protection Measures for the Project

Resource	Environmental Protection Measures As Design Features
Wildlife and Fisheries (Continued)	Alternatively, BakkenLink may conduct ground surveys to identify golden eagle nests within 1 mile of the Project ROW between March 1 and May 15. However, ground surveys are much less reliable than aerial surveys, even during leaf-off conditions, and 75 percent of golden eagle nests present may be missed. BakkenLink would conduct at least two ground observation periods lasting at least 4 hours or more per linear mile to designate inventoried habitat or territory as unoccupied as long as all potential nest sites and alternate nests are visible and monitored. If a golden eagle nest is observed, BakkenLink would contact the USFWS for further consultation to determine appropriate protection measures and possible "take" permit implications.
Special Status Species	Prior to the initiation of construction, applicable biological surveys would be conducted through areas of suitable habitat for specific species during the appropriate season, as determined by the jurisdictional agencies (e.g., BLM, USFS, USACE, and USFWS) and survey results reported in compliance with Section 7 of the ESA.
	If threatened, endangered, candidate, or sensitive plant species are identified in proposed disturbance areas prior to construction, appropriate protection measures would be determined in consultation with agencies.
	Surface use is prohibited from March 1 through June 15 within 1 mile (line of sight) of a sharp-tailed grouse lek.
	No surface occupancy or use is allowed within 0.25 mile (line of sight) of a sharp-tailed grouse lek.
	The loss of special status plant species individuals or populations may occur as a result of adjacent noxious weed-related herbicide application treatments. To effectively mitigate this impact, consultation between the special status plant species jurisdictional agency and the weed control specialists would be completed prior to treatments. The location of known special status plant species and noxious weed species individuals and populations would be confirmed prior to treatments. In addition, techniques for special status plant species avoidance via direct and indirect applications would be developed.
	To prevent the spread of aquatic nuisance species during construction and operation, BakkenLink would remove aquatic plants and animals from equipment prior to entering and before leaving any waterbody. Project staff would spray/wash equipment with high pressure hot water when leaving a wetland/waterbody, or would dry equipment for at least 5 days before use at a different wetland/waterbody.
	The revegetation plan would include a commitment to reseed disturbed native prairie with a comparable native grass/forb seed mixture and planting a diverse mixture of native cool- and warm-season grasses and forbs.
	BakkenLink would obtain a seed source that is as local as possible to ensure the particular cultivars are well adapted to the local climate.
	Disturbed native prairie would be reclaimed to its original condition using native seed mixes specified by applicable state and federal agencies. The objective is for no net loss of native prairie habitat to occur. Where avoidance of native prairie is not feasible, the following protection measures would be implemented to minimize impacts to the Dakota skipper, regal fritillary, Ottoe skipper, and tawny crescent: 1) Restrict workspaces where the ROW crosses native prairie habitat; 2) Salvage and segregate topsoil in native prairie to maintain the native seed sources for re-vegetation of the ROW in native prairie; and 3) Eliminate herbicide and pesticide use where Dakota skippers, regal fritillaries, Ottoe skippers, and tawny crescents are found.

Table 2-4 Summary of Environmental Protection Measures for the Project

Resource	Environmental Protection Measures As Design Features
Special Status Species (Continued)	If construction occurs during spring or fall migration, BakkenLink would provide whooping crane monitors in suitable habitat along the ROW. If a whooping crane is sighted within 1 mile of a pipeline or associated facilities during construction, all work would cease within 1 mile of the area and the USFWS would be contacted immediately. In coordination with the USFWS, work would resume after the bird(s) leave the area.
	If construction were to occur during the interior least tern or piping plover breeding season (April 1 through August 31), BakkenLink would conduct surveys in suitable habitat within 0.5 mile of the Lake Sakakawea crossing location. A qualified biologist would survey no more than 5 days prior to construction-related activities to identify occupied breeding territories and/or active nest sites. If occupied breeding territories and/or active nest sites are identified, the USFWS would be notified. Appropriate protection measures, such as seasonal constraints and the establishment of a spatial buffer area, would be implemented on a site-specific basis in coordination with the USFWS. Similar constraints and/or mitigation measures may apply to pipeline maintenance activities if conducted during the breeding season within 0.5 mile of the Project area.
	In order to avoid potential spawning impacts to the pallid sturgeon, construction at Lake Sakakawea would occur after June 1, in order to avoid the warmwaterfish spawning period (April 15 through June 1).
Land Use	Any range improvements such as fences, gates, cattle guards, and developed water sources located within disturbance or access routes would be repaired to the satisfaction of the agency or private landowner.
	If construction would disturb or destroy a natural barrier used for livestock control, the opening would be temporarily closed during construction and permanently closed following construction, as required by the agency or private landowner.
	BakkenLink would coordinate with landowners to minimize impacts to their lands. Lands would be restored to cropland and farming use following the construction phase of the Project.
	In cultivated areas, the depth of cover may be increased to avoid interference with land use activities.
Recreation and Visual Resources	Measures would be implemented to minimize the visual effects of construction on high value road, river, and trail crossings as identified by the BLM, USFS, or USACE.
	To prevent unauthorized use of the ROW by off-road vehicles and subsequent potential impacts to soil, vegetation, and wildlife resources, access would be blocked at locations specified by agencies and/or private landowners.
	Aboveground structures would be painted with BLM-approved environmental colors to minimize contrasts with surrounding landscapes.
Transportation	All major highway and improved gravel or scoria road crossings would be bored to limit traffic interruptions.
	Placement of temporary access would be designed to avoid sensitive features such as wetlands. Areas used for temporary roads or working areas during construction would be restored to their original condition to the extent practicable.

Table 2-4 Summary of Environmental Protection Measures for the Project

Resource	Environmental Protection Measures As Design Features
Cultural and Paleontological Resources	Prior to the Project construction, cultural and paleontological resource inventories would be conducted on all proposed disturbance areas not previously inventoried. All cultural resources recorded during the inventories would be evaluated for eligibility to the National Register of Historic Places (NRHP). Avoidance would be recommended for cultural resources listed on the NRHP or evaluated as eligible for listing on the NRHP. If avoidance is not possible, a treatment plan would be developed by the BLM in consultation with the North Dakota State Historic Preservation Office (SHPO), USFS/USACE (if on their lands), and interested tribes. The treatment plan would be implemented prior to Project construction.
	To minimize indirect impacts to cultural and paleontological resources, Project-related personnel would be educated as to the sensitive nature of the resources; a strict policy of prohibiting collecting of these resources would be implemented.
	Sensitive areas would be marked and flagged as an "environmental sensitive area."
	If cultural resources, including human remains, are discovered during Project construction, all work would stop in the area of the discovery and the procedures outlined in the Unanticipated Discoveries Plan would be followed. Written permission stating that work in this area no longer presents a hazard to cultural resources would be required before work could resume in the area of the discovery. If paleontological resources are discovered during Project construction, all work would cease and a certified paleontologist permitted by the State of North Dakota would be contacted to determine appropriate resource identification and protection procedures.
Noise	The proposed route would be at least 500 feet from occupied houses and structures. At this distance, noise created during construction should be below ambient background levels, especially near highways and railroad lines.
Health and Safety	The Project would be located a minimum distance of 500 feet from residences to minimize hazards to human health and safety. Also, isolation valves would be installed along the pipeline in accordance with federal regulations to isolate the pipeline during a potential leak to minimize the release.
	A Spill Risk Assessment (**Appendix A**) has been completed to identify HCAs and potential impacts as a result of an accidental release of crude oil during pipeline operation.
	Any burning during the Project would comply with all federal, state, county, and local fire regulations pertaining to burning permits.
	All hazardous and potentially hazardous materials would be transported, stored, and handled in accordance with applicable regulations.
	If toxic or hazardous waste materials are encountered during construction, construction would stop immediately, and would not restart until clearance is granted by the appropriate agency.
USFS Specific Mitigation Measures	Keep disturbance to a minimum to reduce impacts to suitable sensitive species habitat and native vegetation communities in general, and also to reduce spread of invasive species.
	Where the disturbance area would intersect noxious weeds or patches of invasive species, treat the noxious weeds or invasive species at least 2 weeks prior to construction, or salvage and stockpile the topsoil from these sites separately to isolate the vegetative propagules and seed. These areas should be identified to ensure they are monitored after reclamation.

Table 2-4 Summary of Environmental Protection Measures for the Project

Resource	Environmental Protection Measures As Design Features
USFS Specific Mitigation Measures (Continued)	Use a USFS-approved native seed mix for reclamation; monitor to ensure proper establishment. Monitor annually for 5 years following reclamation to ensure reclamation success and to identify noxious weeds and invasive species establishment. If, at any time during the 5-year monitoring period, revegetation is deemed successful by the USFS, no additional monitoring would be conducted.
	If invasive species are found on reclaimed sites that are in areas mostly dominated by native species, treat the invasive species sites and reseed if necessary.
	If noxious weeds are found on reclaimed sites, treat the weeds and reseed if necessary.
	Clean vehicles and equipment used for construction at approved water or air wash stations (monitored by an EI) prior to entering the National Grassland to remove all seeds and plant propagules (seeds and vegetative parts that may sprout) in order to prevent the potential spread of noxious weeds and invasive species. Approved wash stations would include commerical car washes and on-site locations. This mitigation would be applied when moving equipment from an area containing invasive species to an area that does not contain invasive species.
	Clearly mark (stake/fence/flag) sensitive plant populations within or very near the ROW prior to construction and note them on alignment sheets to ensure that they are avoided. Ensure that such marking is still visible prior to reclamation activities.
	Any discovery of sensitive or watch plants within the Project area should be reported to the McKenzie Ranger District Office. Sensitive plant populations discovered after Project approval should be protected; therefore, last-minute alterations of the Project design or access route may be requested in order to avoid negative impacts to such populations.

Appendix XIX

Legal Corridor Description

Appendix XIX. Legal Corridor Description

County	Civil Township	TWN	RNG	Section(s)
McKenzie	Grail	150N	95W	18
McKenzie	Unorganized Territory	150N	96W	1, 12, 13
McKenzie	Blue Butte	151N	96W	1,12,13,24,25,36
McKenzie	Keene	152N	96W	1,12,13,24,25,36
McKenzie	Elm Tree	153N	95W	3,4,9,15,16,22,27,28,33
McKenzie	Unorganized Territory	154N	95W	27,34
Williams	Unorganized Territory	154N	95W	4,9,16,21,27,28
Williams	Dry Fork	155N	95W	6,7,8,17,20,21,27,28,29,33,34
Williams	Pleasant Valley	156N	95W	31

Appendix XX

Road Crossings and Methodology

Appendix XX. Road Crossings and Methodology

ROAD CROSSINGS				
Road Name	Approx. MP	Construction Method	Bore Length (ft)	Condition
28th St NW	1.7	Bore	150	Improved Scoria
30th St NW	3.3	Bore	150	Improved Scoria
32nd St NW	5.4	Bore	150	Improved Scoria
33rd St NW	6.4	Bore	150	Improved Scoria
34th St NW	7.4	Bore	150	Improved Scoria
38th St NW	11.6	Bore	150	Improved Scoria
Highway 23	12.6	Bore	150	Paved Highway
40th St NW	13.6	Bore	150	Improved Scoria
42nd St NW	15.8	Bore	150	Improved Scoria
43rd St NW	16.8	Bore	150	Improved Scoria
104th AVE	17.7	Bore	150	Improved Scoria
44th St NW	18.2	Bore	150	Improved Scoria
Highway 1806	19.2	Bore	150	Paved Highway
104th AVE	20	Bore	150	Improved Scoria
46th St NW	21.1	Bore	150	Improved Scoria
48th St NW	23	Bore	150	Improved Scoria
52nd St NW	26.8	Bore	150	Improved Scoria
Highway 1804	28.9	Bore	150	Paved Highway
103rd Ave NW	32.5	Bore	150	Improved Scoria
57th St NW	33.4	Bore	150	Improved Scoria
58th ST NW	34.4	Bore	150	Improved Scoria
104th AVE	35.4	Bore	150	Improved Scoria
59th St NW	35.6	Bore	150	Improved Scoria
60th ST NW	36.8	Bore	150	Improved Scoria

Appendix XXI

Inadvertent Returns Contingency Plan

1.0 Project Description

BakkenLink Pipeline LLC (BakkenLink) is proposing to build, own, and operate an approximately 37-mile long pipeline for the transportation of crude oil from the Beaver Lodge receipt point in Williams County, North Dakota to the Dry Creek Terminal in McKenzie County, North Dakota. The connection to the Dry Creek Terminal will establish a connection with the existing BakkenLink Pipeline. The Horizontal Directional Drilling (HDD) water volumes will be used at the crossings listed in Table 1.

TABLE 1. HDD CROSSINGS AND ESTIMATED WATER USEAGE FOR DRILLING PURPOSES

HDD Sections	Approx. MP	Segment length (ft)	Water Volume (gal) Drilling
Lake Sakakawea – North Bluff	25.6	3,050	215,031
Lake Sakakawea – South Bluff	22.01	3,767	265,581
United States Forest Service	20.24	4,183	294,909
Totals		**11,000**	**775,521**

*Table estimates water use for drilling purposes independently of hydrotest. It is possible that water from Hydrotest activities can be reused for use in drilling operations. Table 1 does not account for water reuse.

1.1 Drilling Basics

Horizontal directional drilling is a trenchless pipeline installation technique with the advantage of minimal surface impact, limited to the established entry and exit sites for drilling equipment which can be located outside the environmentally sensitive area. This method of crossing will eliminate any future ground surface disturbance associated with an operating company's required annual maintenance for bank stabilization and depth of cover control typically for an open ditch crossing. This is a technically advanced process requiring skilled operators. Detection of drilling fluid seepage is dependent upon the skill and experience of the drilling crew. For this reason, BakkenLink will contract with firms that specialize in horizontal directional drilling. The entry and exit sites vary in size depending on the diameter of the drill and associated equipment required. No surface ground disturbance by equipment will occur between the entry and exit drill path locations. The typical minimum depth of a drill will be 25

feet below the area of avoidance based on the site-specific design parameters. Pipe with increased wall thickness and abrasion resistant overcoat will be utilized to insure pipeline integrity for the proposed crossing.

Any future maintenance of an HDD crossing if problems occur will result in the existing pipe abandonment and re-drilling the crossing which again minimizes any surface impacts. There is a potential for drilling fluid release during installation, which can be signaled when pressure in the drill hole is not maintained. Minimal consistent loss of drilling fluid typically occurs during the drilling process when layers of loose sand, gravel, or fractured rock are encountered and drilling fluid fills voids in the material. The loss of returning drilling fluid and a reduction in drilling pressure indicates that seepage is occurring outside of the drill hole. For example, a loss of drilling fluid and an absence of subsurface material would indicate a loss of containment pressure within the hole.

2.0 Drilling Fluid and Drilling Fluid System

The directional drilling process uses drilling fluid to remove the cuttings from the borehole, stabilize the borehole, and act as a coolant and lubricant during the drilling process. The fluid consists primarily of water and bentonite, naturally occurring clay, made up of 1-5 percent active clays, 0-40 percent inert solids and the remainder being water. Drilling fluid is not a hazardous material as it is composed of benign components, however, an inadvertent release will require mitigation measures to reduce the impact to a waterbody or sensitive area.

The drilling fluid is prepared in the mixing tank using both new, recycled, and cleaned drilling fluids. The fluid is pumped at rates of 200 to 1,000 gpm through the center of the drill pipe to the cutters. Return flow is through the annulus created between the wall of the boring and the drill pipe. Cuttings are returned to the entry pit. In the entry pit, the fluid is pumped to fluid processing equipment. Typically, shaker screens, desanders, desilters, and centrifuges remove increasingly finer cuttings from the drilling fluid. The cleaned fluid is recycled to the mixing tank and pumps for reuse in the borehole. The cuttings are disposed of at an approved disposal site.

3.0 Drilling Fluid Release

3.1 Prevention

HDD is typically used to avoid disturbance of sensitive surface features, including waterbodies and wetlands. There is however the potential for surface disturbance through an inadvertent drilling fluid release. Drilling fluid releases are typically caused by pressurization of the drill hole beyond the containment capability of the overburden soil material, which allows the drilling fluid to flow to the ground surface. Releases can be caused by fractures in bedrock or other voids in the geologic strata that allow the fluid to surface even if downhole pressures are low. Providing adequate depth of cover for the installation can substantially reduce the potential for inadvertent releases.

3.1.1 Suitable Material and Adequate Overburden

Prevention of a drilling fluid seepage is a major consideration in determining the profile of the horizontal directional drilled crossing. The primary factors in selecting the pipeline crossing profile include the type of soil and rock material and the depth of cover material. Cohesive soils, such as clays, dense sands, and competent rock are considered ideal materials for horizontal drilling. The depth of adequate overburden is also considered. A minimum depth of cover of 25 feet in competent soils is required to provide a margin of safety against drilling fluid seepage. The areas that present the highest potential for drilling fluid seepage are the drill entry and exit points where the overburden depth is minimal. At the entry and exit points, a pit can be constructed to collect and provide temporary storage for the drilling fluid seepage until it can be pumped into the drilling system. These pits will be sized adequately to accommodate the maximum volume of drilling fluid that may need to be contained in the pits. Secondary containment of the pits will contain any seepage and minimize any migration of the mud from the work area. This containment system may consist of straw bales and silt fencing around the pit.

3.1.2 Pipeline Geometry

The geometry of the pipeline profile can also affect the potential for drilling fluid seepage. In a profile that forces the pipe to make compound or excessively tight radii turns, downhole pressures can build up, thereby increase the potential for drilling fluid seepage. The profiles for the drilled crossing are intended to minimize this potential, with very smooth and gradual vertical curves. Therefore, the potential for pressure buildup caused by pipeline geometry has been minimized.

3.1.3 Responsibility of Drilling Contractor

The drilling contractor will be responsible for submitting a site specific “Fracture Prevention Plan” to include execution of the directional drilling operation, and actions for detecting and controlling drilling fluid seepage. BakkenLink will review this plan with all relevant government agencies prior to execution for approval and closely supervise the progress and actions of the drilling contractor.

3.2 Detection and Monitoring Procedures

To determine if an inadvertent release has occurred, horizontal directional drilling activities will constantly be monitored on this project, either by the contractor, the Construction Inspector, the Environmental Inspector or any combination of these. Monitoring and sampling procedures will include:

- Inspection along the drill path
- Continuous examination of drilling mud pressures and returns flows
- Periodic status information regarding drilling conditions during the course of drilling activities
- If a wetland release occurs inspection to determine the potential movement of released drilling mud within the wetland will be necessary
- If a wetland release occurs, drilling mud will be collected at the drill entry location for future analysis, as required. If a wetland release occurs, monitoring of the release will be

documented by the Environmental Inspector. BakkenLink will keep photographs of release events on record.

4.0 Notification Procedures

If an inadvertent release is discovered, procedures will be taken by the drilling contractor and BakkenLink to contain the release as described below in the Corrective Action section. Procedures for notification of construction management personnel and regulatory agencies are identified in this section. If monitoring indicates a wetland release has occurred or is occurring, the contractor, Construction Inspector, or Environmental lnspector will immediately notify BakkenLink's construction management personnel.

BakkenLink will notify all applicable federal and state agencies immediately upon discovery of an inadvertent wetland release, detailing the location and nature of the release, corrective actions being taken, and whether the release poses any threat to public health and safety.

5.0 Corrective Action

The greatest potential for drilling fluid seepage is during drill entry and exit where the overburden is minimal. To contain and control drilling fluid seepage on land, the contractor will have available equipment and materials onsite, including backhoes or small bulldozers, portable pumps, sand bags, and hay bales. BakkenLink will address an inadvertent release immediately upon discovery. Containment equipment including portable pumps, hand tools, sand, hay/straw bales, silt fencing, and lumber will be readily available and stored at the drilling site. The following measures will be implemented to minimize or prevent further release, contain the release, and clean up the affected area:

5.1 Upland Release

- The contractor will determine and implement any modifications to the drilling technique or composition of drilling fluid (e.g. thickening of mud by increasing bentonite content) to minimize or prevent further releases of drilling mud.
- BakkenLink will place containment structures at the affected area to prevent migration of the release.
- If the amount of the release is large enough to allow collection, the drilling mud released into containment structures will be collected. It will then be returned to the drilling operations, taken to a disposal site by hose or tanker, or filtered through bladder bags (with bags either buried on site or removed for disposal).
- If the amount of the release is not large enough to allow collection, the affected area will be diluted with fresh water and pumped into a vacuum truck or equivalent. Steps will be taken to prevent silt-laden water from flowing into a wetland or waterbody.

- If public health and safety are threatened by an inadvertent release, drilling operations will be shut down until the threat is eliminated.

5.2 **Waterbody Release**

- If a release occurs within a waterbody, BakkenLink will stop work and contact all applicable Federal and State agencies as soon as possible. BakkenLink will notify the applicable state representative for department of environmental quality control if there is a threat to public health and safety and explain whether or not the release can be corrected without incurring additional environmental impact. If necessary, drilling operations will be reduced or suspended to assess the extent of the release and to implement corrective actions.
- If public health and safety are threatened, drilling fluid circulation pumps will be turned off. This measure will be taken as a last resort because of the potential for drill hole collapse resulting from loss of down-hole pressure.
- If monitoring indicates that the intake water quality at downstream user locations is impacted to the extent that it is no longer suitable for treatment, alternative water sources (i.e. trucked or bottled water) will be provided to impacted users.

5.3 Wetland/Riparian Area Release

- The contractor will determine and implement any modifications to the drilling technique or composition of drilling fluid (e.g., thickening of mud by increasing bentonite content) to minimize or prevent further releases of drilling mud.
- If a release occurs within the wetland, reasonable measures, within the limitation of directional drilling technology and contractor's capability, will be taken to re-establish drilling mud circulation.
- BakkenLink will evaluate the release to determine if containment structures are warranted and can effectively contain the release. When making this determination, BakkenLink will also consider if placement of containment structures will cause additional adverse environmental impact.
- Upon completion of the drilling operations, BakkenLink will consult with applicable regulatory agencies to determine any final clean-up requirements for the inadvertent release.
- If public health and safety are threatened by an inadvertent release, drilling operations will be shut down until corrective actions can eliminate the threat. If corrective actions do not prevent the threat, BakkenLink may opt to re-drill the hole along a different alignment after receiving appropriate regulatory approvals. In this case, the following procedures will be implemented to abandon the previous drill hole: To seal the abandoned drill hole, thickened drilling mud will be pumped into the hole as the drill assembly is extracted. At the surface (within approximately 5 feet of the surface) BakkenLink will fill the drill end points with soil and grade the location to the original contour.

5.4 Follow-up

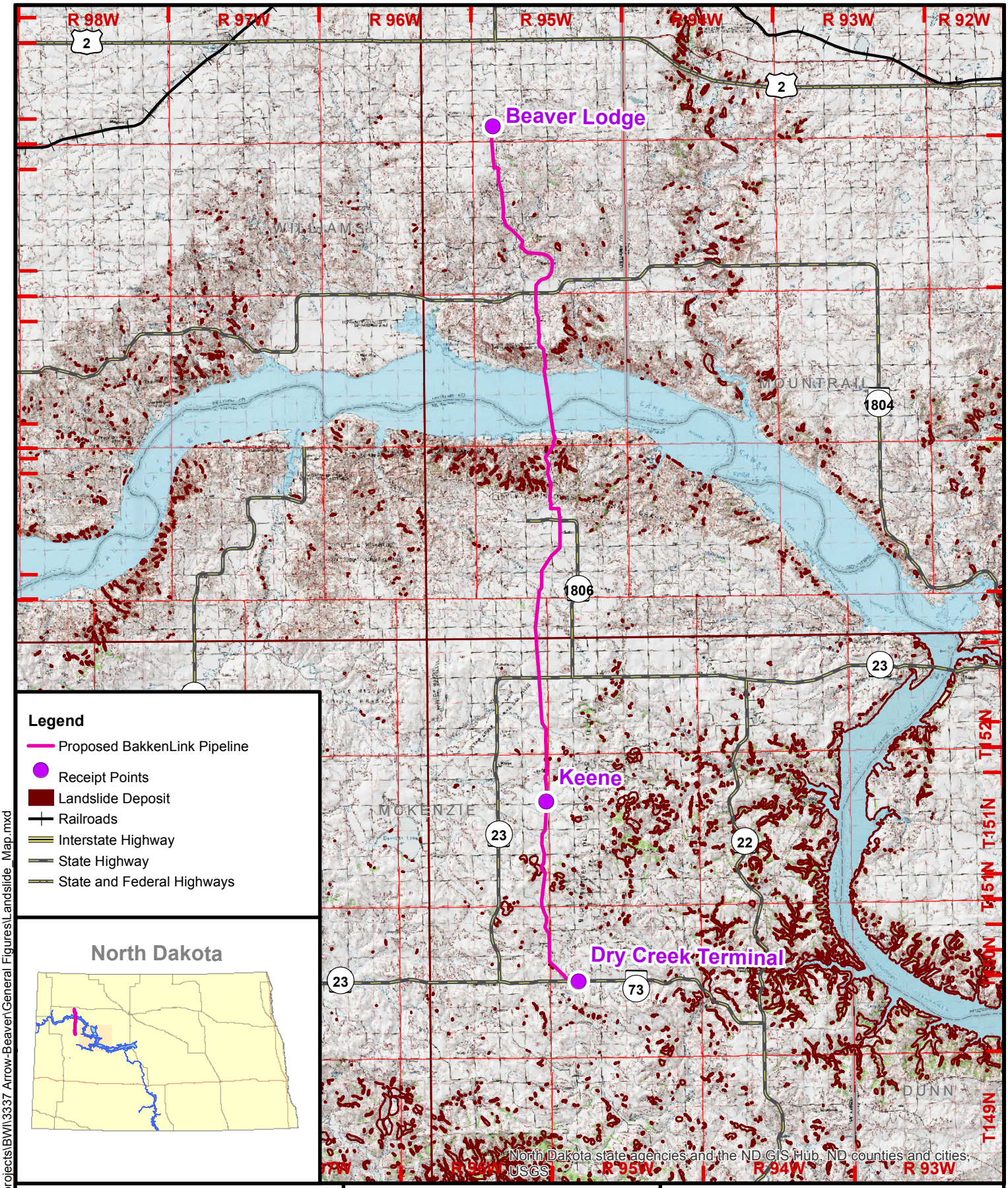
After a drilling fluid seepage has been contained, the drilling contractor and BakkenLink will make every effort to determine the cause of the seepage. After the cause has been determined, measures will be implemented to control the factors causing the seepage and to minimize the chance of recurrence. Developing the corrective measure will be a joint effort of BakkenLink and the drilling contractor and will be site and problem specific. In some cases, the corrective measure may involve a determination that the existing hole encountered a void, which could be bypassed with a slight change in the profile. In other cases, it may be determined that the existing hole encountered a zone of unsatisfactory soil material and the hole may have to be abandoned. If the hole is abandoned, it will be filled with cuttings and drilling fluid.

6.0 Response Equipment

Containment equipment and materials, including lumber for temporary shoring, sandbags, portable pumps, hand tools, silt fence, and hay bales, will be stored within the drilling sites. The drilling contractor will also have heavy equipment such as backhoes that can be utilized to control and clean up drilling fluid seepage. The drilling contractor will be responsible for correctly implementing these devices as soon as an incident is detected.

Appendix XXII

Landslide Map



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0 2.5 5 Miles

Basemap: ND GIS Hub, 100k Topographic Map

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Landslide Map

Project Overview
BakkenLink Pipeline
Dry Creek Terminal to Beaver Lodge

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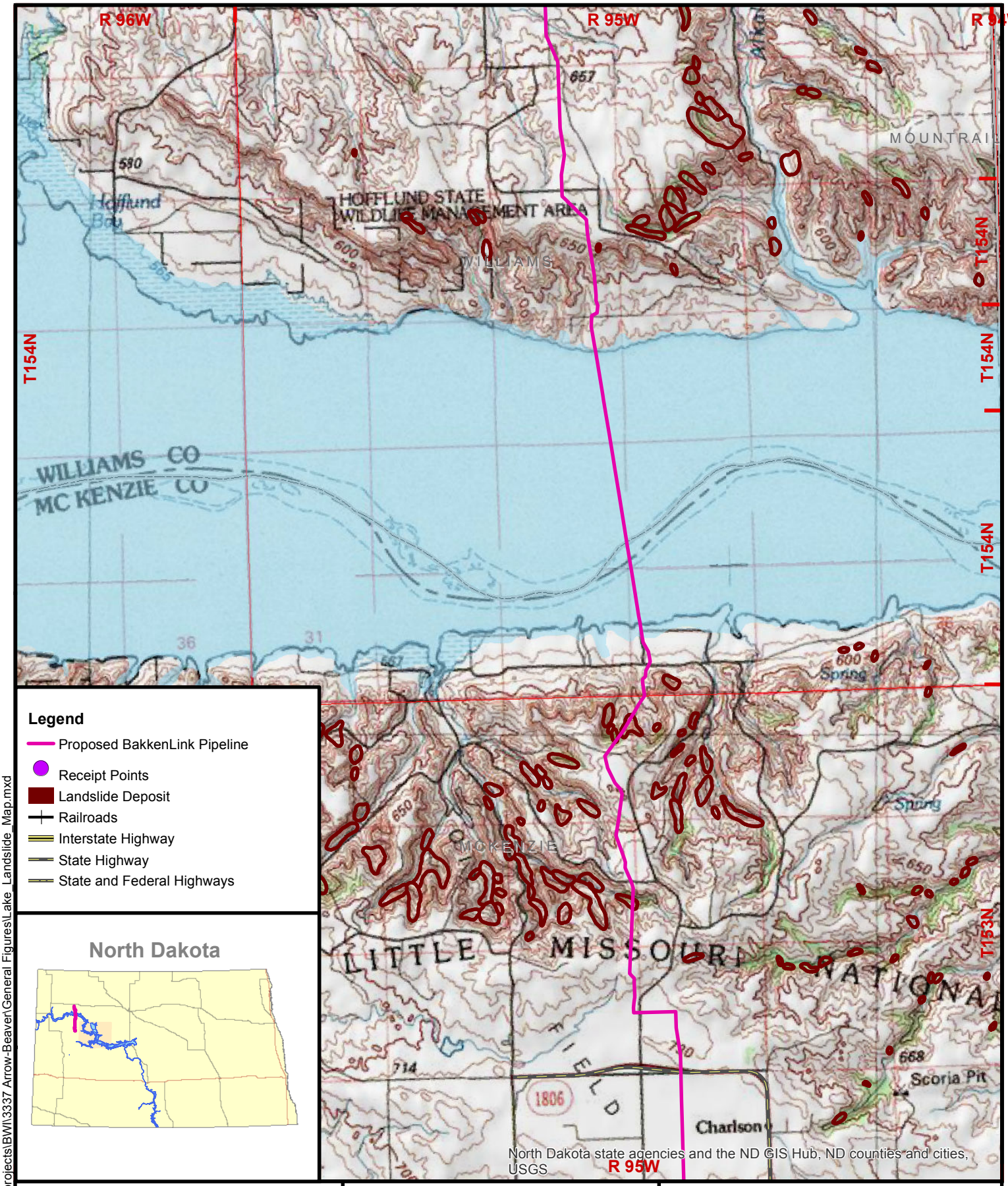
August 2014



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Basemap: ND GIS Hub, 100k Topographic Map

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Landslide Map

Lake Sakakawea Crossing
BakkenLink Pipeline
Dry Creek Terminal to Beaver Lodge

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August 2014

Appendix XXIII

Tree and Shrub Mitigation Specifications

Case No. PU-10-218

Tree and Shrub Mitigation Specifications

Inventory

1. Trees and shrubs anticipated to be cleared, including those that are considered invasive species or noxious weeds (*e.g., Caragana arborescens, Elaeagnus angustifolia, Rhamnus cathartica, Tamarix chinensis, T. parviflora, T. ramosissima, Ulmus pumila*), shall be inventoried before cutting. The inventory shall record the location, number, and species of trees and shrubs.

2. In windbreaks, shelterbelts and other planted areas, trees or shrubs anticipated to be cleared, regardless of size, shall be inventoried for replacement.

3. In native growth areas, trees anticipated to be cleared that are 1 inch diameter at breast height ("dbh") or greater shall be inventoried for replacement.

4. In native growth areas, shrubs anticipated to be cleared in the permanent right-of-way shall be inventoried for replacement.

5. In native growth areas outside the permanent right-of-way, shrubs shall be cut flush with the surface of the ground, taking care to leave the naturally occurring seed bank and root stock intact. If soil disturbance is necessary, the native topsoil shall be preserved and replaced after construction. Shrubs shall be allowed to regenerate naturally where native topsoil is preserved and replaced. Where native topsoil is not preserved and replaced, shrubs anticipated to be cleared shall be inventoried for replacement.

6. In native growth areas, trees and shrubs may be inventoried by actual count or by sampling method that will properly represent the woody

vegetation population. A sampling plan developed by the company, filed with the North Dakota Public Service Commission (NDPSC) and approved prior to the start of construction shall define the sampling method to be used for trees, for tall shrubs and for low shrubs. The data from the sample plots shall be extrapolated to the total acreage of the wooded area to be cleared to determine the species and quantity of trees and shrubs to be replaced.

Clearing for Construction

7. Trees and shrubs shall be selectively cleared, leaving mature trees and shrubs intact where practical.

8. The width of clear cuts through windbreaks, shelterbelts and all other wooded areas shall be limited to 50 feet or less unless otherwise approved by the NDPSC.

9. If the area of trees or shrubs actually cleared differs from the area inventoried, the difference in number of trees and shrubs to be replaced shall be noted on the inventory.

Replacement

10. Prior to tree/shrub replacement, documentation identifying the number and variety of trees removed as well as the mitigation plan for the proposed number, variety, type, location and date of replacement plantings shall be filed with the NSPSC for approval.

11. Tree replacement shall be on a 2 to 1 basis with 2-year-old saplings. Shrub replacement shall be on a 2 to 1 basis with stem cuttings.

12. Trees and shrubs shall be replaced by the same species or similar species suitable for North Dakota growing conditions as recommended by the North Dakota Forest Service.

13. Tree and shrub replacement shall not be conducted within a 20 to 30 foot wide path over the pipeline to facilitate visual inspections of the right-of-way in accordance with U.S. Department of Transportation safety regulations.

14. Landowners shall be given the option of having replacement trees/shrubs planted off the right-of-way on the landowner's property or waiving that requirement in writing and allowing those replacement trees/shrubs to be planted at alternative locations.

15. At the conclusion of the project, documentation identifying the actual number, variety, type, location and date of the replacement plantings shall be filed with the NDPSC.

16. Tree/shrub replacements shall be inspected once a year for three years, on about the anniversary of the plantings, and, on or shortly before October 1 of each year, a report shall be submitted to the NDPSC documenting the condition of replacement planting and any woodlands work completed. If after three years from the anniversary of the plantings the survival rate is less than 75%, the NDPSC may order additional planting(s).

XXIV

Tree and Shrub Inventory and Sampling Plan

TREE AND SHRUB INVENTORY AND SAMPLING PLAN

Prepared for:

BakkenLink Pipeline
Dry Creek Terminal to Beaver Lodge
PU-10-218

January 16, 2014

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ENVIRONMENTAL • ENGINEERING • LAND SURVEYING

1. Introduction

BakkenLink Pipeline LLC (BakkenLink) proposes to construct, own, and operate approximately 34 miles of 16-inch steel crude oil pipeline extending from the Dry Creek Terminal in McKenzie County, North Dakota to the Beaver Lodge receipt point in Williams County, North Dakota (Case #PU-10-218). BakkenLink will comply with the tree and shrub mitigation specifications as outlined in Appendix A. Specifically, this Plan outlines the process for completing the tree and shrub inventory.

2. Inventory Methods

BakkenLink will inventory trees and shrubs, including those considered invasive species, to be cleared within the ROW easement. Inventories will be documented on standard forms and will include the inventory location, species present, and number of trees and shrubs in the location. An example form is found in Appendix B.

1.1) Planted Areas

In windbreaks, shelterbelts, and other planted areas, trees and shrubs anticipated to be cleared regardless of size will be counted by direct stem count. All trees, regardless of size, will be inventoried for replacement.

In windbreaks, shelterbelts, and other planted areas, shrubs that form colonies (such as buffalo currant, chokecherry, dogwood, plum, pussy willow, sandbar willow, western snowberry, and Woods rose) and that are cut flush with the ground surface and not cleared, so as to leave the naturally occurring seed bank and root stock intact will not be direct stem counted. Instead, the area will be delineated on an aerial photo and indicated on construction drawings to not be cleared or have the ground disturbed. If ground disturbance occurs, BakkenLink will conduct a direct stem count of the disturbance area or estimate the number of stems cleared using a Commission approved sampling estimate method (see Shrub Sampling Method, Appendix C).

1.2) Native Growth Areas

In native growth areas, trees that are one-inch or greater diameter at breast height (DBH) will be inventoried for replacement. Inventories will be conducted using direct counts when feasible. Counts will include native and invasive species.

In high-density woodland areas, a Commission approved sampling method may be used in place of individual counting (see Tree Sampling Method, Appendix D).

In native growth areas, shrubs that form colonies (such as buffalo currant, chokecherry, dogwood, plum, pussy willow, sandbar willow, western snowberry, and Woods rose) and that are cut flush with the ground surface and not cleared, so as to leave the naturally occurring seed bank and root stock intact will not be direct stem counted. Instead, the area will be delineated on an aerial photo and indicated on construction drawings to not be cleared or have the ground disturbed. If ground disturbance occurs, BakkenLink will conduct a direct stem count of the disturbance area or estimate the number of stems cleared using a Commission approved sampling estimate method (see Shrub Sampling Method, Appendix C).

I. Tree Sampling Method

Per the Commission's Tree and Shrub Inventory Specifications (Inventory Specification No. 6 in Appendix A), in high-density woodland areas, BakkenLink proposes the following sampling method for the tree inventory. The dimensions of the entire woodland stand within the ROW will be delineated to determine the area of the woodland. Tree and shrub counts will be made in representative sample site areas within the woodland. Transects will be developed and the circular sample sites placed along the transect. The number of sample sites within a woodland stand will be dependent on woodland size and uniformity. A smaller, more uniform woodland stand would require fewer sample sites than a larger, less uniform woodland stand.

The sample sites will be 0.10 acres (37.24-foot radius circles). A rope 37.24 feet in length will be attached to a central stake and rotated in a circle (Appendix D). Trees and shrubs within the circle will be counted. Tree and shrub density for the entire woodland area within the ROW will be calculated based on the average density from all of the sample locations within the woodland, weighted against the woodland size.

II. Shrub Sampling Method

Per the Commission's Tree and Shrub Inventory Specifications (Inventory Specification No. 6 in Appendix A), in high-density woodland areas, BakkenLink proposes the following sampling method for the shrub inventory. The dimensions of the entire woodland stand within the ROW will be delineated to determine the area of the woodland. Shrub counts will be made in representative sample site areas within the woodland. Transects will be developed and the circular sample sites placed along the transect. The number of sample sites within a woodland stand will be dependent on woodland size and uniformity. A smaller, more uniform woodland stand would require fewer sample sites than a larger, less uniform woodland stand.

The sample sites will be 0.001 acres (3.72-foot radius circles). A rope 3.72 feet in length will be attached to a central stake and rotated in a circle (Appendix C). Shrubs within the circle will be counted. Tree and shrub density for the entire woodland area within the ROW will be calculated based on the average density from all of the sample locations within the woodland, weighted against the woodland size.

Appendix A

Tree and Shrub Mitigation Specifications

Inventory

1. Trees and shrubs anticipated to be cleared, including those that are considered invasive species or noxious weeds (*e.g., Caragana arborescens, Elaeagnus angustifolia, Rhamnus cathartica, Tamarix chinensis, T. parviflora, T. ramosissima, Ulmus pumila*), shall be inventoried before cutting. The inventory shall record the location, number, and species of trees and shrubs.
2. In windbreaks, shelterbelts and other planted areas, trees or shrubs anticipated to be cleared, regardless of size, shall be inventoried for replacement.
3. In native growth areas, trees anticipated to be cleared that are 1 inch diameter at breast height ("dbh") or greater shall be inventoried for replacement.
4. In native growth areas, shrubs anticipated to be cleared in the permanent right-of-way shall be inventoried for replacement.
5. In native growth areas outside the permanent right-of-way, shrubs shall be cut flush with the surface of the ground, taking care to leave the naturally occurring seed bank and root stock intact. If soil disturbance is necessary, the native topsoil shall be preserved and replaced after construction. Shrubs shall be allowed to regenerate naturally where native topsoil is preserved and replaced. Where native topsoil is not preserved and replaced, shrubs anticipated to be cleared shall be inventoried for replacement.
6. In native growth areas, trees and shrubs may be inventoried by actual count or by sampling method that will properly represent the woody vegetation population. A sampling plan developed by the company, filed with the North Dakota Public Service Commission (Commission) and approved prior to the start of construction shall define the sampling method to be used for trees, for tall shrubs and for low shrubs. The data from the sample plots shall be extrapolated to the total acreage of the wooded area to be cleared to determine the species and quantity of trees and shrubs to be replaced.

Clearing for Construction

7. Trees and shrubs shall be selectively cleared, leaving mature trees and shrubs intact where practical.

8. The width of clear cuts through windbreaks, shelterbelts and all other wooded areas shall be limited to 50 feet or less unless otherwise approved by the NDPSC.
9. If the area of trees or shrubs actually cleared differs from the area inventoried, the difference in number of trees and shrubs to be replaced shall be noted on the inventory.

Replacement

10. Prior to tree/shrub replacement, documentation identifying the number and variety of trees removed as well as the mitigation plan for the proposed number, variety, type, location and date of replacement plantings shall be filed with the NSPSC for approval.
11. Tree replacement shall be on a 2 to 1 basis with 2-year-old saplings. Shrub replacement shall be on a 2 to 1 basis with stem cuttings.
12. Trees and shrubs shall be replaced by the same species or similar species suitable for North Dakota growing conditions as recommended by the North Dakota Forest Service.
13. Landowners shall be given the option of having replacement trees/shrubs planted off the right-of-way on the landowner's property or waiving that requirement in writing and allowing those replacement trees/shrubs to be planted at alternative locations.
14. At the conclusion of the project, documentation identifying the actual number, variety, type, location, and date of the replacement plantings shall be filed with the NDPSC.
15. Tree/shrub replacements shall be inspected once a year for three years, on about the anniversary of the plantings, and, on or shortly before October 1 of each year, a report shall be submitted to the NDPSC documenting the condition of replacement planting and any woodlands work completed. If after three years from the anniversary of the plantings the survival rate is less than 75%, the NDPSC may order additional planting(s).

Appendix B

Sampling Form

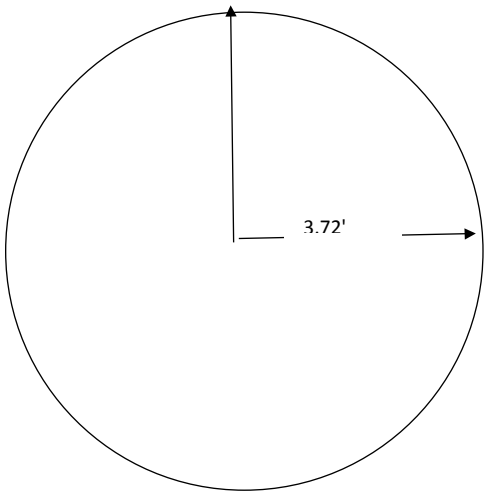
TREE/SHRUB INVENTORY **BakkenLink Pipeline**				
Sampled by:			**Date:**	
Location / Site ID:				
Woodland Type (circle): Native Planted		**Plot Size (circle): 3.72 ft 37.2 ft**		
SPECIES	**Planted**	**Native**		**TOTAL**
	All trees shrubs	**Trees >1”**	**All shrubs**	

Appendix C

Shrub Sampling Method

Sample Plot

- Circular sample plots with a radius of 3.72 feet, or area equivalent to 0.001 acres created with a central stake and rope.
- The rope, 3.72 feet in length, anchored to the central stake and rotated in a circle



Shrub Counts

- Direct stem counts from each plot
- Tallied on work sheet by species

Woodland size

- GPS points taken in the field around boundary
- GIS used to calculate acreage

Calculations

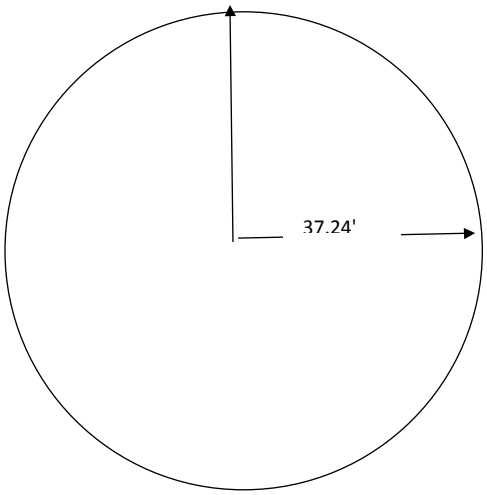
- Average determined from all plots sampled in a woodland area or area is equivalent to stems/0.001 acre
- Converted to a per acre basis (average times 1,000)
- Total number per woodland determined by multiplying average number per acre with woodland size

Appendix D

Tree Sampling Method

Sample Plot

- Circular sample plots with a radius of 37.24 feet, or area equivalent to 0.10 acres created with a central stake and rope.
- The rope, 37.24 feet in length, anchored to the central stake and rotated in a circle



Tree Counts

- Direct stem counts from each sample site
- Tallied on work sheet by species

Woodland size

- GPS points taken in the field around boundary
- GIS used to calculate acreage

Calculations

- Average determined from all plots sampled in a woodland area or area is equivalent to stems/0.10 acre
- Converted to a per acre basis (average times 10)
- Total number per woodland determined by multiplying average number per acre with woodland size

Appendix XXV

USACE SOP #14 – Garrison Project Tree/Vegetation Mitigation

CENWO-OD-GA **September 26, 2011**

MEMORANDUM FOR ALL GARRISON PROJECT EMPLOYEES

SUBJECT: SOP #14 - Garrison Project Tree/Vegetation Mitigation

1. Purpose.
The purpose of this United States Army Corps of Engineers - Garrison Project (USACE) Standard Operating Procedure (SOP) is to control and regulate the indiscriminate or excessive removal, large-scale, clear-cutting and destruction of trees/vegetation and to control, standardize and prevent conditions such as: degradation of sensitive areas or wanton destruction which cause an increase in storm water runoff, sedimentation, soil erosion, loss of wildlife habitat, air or noise pollution or inhibit aquifer recharge or impair the ambiance or physical appearance of the property. The guidance contained in this SOP is designed to limit such adverse impact while not interfering with the right of an entity to appropriately remove trees/vegetation in accordance with the guidance set forth herein below.

2. Applicability.
a. The terms and provisions of this SOP shall apply to real property, in all cases of parcels upon which new construction will take place and/or cases of maintenance or demolition of existing structures.
b. Unless specifically exempted herein, it shall be prohibited for any person to remove or cause to be removed any tree/vegetation, under the circumstances set forth in paragraph a. above, with the trunk diameter breast height (DBH) of two (2) inches or larger (fifty-four (54) inches above the actual ground level) being individually counted and trees smaller than 2 inches and all shrubs/vegetation being clump counted by square foot without first having obtained documented project permission to do so.
c. This SOP shall not be utilized for the purpose of removal of trees by an adjacent landowner for the purpose of View Management.

3. Tree/Vegetation Replacement Plan.
A tree/vegetation replacement plan shall consist of the following:
a. A site plan, survey or plot plan of one (1) inch equals twenty (20) feet or less, showing the location of existing trees/vegetation and clearly marked property boundaries. There shall be a list identifying the number and species of trees/vegetation inventoried. The site plan shall include the legal land survey description.
b. The locations on the parcel where tree/vegetation removal is to take place. Shape files of the location are highly encouraged.
c. The total square footage of the area being utilized.
d. Trees with a DBH of two (2) inches or larger shall be individually counted and trees with a DBH smaller than two (2) inches and all shrubs shall be clump counted by square foot.
e. The total number, by size and species, of existing trees with a DBH of two (2) inches or greater on the parcel.
f. The total number, by size and species, of existing trees with a DBH of two (2) inches or greater, which are to be removed.
g. The total number, by species, of existing trees with a DBH smaller than two (2) inches and all shrubs clump counted by square foot on the parcel.
h. The total number, by species, of existing trees with a DBH smaller than two (2) inches and all shrubs clump counted by square foot which are to be removed.
i. A planting detail for replacement trees/vegetation.

j. All specific plans for replacement of removed trees /vegetation shall be based on the following requirements:

1. The replacement trees/vegetation shall be planted on the property where the trees/vegetation were removed or in a location designated by the USACE.

2. All inventories/ informational documents must be provided to the USACE prior to construction.

3. Should a road be constructed a specific seed mix will have to be applied to the ditches.

4. The use of erosion control methods will be required as needed.

5. Replacement trees must be planted within one year after the applicant's project has been completed.

4. Replacement Tree Value Calculations.

a. Dead and diseased trees as determined by the USACE shall not be included as trees to be replaced.

b. The USACE may elect, in lieu of planting replacement trees, to have the applicant provide compensation (a sum of money for each tree that was damaged or removed.

c. The replacement value of all trees and shrubs that are damaged or removed will be as follows:

Number/Value of Replacement Trees

Size of Tree Removed Inches DBH	Replacement Tree Ratio	Replacement Tree Value
Two, but not more than four (2"-4")	2:1	$100.00
More than four, but less than eight (4"-8")	3:1	$200.00
More than eight, but less than twelve (8"-12")	4:1	$400.00
More than twelve, but less than eighteen (12"-18")	5:1	$500.00
More than eighteen, but less than twenty-four (18"-24")	6:1	$800.00
More than twenty-four (24" +)	7:1	$1000.00
Trees with a DBH smaller than 2" and all Vegetation/shrubs clump counted by square feet	4:1	$200.00

5. Species Requirements.

The approved 'USACE Tree/Vegetation List' contains species or their varieties acceptable for planting on USACE property. The chief objective of the replacement plantings is to enhance habitat for wildlife. Other vegetative species or their varieties not listed may be planted on USACE owned property at USACE discretion, but only desirable vegetation of good appearance, beauty and adaptability that are generally free from injurious insects, diseases or other limitations. Where certain planting sites have been assigned a particular species or variety, only designated species or variety shall be planted on such sites, unless the plan is revised by the USACE.

6. Planting Requirements (Trees)

a. Size - All small deciduous trees and coniferous and their cultivars or varieties shall be in the age classes: 1-2, 2-1, 3-0, or 2-2 with a top height no less than (8) inches. Age class translates to the age of the tree. The number preceding the hyphen relates to the years the tree spent in a seed bed and the number following the hyphen is the years the tree spent in a nursery field. As such, a 2-2 would be a 4 year old tree.

b. Grade - Unless otherwise allowed for specific reasons, all trees shall have comparatively straight trunks, well developed leaders and tops, and the roots should be characteristic of the species. They shall have acceptable balance between top and root. At the time of planting, all trees must be free of mechanical injuries, and other objectionable features that tend to affect the future health, growth, strength, form and beauty of the plant. Replacement stock must be purchased from USDA Plant Hardiness zones 3b and 4a.

c. Location and Spacing - No tree shall be planted closer than ten (10) feet to a utility pole to allow room for line maintenance. Any tree planted under utilities shall not be planted if its eventual height will interfere with said utility lines. Selection of planting site and species will be determined by the USACE. Spacing of trees shall be determined by the USACE in accordance with local conditions; the species, cultivars or varieties used, and their mature height, spread and form. Generally, all large and medium sized trees, at maturity, shall be spaced twelve (12) feet, center-to-center and all small trees shall be spaced a minimum of eight (8) feet, center-to-center.
d. Methods of Planting and Support - Most small, deciduous trees and coniferous and shrubs may be moved bare-rooted unless otherwise indicated. Roots of bare-rooted trees and shrubs must be protected against drying out. All coniferous trees shall be moved balled and burlap. Balled roots should be prevented from drying out at the surface of the ball and they should be protected against freezing. Pits for the planting of bare-root plants shall be at least twelve (12) inches larger in diameter than the diameter of the root system in order to accommodate the roots without crowding. Bare root trees may also be planted in rows utilizing a mechanical tree planter for the planting of large numbers of trees. For balled trees, the pits should be minimum twelve (12) inches larger than the diameter of the ball of soil to allow proper backfill. Plants shall be planted no deeper than previously grown, with due allowance for settling. When the planting is completed, the entire root area shall be thoroughly saturated with water and burlap wrappings shall be cut. Tree trunks shall be suitably wrapped and guyed, or supported in an upright position, according to accepted arboricultural practices. The guys or supports shall be installed so that they will neither girdle or cause serious injury to the tree nor endanger public safety.

7. General Maintenance Requirements.
a. A minimum of 80% of the replacement trees/shrubs/vegetation must be living at the end of 5 growing seasons in order to meet the mitigation requirements.
b. The use of tree fabric greatly increases tree survivability and reduces the amount of moisture needed for survival. The use of tree fabric is recommended, but not required, especially when a large number of trees are being planted it is highly recommended to ensure 80% survival (other wise a minimum of 3 cultivations throughout the summer will be necessary)

8. Penalty for Non-notification.
a. If trees/shrubs are removed without prior approval, the following protocol will be followed:

1. If it can be determined how many trees/shrubs were removed, the trees will be replaced based on the above replacement table.

2. In the event that it is unknown how many trees were removed, the number of trees requiring replacement shall be computed by assuming ten (10) trees greater than twelve (12) inches DBH per half acre of disturbed area were removed.

3. Shrubs, grasses and forbs will be treated similarly at USACE discretion

b. Any person who violates, or fails, or refuses to comply with this SOP, shall be liable to a penalty set forth in the USACE Title 36 Rules and Regulations of not less than two hundred fifty ($250.00) dollars.

Todd J. Lindquist
Operations Project Manager

USACE Tree List

American Linden (*Tilia americana*) ---- *Jamestown* http://www.ag.ndsu.edu/trees/handbook/th-3-123.pdf)
Balsam Poplar (*Populus balsamifera*) http://plants.usda.gov/java/profile?symbol=POBA2)
Black Hills Spruce (*Picea glauca var. densata*) http://www.ag.ndsu.edu/trees/handbook/th-3-175.pdf
Box Elder (*Acer negundo*) http://plants.usda.gov/java/profile?symbol=ACNE2
Bur Oak (*Quercus macrocarpa*) http://plants.usda.gov/java/profile?symbol=QUMA2
Common Hackberry (*Celtis occidentalis*) http://www.ag.ndsu.edu/trees/handbook/th-3-119.pdf
Colorado Blue Spruce (*Picea pungens*) http://www.ag.ndsu.edu/trees/handbook/th-3-177.pdf
Cottonwood (*Populus*) http://plants.usda.gov/java/profile?symbol=POPUL
Honeylocust (*Gleditstia triacanthos*) http://www.ag.ndsu.edu/trees/handbook/th-3-121.pdf
Laurel Willow (*Salix pentandra*) http://www.ag.ndsu.edu/trees/handbook/th-3-141.pdf
Peachleaf Willow (*Salix amygdaloides* Andersson) http://plants.usda.gov/java/nameSearch
Ponderosa Pine (*Pinus ponderosa*) http://plants.usda.gov/java/profile?symbol=PIPO
Quaking Aspen (*Populus tremuloides*)
http://plants.usda.gov/java/profile?symbol=POTR5&mapType=nativity&photoID=potr5_002_avp.jpg
Rocky Mountain Juniper (*Juniperus scopulorum*)
http://plants.usda.gov/java/profile?symbol=JUSC2&mapType=nativity&photoID=jusc2_001_avp.tif
Sandbar Willow (*Salix interior*) http://www.ag.ndsu.edu/trees/handbook/th-3-65.pdf
Silver Maple (*Acer saccharinum*) http://plants.usda.gov/java/profile?symbol=ACSA2

USACE Shrub List

American Plum (*Prunus Americana*)
http://plants.usda.gov/java/profile?symbol=PRAM&mapType=nativity&photoID=pram_002_ahp.jpg
American Cranberry Bush (*Viburnum trilobum*) http://www.ag.ndsu.edu/trees/handbook/th-3-17.pdf
Black Currant (*Ribes americanum*) http://plants.usda.gov/java/profile?symbol=RIAM2
Common Chokecherry (*Prunus virginiana*)
http://plants.usda.gov/java/profile?symbol=PRVI&mapType=nativity&photoID=prvi_001_avp.jpg
Elderberry (*Sambucus*) http://plants.usda.gov/java/profile?symbol=SAMBU
Freedom Honeysuckle (*Lonicera x 'Freedom'*) http://www.ag.ndsu.edu/trees/handbook/th-3-29.pdf
False Indigo (*Amorpha fruticosa*) http://www.ag.ndsu.edu/trees/handbook/th-3-31.pdf
Golden Currant (*Ribes odoratum*) http://www.ag.ndsu.edu/trees/handbook/th-3-19.pdf
Hawthorn (*Crataegus arnoldiana*) http://www.ag.ndsu.edu/trees/handbook/th-3-79.pdf
Juneberry (*Amelanchier alnifolia*)
http://plants.usda.gov/java/profile?symbol=AMAL2&mapType=nativity&photoID=amal2_002_ahp.tif
Redosier Dogwood (*Cornus sericea*) http://www.ag.ndsu.edu/trees/handbook/th-3-21.pdf
Silverberry (*Elaeagnus commutate*)
http://plants.usda.gov/java/profile?symbol=ELCO&mapType=nativity&photoID=elco_001_avp.tif
Silver Buffaloberry (*Shepherdia argentea*)
http://plants.usda.gov/java/profile?symbol=SHAR&mapType=nativity&photoID=shar_001_ahp.tif
Skunkbush Sumac (*Rhus trilobata*)
http://plants.usda.gov/java/profile?symbol=RHTR&mapType=nativity&photoID=rhtr_001_ahp.tif
Smooth Sumac (*Rhus glabra*) http://plants.usda.gov/java/profile?symbol=RHGL
Snowberry (*Symphoricarpos occidentalis*) http://plants.usda.gov/java/profile?symbol=SYOC
Western Sandcherry (*Prunus besseyi*) http://www.ag.ndsu.edu/trees/handbook/th-3-45.pdf
Woods Rose (*Rosa woodsii*) http://plants.usda.gov/java/profile?symbol=ROWO

USACE Grass Species Mix NO. 1	PLS
Canada wild rye	15%
Blue grama (bad river)	20%
June grass	5%
Big bluestem	10%
Little bluestem	25%
Indian grass	5%
Switchgrass	5%
Side oats grama	15%

Seeding dates: May 1 – June 15

USACE Grass Species Mix NO. 2

Species	Variety	Common Name	% of Mix	Actual PLS Mix Po/Acre	Broadcast Actual PLS Lbs/Acre
Grasses Cool Season:					
Agropyron smithii	Rodan	Western wheatgrass	40%	4.00	8.00
Stipa viridula	Lodorm	Green needlegrass	30%	3.00	6.00
Grasses Warm Season					
Calamovilfa longifolia	Goshen	Prairie sandreed	30%	3.00	6.00
Total of All Species			**100%**	10.00	20.00
Cover Crop: 1 of 3	Mandan	Oats or Barley or Canadian Wild Rye		4.00	8.00
Total Pounds per Type				14.00	28.00

Seeding dates: May 1 – June 15

The recommended seeding rate would be 12 lbs PLS/acre if broadcasted or if drilled a seed rate of 8-10 lbs PLS/acre will be used.

Use of Pure Live Seed (PLS) for calculating seed mixtures
All of the seed mixtures in this guide give the rate of pure live seed (PLS) for each species per acre. These rates were derived using three basic figures: percent of each species desired by composition, number of seeds per pound according to species, and total number of PLS per square foot.

The following equation should be used to calculate how much seed is needed to provide the required pounds of PLS needed.

% purity x germination rate % = % PLS
pounds of PLS desired divided by % PLS = Pounds of Seed Required

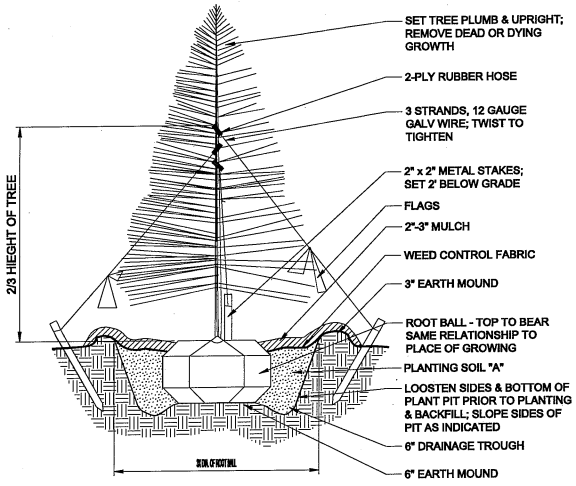
An example of this is: 10 pounds of PLS is required. The given seed lot for this species has a purity of 95% and a germination rate of 85%. How many pounds of seed will be necessary to have 10 PLS?

.95 (purity) X .85 (germination rate) = .81 (% PLS)
10 (required poundage) divided by .81 (%PLS) =12.3
12.3 pounds of seed will be necessary to provide 10 pounds PLS of seed.

USACE Wildflower Species

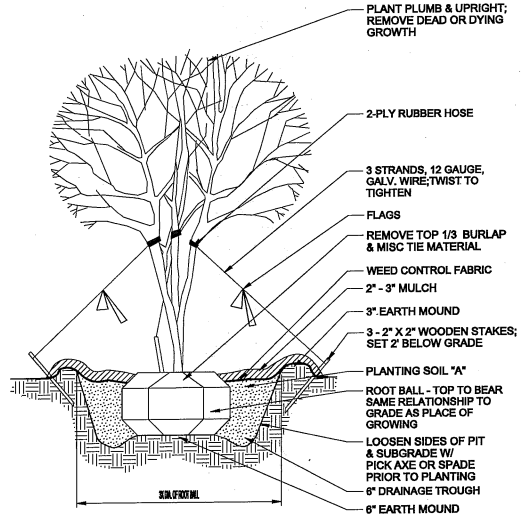
Purple coneflower (*Ratibida columnifera*)
Upland goldenrod (*Solidago ptarmicoides*)
Wild lupine (*Lupinus perennis*)
White prairie clover (*Petalostemum candidum*)
Fragrant giant hyssop (*Agastache foeniculum*)
Yarrow (*Achillea millefolium*)
Stiff sunflower (*Helianthus rigidus*)
Wild bergamot (*Monarda fistulosa*)
Purple prairie clover (*Petalostemum purpureum*)
Gray goldenrod (*Solidago nemoralis*)

*Any species not included on our approved lists that is considered non-native or invasive will NOT be deemed as an option for replacement or reseeding stock.



2 DETAIL - EVERGREEN TREE PLANTING

NO SCALE



1 DETAIL - MULTI-STEM TREE PLANTING

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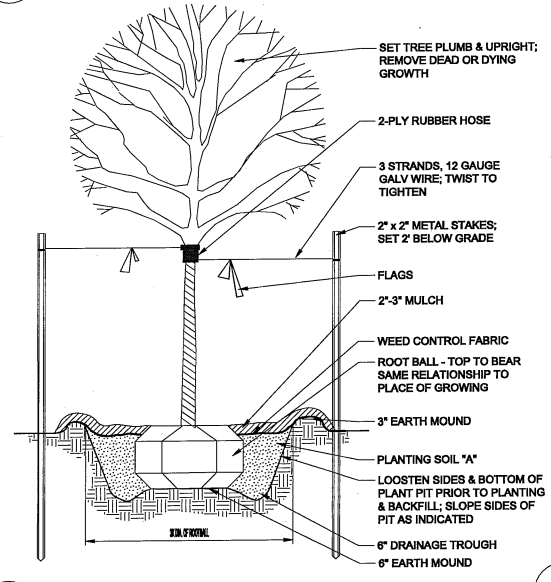

4 DETAIL - SHADE TREE PLANTING

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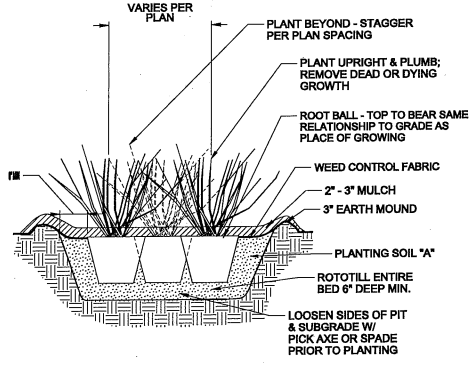
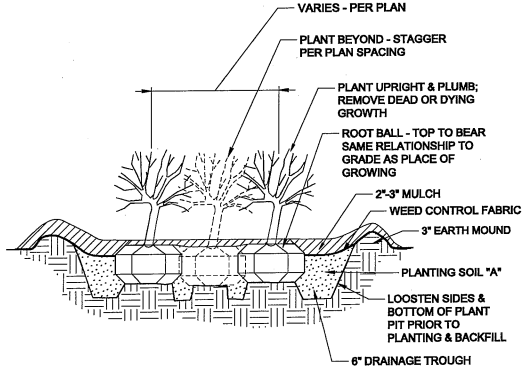


4 DETAIL - GROUND COVER / PERENNIAL PLANTING

NO SCALE



3 DETAIL - SHRUB PLANTING

NO SCALE

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: VKS | DATE: XXX
DWN BY: KVS | CKD BY: JVH | SOLICITATION NO.: XXX
SUBMITTED BY: | CONTRACT NO.: XXX
FILE NAME: Plant Details.dgn | FILE NUMBER: XXX
SIZE: 33.10x22 | PLOT SCALE: 0.1 in. / in. | PLOT DATE: 9/9/2011

XXX
XXX
XXX

TYP PLANTING AND BEDDING DETAILS

SHEET IDENTIFICATION NUMBER
X

C:\Documents and Settings\jfadam\Desktop\Plant Details P-501.dgn

Appendix XXVI

Raptor and Prairie Grouse Survey

Raptor and Prairie Grouse Survey

BakkenLink Pipeline
Dry Creek Station to Beaver Lodge
McKenzie and Williams County
Project #3337-01

Prepared for:

BakkenLink Pipeline, LLC

January 16, 2014

Carlson McCain

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Raptor and Prairie Grouse Survey
BakkenLink Pipeline
Dry Creek Terminal to Beaver Lodge
McKenzie and Williams Counties, ND

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APPENDICES

Appendix A Figures

1.0 INTRODUCTION

Carlson McCain, Inc. conducted a survey for raptor nests and prairie grouse leks (sharp-tail grouse and sage-grouse) for BakkenLink Pipeline LLC (BakkenLink) along the proposed BakkenLink crude oil pipeline system in April 2012 and May 2013. The proposed pipeline system consists of approximately 34 miles of 16-inch steel crude oil pipeline extending from the Dry Creek Terminal in McKenzie County, North Dakota to the Beaver Lodge receipt point in Williams County, North Dakota being developed by an affiliate of BakkenLink. The survey area includes the following counties: McKenzie and Williams in North Dakota.

2.0 BACKGROUND INFORMATION

Records from the North Dakota Game and Fish Department (NDGF), North Dakota Parks and Recreation Department Heritage Inventory (NDPRC), US Fish and Wildlife Service (USFWS), US Forest Service (USFS), and Bureau of Land Management (BLM) were reviewed to determine the locations and status of previously observed and recorded raptor nests and prairie grouse leks.

The majority of the proposed route is located on private land; however, portions of the route are located on State, US Army Corps of Engineers (USACOE), and USFS lands in North Dakota. The USFS and BLM require spring surveys to document active raptor nests and prairie grouse leks on their managed lands. The NDGF and USFWS recommend that raptor and prairie grouse surveys be conducted along the entire route. Surface occupancy and construction timing restrictions may be recommended by these agencies in proximity to active raptor nests and lek locations.

The pipeline crosses varying topography including gently rolling hills, badland inclusions, steep wooded native draws, and level agricultural lands. Large trees and steep clay breaks located along the route provide suitable nesting habitat for migratory raptors. Green ash and American elm are the most common trees in grassland drainages. Cottonwood is common along river systems and streams. Shelterbelts in croplands and near farm residences include several tree species, native and introduced. In North Dakota breeding and nest initiation begins in February and nesting continues through late July or August.

Sharp-tail grouse leks, or dancing grounds, are generally located on rolling to flat native grasslands, with short vegetative height but may also occur on cultivated agricultural lands. Males generally select hilltops, ridges, or flats with a good field of view. Lek locations may be used for several years, but may become abandoned if vegetation structure gets too high. Peak attendance on leks is April to early May. The USFS has set a timing restriction on construction within a 1 mile line of sight radius of active sharp-tailed grouse leks from March 1 – June 15. In addition, there is a no surface occupancy restriction within ¼ mile line of sight of a grouse lek. The restrictions are waved if the lek grounds have been inactive for two previous consecutive breeding seasons.

Currently in North Dakota, the greater-sage grouse's range is limited to the extreme southwest portion of the state. Greater sage-grouse numbers have been in a downward trend since the 1960's due to habitat loss and fragmentation. The survey area is outside the pre-settlement range of the greater sage-grouse and none were observed during the surveys.

The proposed construction activities may affect raptor and migratory bird species through direct mortality, temporary habitat degradation, and/or temporary displacement of individual birds. These impacts are regulated in part through the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), and USFWS Endangered Species Act of 1973.

Under the MBTA and BGEPA, the USFWS recommends pre-construction nest surveys if construction takes place between February 1 and July 15 to avoid disturbance to migratory bird nests. Pre-construction surveys are to take place no more than 5 days in advance of construction. The USFWS

may request to be consulted to determine mitigation measures to avoid disturbance of located nests. Mitigation measures may include applying an avoidance buffer to nest locations or delaying construction in that area until young of the year are fledged.

The USFS has a no surface occupancy (NSO) boundary within line of site of active golden eagle, bald eagle, merlin, ferruginous hawk, peregrine falcon, prairie falcon and burrowing owl nests. The NSO boundary is set at 1-mile for bald eagle and peregrine falcon nests, ½-mile for golden eagle merlin, and ferruginous hawk nests and ¼-mile for prairie falcon and burrowing owl nests. The timing of preconstruction surveys is February 1 through July 31. A known raptor nest must be inactive for each of the previous seven years to waive the NSO restrictions.

3.0 METHODS

An aerial survey for raptor nests was conducted April 13-14th, 2012, in a Piper Super Cub, fixed-wing aircraft with a qualified observer and a pilot. Transects were generally flown ¼-mile each side of the proposed centerline along the entire length of the proposed route, approximately 50-200 feet above the ground surface. Additional areas were surveyed to account for possible changes to the pipeline route. Nests located from the air were revisited and observed from the ground on April 18 2012, to determine or confirm nesting activity. In addition a ground survey for raptors was conducted along the proposed pipeline corridor on May 23, 2013.

Greater sage-grouse and sharp-tail grouse surveys were conducted April 13-14th, 2012, in a Piper Super Cub, fixed-wing aircraft with a qualified observer and a pilot. Parallel transects spaced ¼-mile apart, and 200-300 feet above the ground surface, were flown in a north-south direction, extending two miles from the proposed centerline. The survey was conducted from ½-hour before sunrise till approximately two hours after sunrise.

Ground surveys for sharp-tail and greater sage-grouse leks on USFS lands within one-mile of the route were conducted on May 3, 2013. The survey was conducted from ½-hour before sunrise till approximately two hours after sunrise. Weather conditions at the time of the surveys were favorable for detection (i.e. partly cloudy with light winds of 5-10 mph).

Aerial and ground surveys for raptor nest and grouse leks along the proposed route will be conducted in the spring of 2014.

4.0 RESULTS

4.1 Raptor Nests

Occupied or active raptor nests within one mile of the proposed route observed during the 2012 survey included three red-tailed hawk nests and one Swainson's hawk nest. Occupied or active raptor nests within one mile of the proposed route observed during the 2013 ground survey included two red-tailed hawk nests, two great horned owl nests, and one unidentified tree nest. Active raptor nest and prairie grouse lek locations are depicted on the figures in Appendix A and summarized in Tables 1 and 2.

No active golden or bald eagle nests were located during the survey. Two previously recorded golden eagle nest locations were observed, but no nesting activity was evident during the survey. All other previously recorded nest locations surveyed during this project were not found and are assumed to be destroyed.

4.2 Prairie Grouse

One active sharp-tail grouse lek was found within the surveyed project area (Table 2) in 2012 and 2013. The active grouse lek is located on USFS land in the NE¼SE¼ of Section 4, T153N, R95W.

Table 1. Active raptor nests

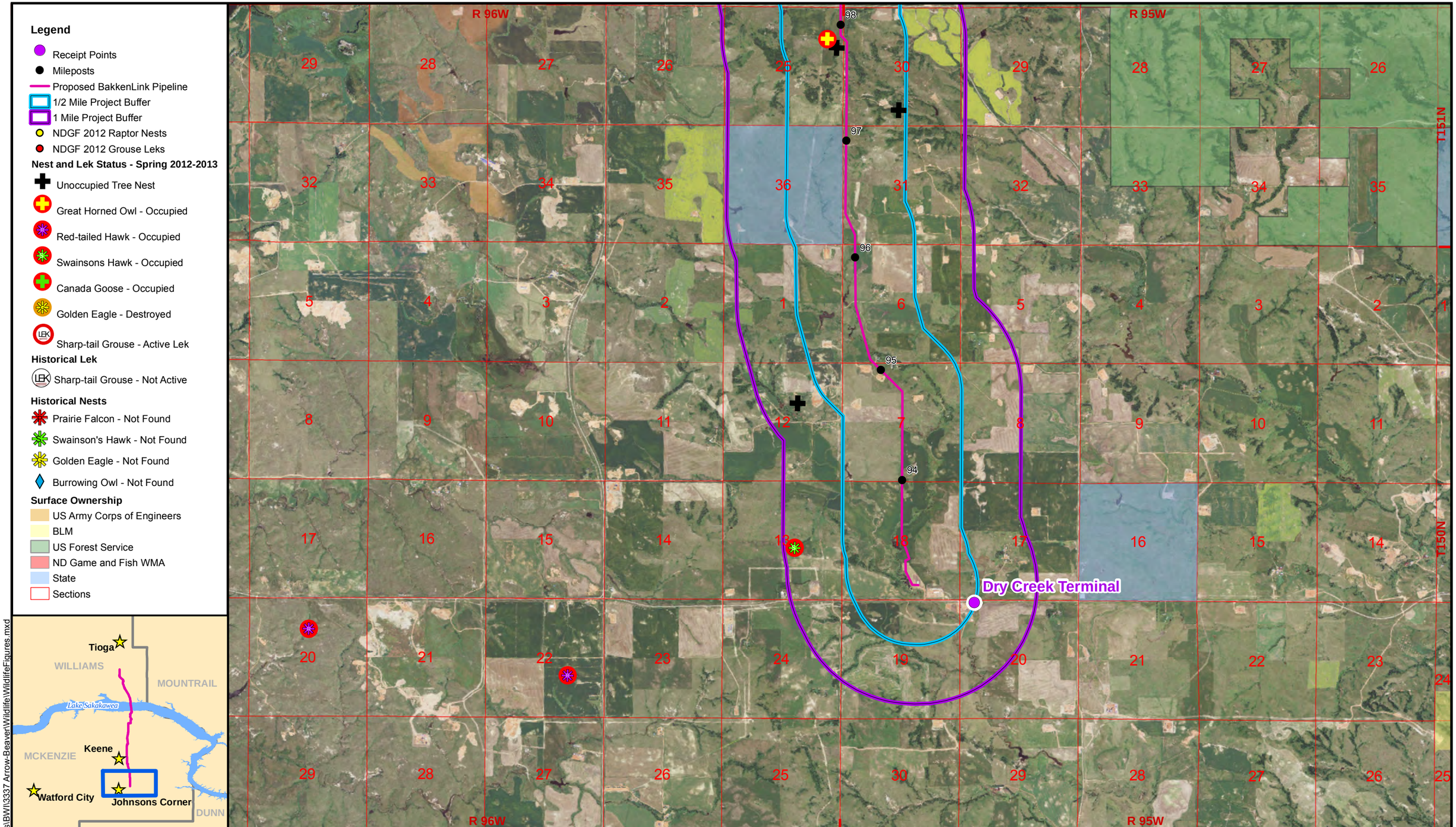
Species	Surface Owner	Survey		Location					Distance (ft) from Corridor
		Date	Method	County	SEC	QQ	TWP	RNG	
Swainson's Hawk	Private	April 14, 2012	Aerial	McKenzie	13	NW, SE	150	96	4,700
Swainson's Hawk	Private	April14, 2012	Aerial	Williams	32	NW, SE	155	95	1,500
Red-tailed Hawk	Private	April 14 2012	Aerial	McKenzie	12	NW, SE	151	96	500
Red-tailed Hawk	Private	April 14, 2012	Aerial	McKenzie	12	NW, SE	151	96	600
Red-tailed Hawk	Private	April 14, 2012	Aerial	McKenzie	27	NE, SW	153	95	4,000
Red-tailed Hawk	USFS	April 14, 2012	Aerial	McKenzie	9	NW, NE	153	96	800
Swainson's Hawk	Private	May 23, 2013	Ground	McKenzie	13	NW, SE	150	96	4,700
Red-tailed Hawk	Private	May 23, 2013	Ground	McKenzie	12	NW, SE	151	96	800
Red-tailed Hawk	Private	May 23, 2013	Ground	McKenzie	27	NW, SW	153	95	3,800
Great Horned Owl	Private	May 23, 2013	Ground	McKenzie	20	NE, NE	155	95	1,800
Red-tailed Hawk	Private	May 23, 2013	Ground	Williams	18	SE, NE	155	95	700
Unidentified	Private	May 23, 2013	Ground	Williams	7	SE, NW	155	95	2,300

Table 2. Active prairie grouse leks

Grouse Species	Owner	Survey		Location							Distance (ft) from Corridor
		Date	Type	Attendance	County	SEC	QQ	TWP	RNG	Latitude Longitude	
Sharp-tail Grouse	USFS	Apr 21 2011 May 3, 2012	Aerial Ground	20	McKenzie	4	NE SE	153	95	48.09941 -102.898	200

Appendix A

Figures



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1:48,000

0 2,000 4,000 Feet

Basemap: ND GIS Hub Aerial Imagery 2012

BakkenLink Pipeline, LLC

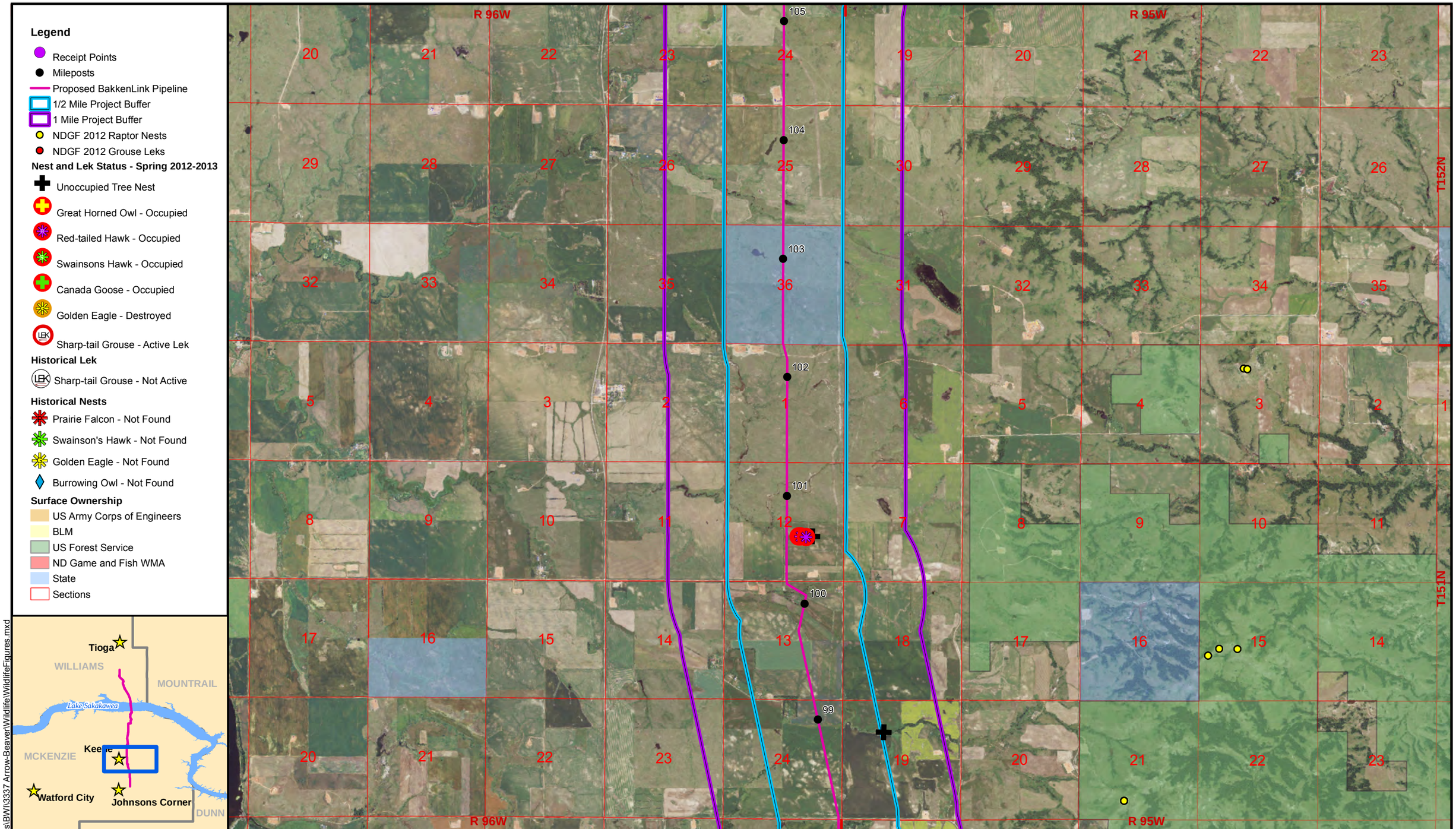
BakkenLink Pipeline

Dry Creek Terminal to Beaver Lodge
North Dakota

Figure 1

Raptor and Prairie Grouse
2012 - 2013 Spring Survey

January 2014 R:\projects\BWI\3337 Arrow-Beaver\Wildlife\WildlifeFigures.mxd



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Basemap: ND GIS Hub Aerial Imagery 2012

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BakkenLink Pipeline

Dry Creek Terminal to Beaver Lodge
North Dakota

Figure 2

Raptor and Prairie Grouse
2012 - 2013 Spring Survey

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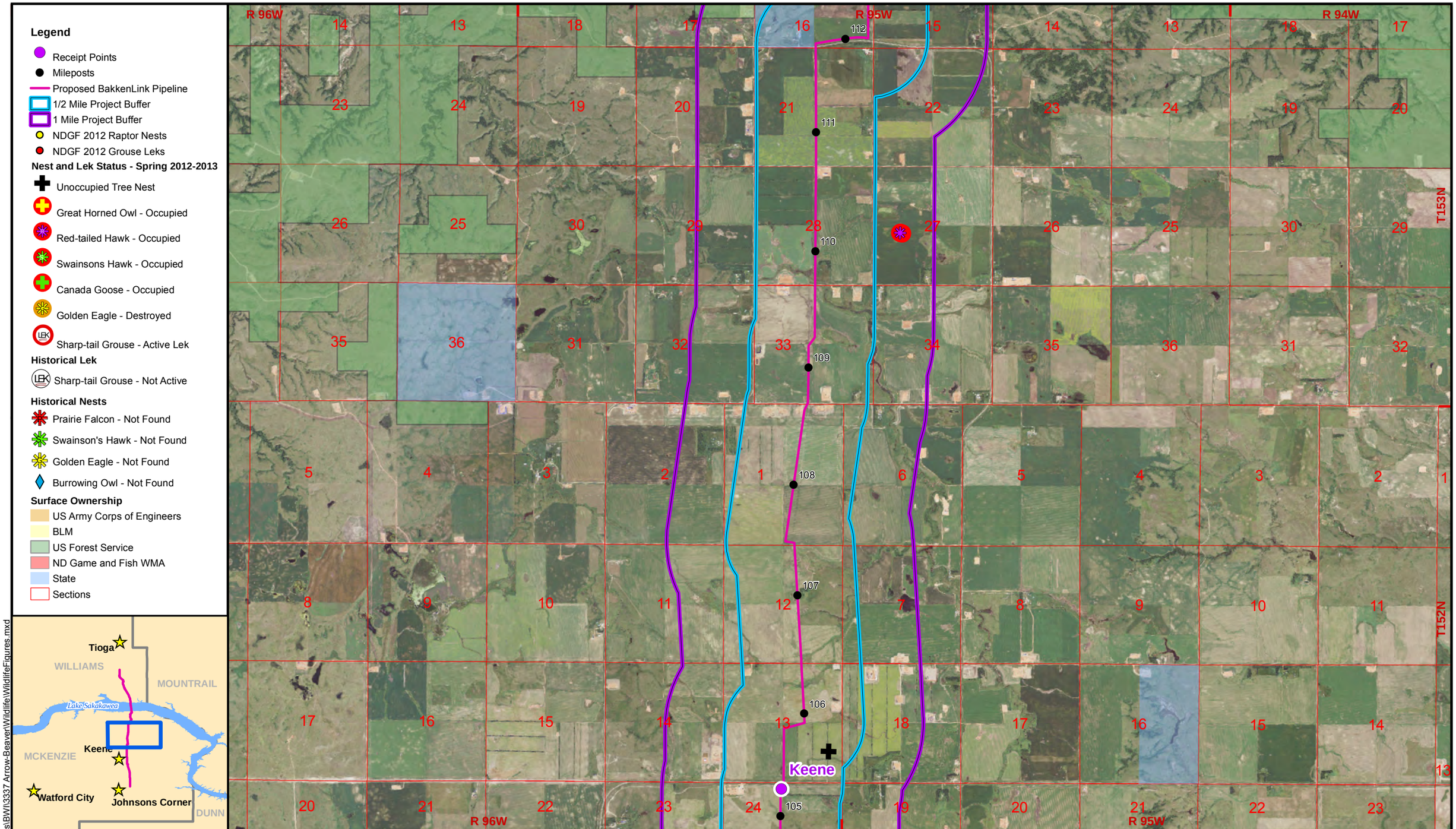
January 2014



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Basemap: ND GIS Hub Aerial Imagery 2012

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BakkenLink Pipeline

Dry Creek Terminal to Beaver Lodge
North Dakota

Figure 3

Raptor and Prairie Grouse
2012 - 2013 Spring Survey

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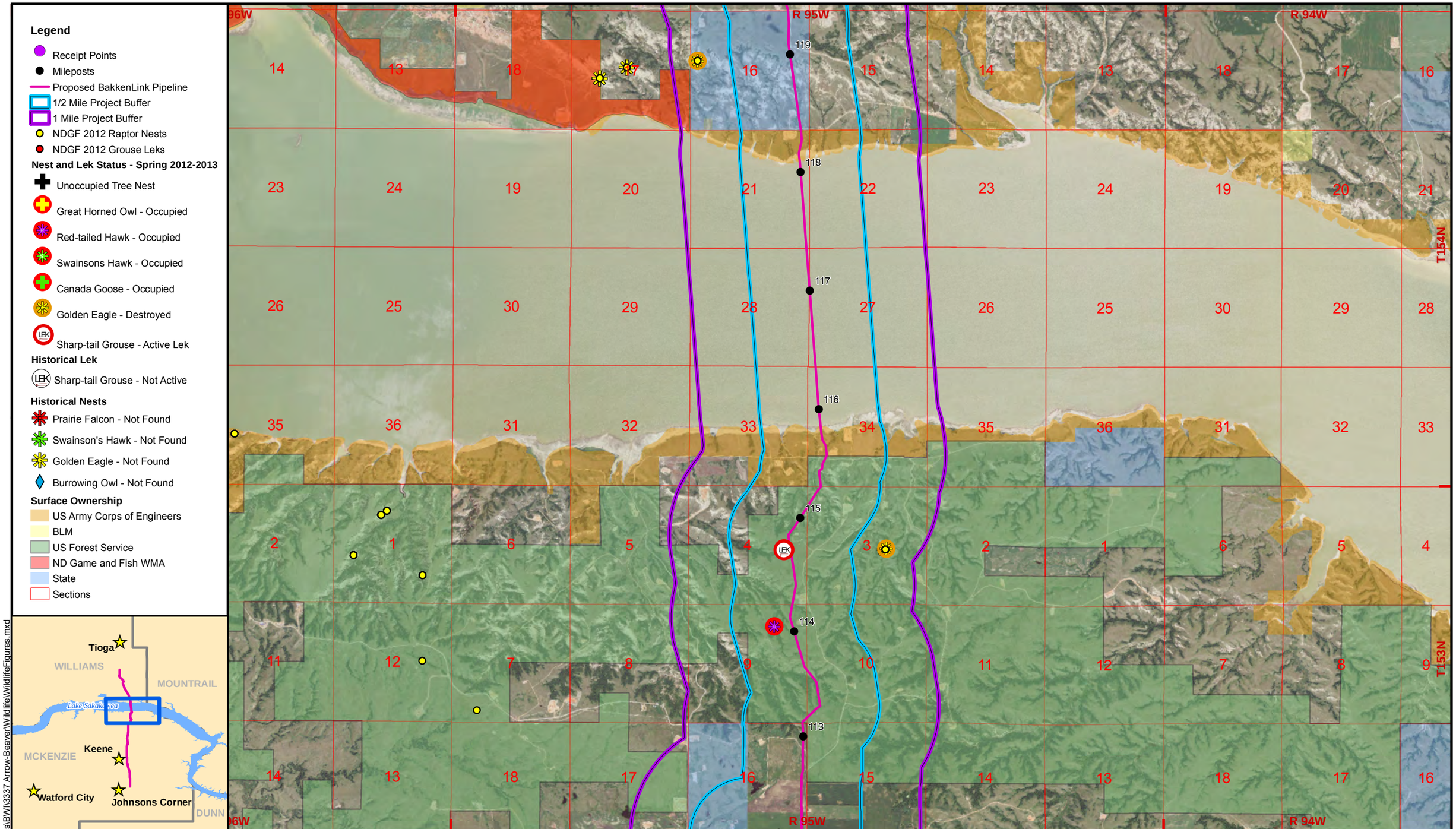
January 2014



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Basemap: ND GIS Hub Aerial Imagery 2012

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BakkenLink Pipeline

Dry Creek Terminal to Beaver Lodge
North Dakota

Figure 4

Raptor and Prairie Grouse
2012 - 2013 Spring Survey

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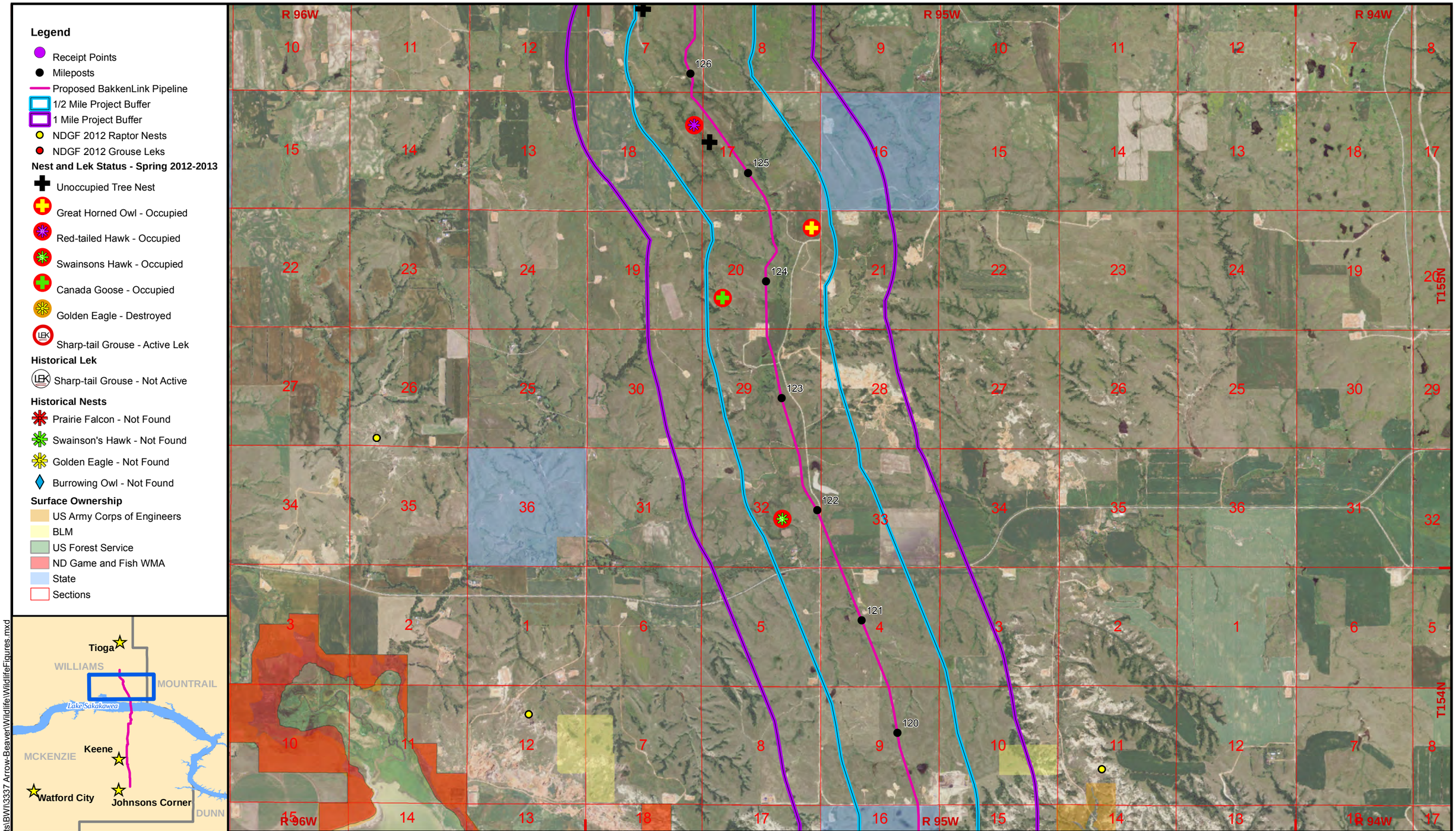
January 2014



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Basemap: ND GIS Hub Aerial Imagery 2012

BakkenLink Pipeline, LLC

BakkenLink Pipeline

Dry Creek Terminal to Beaver Lodge
North Dakota

Figure 5

Raptor and Prairie Grouse
2012 - 2013 Spring Survey

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January 2014

Legend

- Receipt Points
- Mileposts
- Proposed BakkenLink Pipeline
- 1/2 Mile Project Buffer
- 1 Mile Project Buffer
- NDGF 2012 Raptor Nests
- NDGF 2012 Grouse Leks

Nest and Lek Status - Spring 2012-2013

- Unoccupied Tree Nest
- Great Horned Owl - Occupied
- Red-tailed Hawk - Occupied
- Swainsons Hawk - Occupied
- Canada Goose - Occupied
- Golden Eagle - Destroyed
- Sharp-tail Grouse - Active Lek

Historical Lek

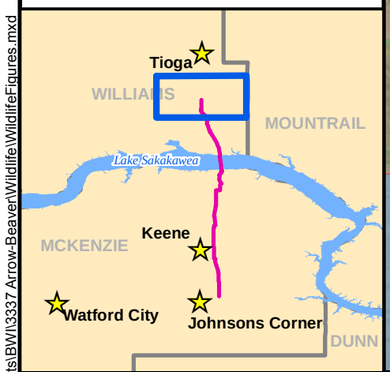
- Sharp-tail Grouse - Not Active

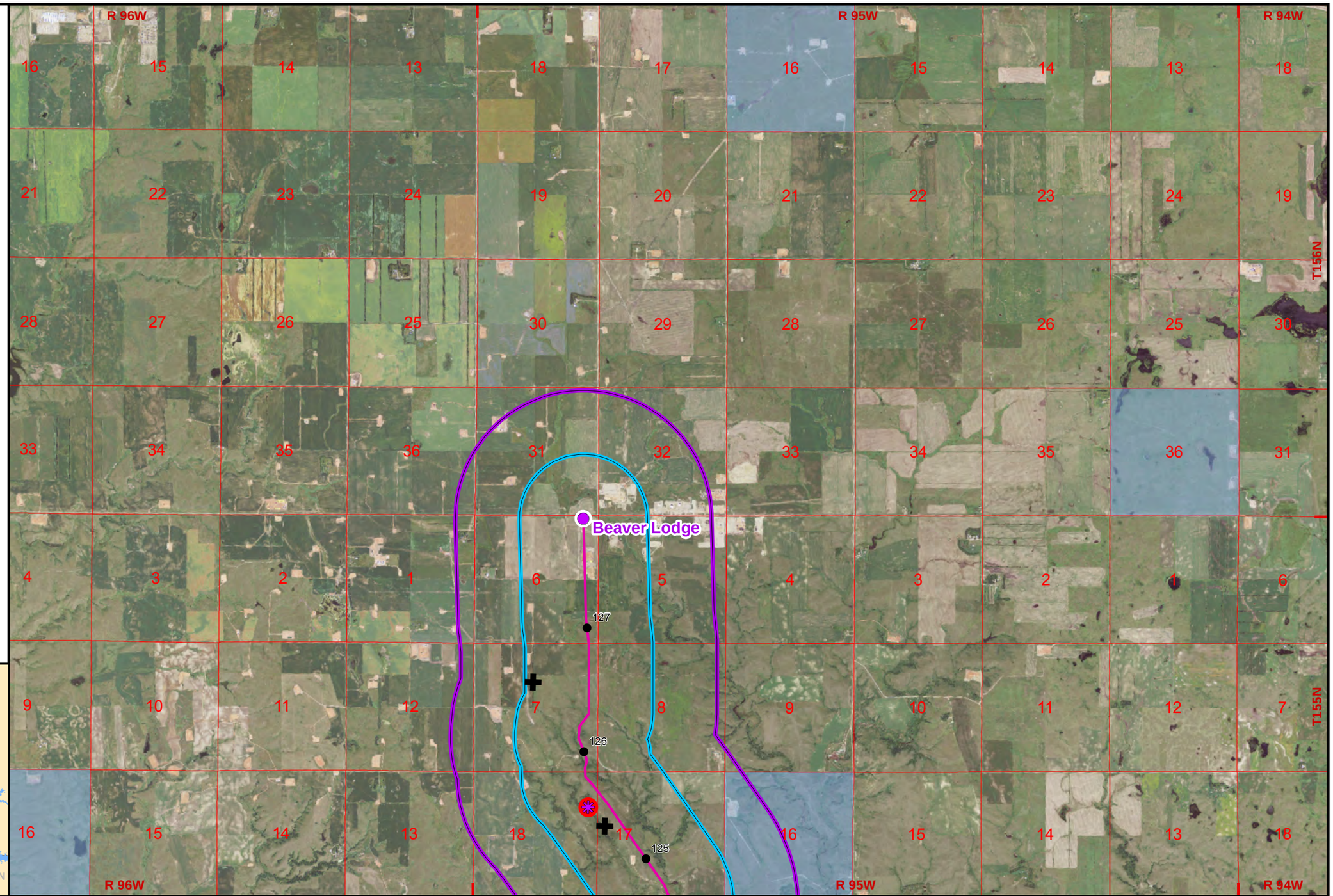
Historical Nests

- Prairie Falcon - Not Found
- Swainson's Hawk - Not Found
- Golden Eagle - Not Found
- Burrowing Owl - Not Found

Surface Ownership

- US Army Corps of Engineers
- BLM
- US Forest Service
- ND Game and Fish WMA
- State
- Sections





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BakkenLink Pipeline, LLC

BakkenLink Pipeline

Dry Creek Terminal to Beaver Lodge
North Dakota

Figure 6

Raptor and Prairie Grouse
2012 - 2013 Spring Survey

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January 2014

Raptor and Prairie Grouse Survey
Spring 2014

BakkenLink Pipeline
Dry Creek Station to Beaver Lodge
McKenzie and Williams County
Project #3337-01

Prepared for:

BakkenLink Pipeline, LLC

June 4, 2014

Carlson McCain

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Raptor and Prairie Grouse Survey
BakkenLink Pipeline
Dry Creek Terminal to Beaver Lodge
McKenzie and Williams Counties, ND

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Appendix A Figures

1.0 INTRODUCTION

Carlson McCain, Inc. conducted a survey for raptor nests and prairie grouse leks (sharp-tail grouse and sage-grouse) for BakkenLink Pipeline, LLC (BakkenLink) along the proposed Phase II of the BakkenLink crude oil pipeline system on May 19-21, 2014. The proposed pipeline system consists of approximately 37 miles of 16-inch steel crude oil pipeline extending from the Dry Creek Terminal in McKenzie County, North Dakota to the Beaver Lodge receipt point in Williams County, North Dakota being developed by an affiliate of BakkenLink. The survey area includes the following counties: McKenzie and Williams in North Dakota.

2.0 BACKGROUND INFORMATION

Records from the North Dakota Game and Fish Department (NDGF), North Dakota Parks and Recreation Department Heritage Inventory (NDPRC), US Fish and Wildlife Service (USFWS), US Forest Service (USFS), and Bureau of Land Management (BLM) were reviewed to determine the locations and status of previously observed and recorded raptor nests and prairie grouse leks. Results of the 2012 and 2013 surveys were also reviewed.

The majority of the proposed route is located on private land; however, portions of the route are located on US Army Corps of Engineers (USACE), USFS lands, and North Dakota Department of Trust lands. The USFS and BLM require spring surveys to document active raptor nests and prairie grouse leks on their managed lands. The NDGF and USFWS recommend that raptor and prairie grouse surveys be conducted along the entire route. Surface occupancy and construction timing restrictions may be recommended by these agencies in proximity to active raptor nests and prairie grouse lek locations.

The pipeline crosses varying topography including gently rolling hills, badland inclusions, steep wooded native draws, and level agricultural lands. Large trees and steep clay breaks located along the route provide suitable nesting habitat for migratory raptors. Green ash and American elm are the most common trees in grassland drainages; whereas, Eastern cottonwood are common along river systems and streams. Shelterbelts in croplands and near farm residences include several native and introduced tree species. In North Dakota breeding and nest initiation begins in February and nesting continues through late July or August.

The proposed construction activities may affect raptor and migratory bird species through direct mortality, temporary habitat degradation, and/or temporary displacement of individual birds. These impacts are regulated in part through the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), and USFWS Endangered Species Act of 1973.

Under the MBTA and BGEPA, the USFWS recommends pre-construction nest surveys if construction takes place between February 1 and July 15 to avoid disturbance to migratory bird nests. Pre-construction surveys are to take place no more than 5 days in advance of construction. The USFWS may request to be consulted to determine mitigation measures to avoid disturbance of located nests. Mitigation measures may include applying an avoidance buffer around nest locations or delaying construction in that area until young of the year are fledged.

The USFS has a no surface occupancy (NSO) boundary within line of site of active golden eagle, bald eagle, merlin, ferruginous hawk, peregrine falcon, prairie falcon and burrowing owl nests. The NSO boundary is set at 1-mile for bald eagle and peregrine falcon nests, ½-mile for golden eagle merlin, and ferruginous hawk nests and ¼-mile for prairie falcon and burrowing owl nests. The timing of preconstruction surveys is February 1 through July 31. A known raptor (previously listed species) nest must be inactive for each of the previous seven years to waive the NSO restrictions.

Sharp-tail grouse leks, or dancing grounds, are generally located on rolling to flat native grasslands with short vegetative height, but may also occur on cultivated agricultural lands. Males generally select hilltops, ridges, or flats with a good field of view. Lek locations may be used for several years, but may become abandoned if vegetation structure gets too high. Peak lek attendance is April to early May. The USFS has set a timing restriction on construction within a 1 mile line of sight radius of active sharp-tailed grouse leks from March 1 – June 15. In addition, there is a no surface occupancy restriction within ¼-mile line of sight of a grouse lek. The restrictions are waved if the lek has been inactive for two previous consecutive breeding seasons.

Currently in North Dakota, the greater-sage grouse's range is limited to the extreme southwest portion of the state. Greater sage-grouse numbers have been in a downward trend since the 1960's due to habitat loss and fragmentation. The survey area is outside the pre-settlement range of the greater sage-grouse and none were observed during the surveys.

3.0 METHODS

An aerial survey for raptor nests and sharp-tail grouse was conducted May 19th and 20th, 2014, in a Cessna 172, fixed-wing aircraft with a qualified wildlife biologist and a pilot. Transects were generally flown ¼-mile each side of the proposed centerline along the entire length of the proposed route. Additional transects were flown ¾-mile each side of the proposed centerline on U.S. Forest Service lands. The survey was conducted approximately 50-200 feet above the ground surface.

Ground surveys for sharp-tail grouse leks on USFS lands within one-mile of the proposed route were conducted on May 21, 2014. Lek locations documented during the aerial survey were visited to confirm activity. Weather conditions at the time of the surveys were favorable for detection (i.e. partly cloudy with light winds of 5-10 mph).

4.0 SURVEY RESULTS

4.1 Raptor

A total of ten raptor nests were documented within one mile of the proposed route during the 2014 survey. Nine of the nests were determined to be occupied or active. The active nests included five red-tailed hawk nests, two great horned owl nests, one golden eagle nest, and one Swainson's hawk nest. Active raptor nests locations are depicted on the figures in Appendix A and summarized in Tables 1.

Three of the active nests were documented during prior surveys conducted along the route. The great horned owl nest located in Section 13, Township (T) 150 North (N), Range (R) 96 West (W), was documented as an active Swainson's hawk nest in 2012. Similarly, the Swainson's hawk nest located in Section 27, T153N, R95W, was recorded as an active Red-tailed hawk nest in 2012. The red-tailed hawk nest located in Section 18, T155N, R95W, was occupied by a red-tail hawk at the time of the 2013 survey. All other previously recorded nest locations surveyed during this project were not found and are assumed to be destroyed.

4.2 Prairie Grouse

One active sharp-tail grouse lek was found within the surveyed project area (Table 2). The active grouse lek is located on USFS land in the NE¼SE¼ of Section 4, T153N, R95W. Currently, the proposed route crosses the lek location. The lek was documented as being active during the both the 2012 and 2013 surveys. The active shape-tail grouse lek location is depicted on the figures in Appendix A and summarized in Tables 2.

Table 1. Raptor Nests

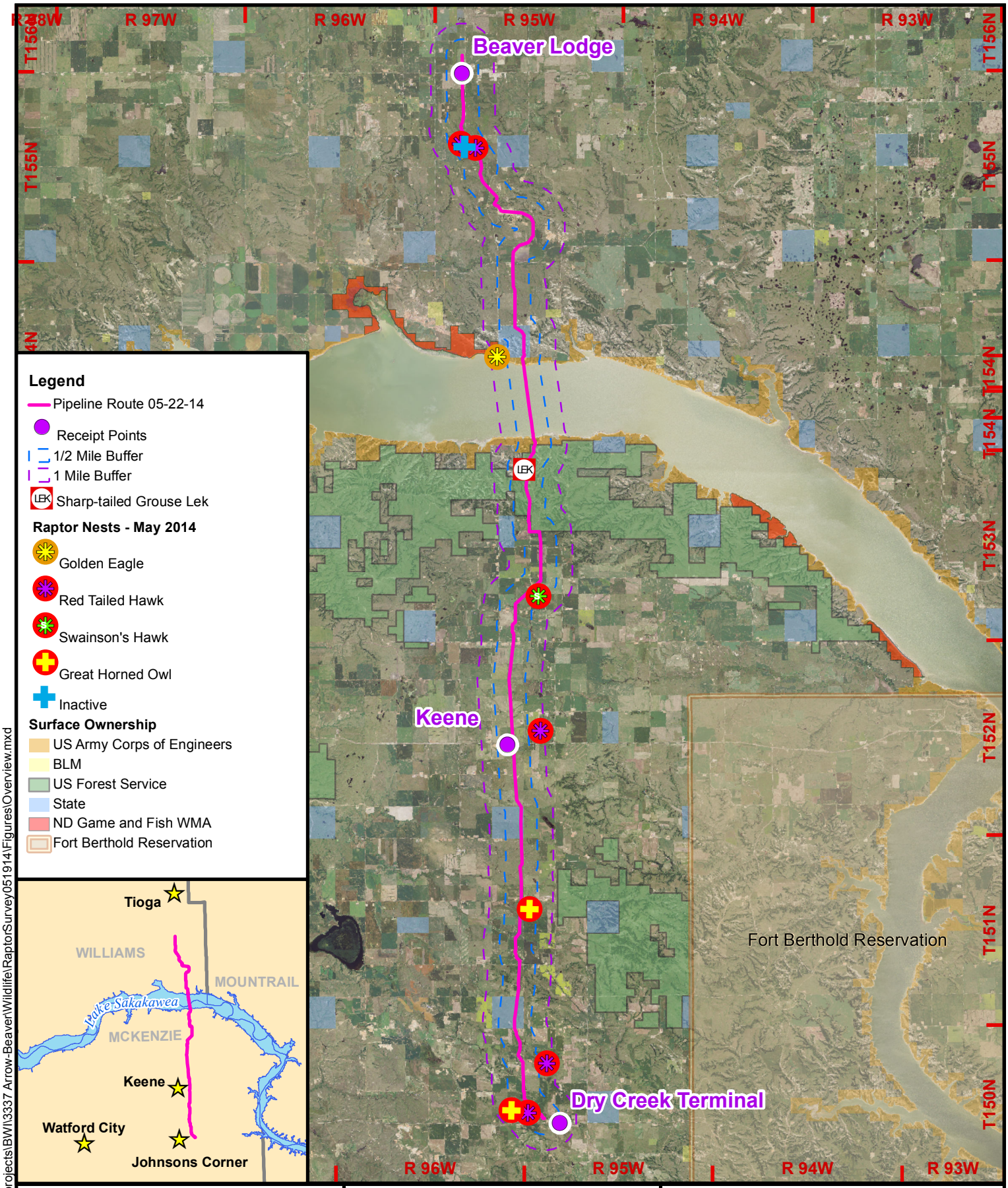
Species	Surface Owner	Survey		Location					Distance (ft) from Corridor
		Date	Method	County	SEC	QQ	TWP	RNG	
Great Horned Owl	Private	May 19, 2014	Aerial	McKenzie	13	NW, SE	150	96	2,900
Red-tailed Hawk	Private	May 19, 2014	Aerial	McKenzie	18	NW, SW	150	95	1,250
Red-tailed Hawk	Private	May 19, 2014	Aerial	McKenzie	7	NE, NE	150	95	4,000
Great Horned Owl	Private	May 19, 2014	Aerial	McKenzie	18	NW, NW	151	95	1,500
Swainson's Hawk	Private	May 19, 2014	Aerial	McKenzie	27	NW, SW	153	95	1,650
Red-tailed Hawk	Private	May 19, 2014	Aerial	McKenzie	18	NW, SE	152	95	4,700
Golden Eagle	NDGF	May 19, 2014	Aerial	Williams	17	SE, SE	154	95	4,250
Red-tailed Hawk	Private	May 19, 2014	Aerial	Williams	18	NE, NE	155	95	1,000
Inactive	Private	May 19, 2014	Aerial	Williams	18	SE, NE	155	95	750
Red-tailed Hawk	Private	May 19, 2014	Aerial	Williams	17	SE, NW	155	95	600

Table 2. Prairie Grouse Lek

Species	Surface Owner	Survey		Location					Distance (ft) from Corridor
		Date	Type	County	SEC	QQ	TWP	RNG	
Sharp-tailed Grouse	USFS	May 21, 2014	Ground	McKenzie	4	NE, SE	153	95	0

Appendix A

Figures



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Overview
Raptor and Prairie Grouse

Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline, LLC

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May 2014

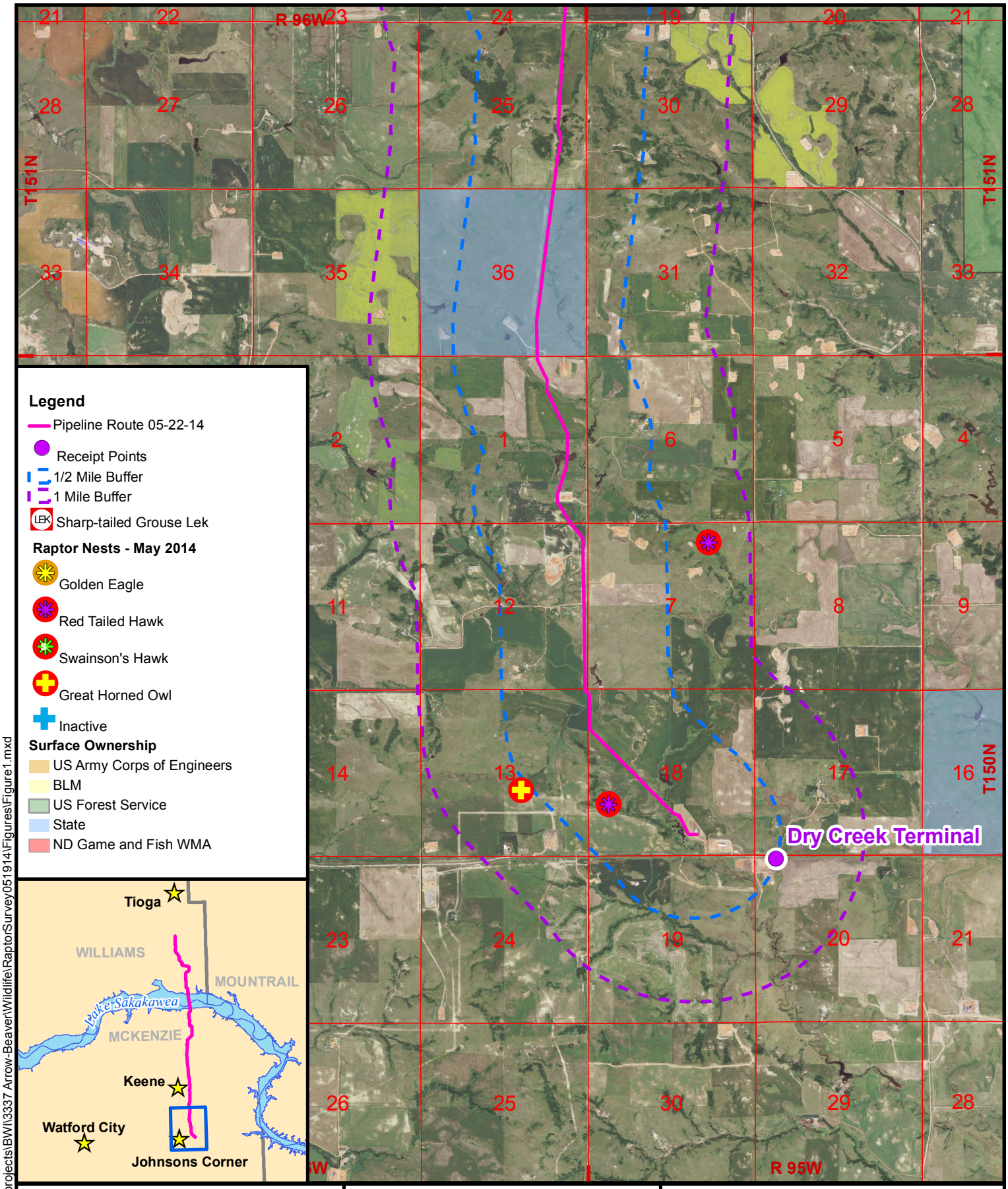

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Figure 1
Raptor and Prairie Grouse
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline, LLC

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June 2014

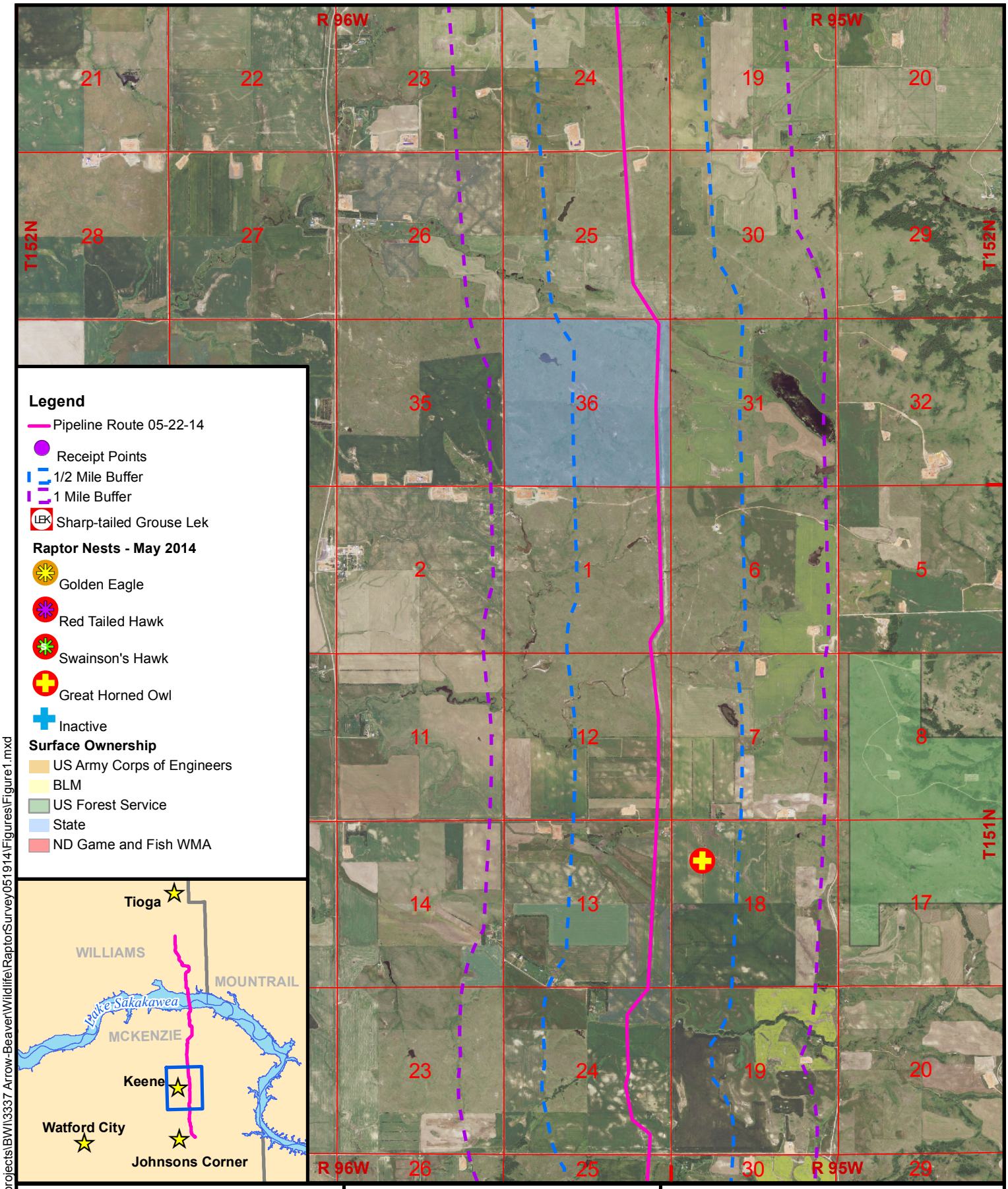

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Figure 2
Raptor and Prairie Grouse
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline, LLC

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June 2014

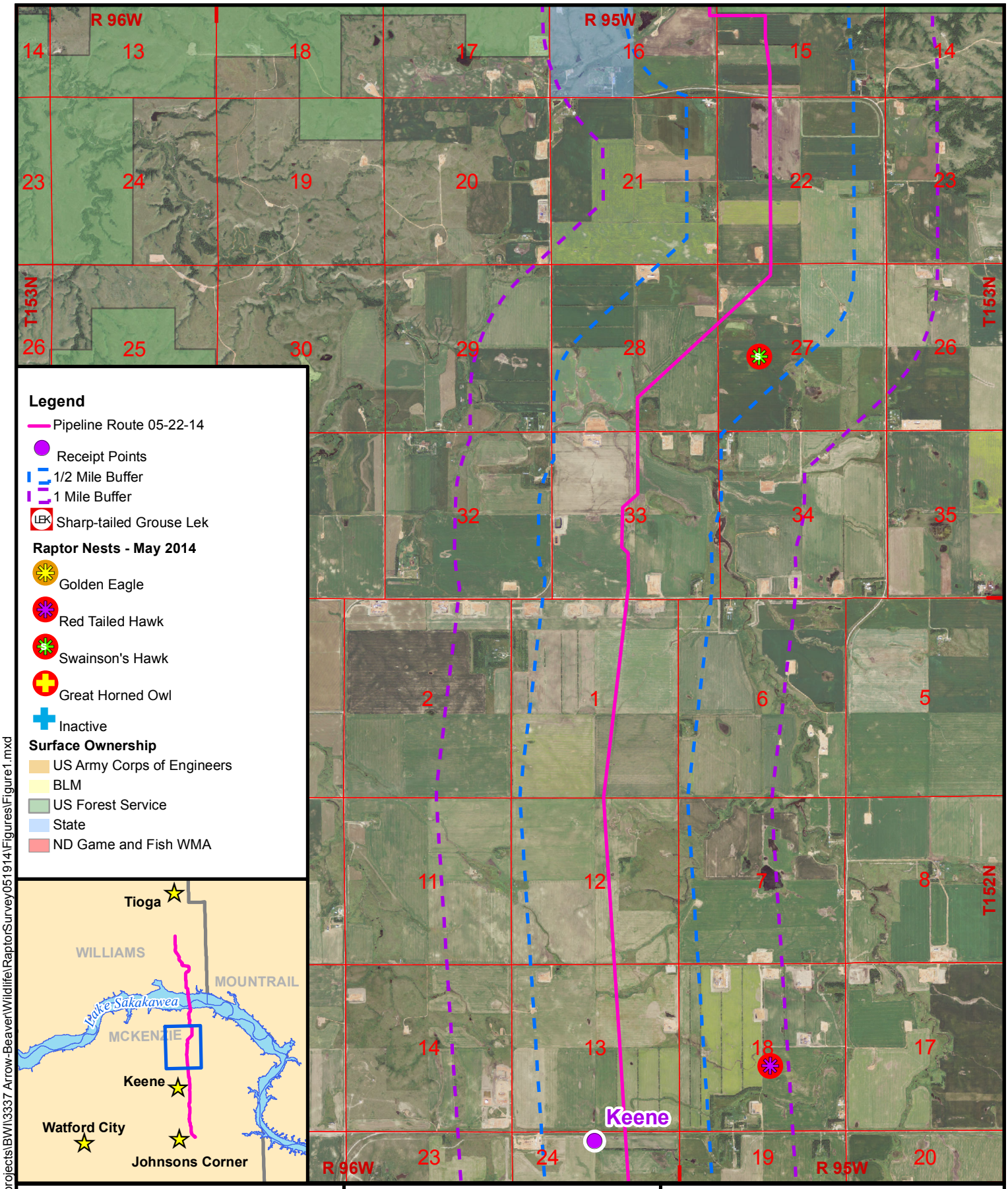

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Figure 3
Raptor and Prairie Grouse
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline, LLC

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June 2014

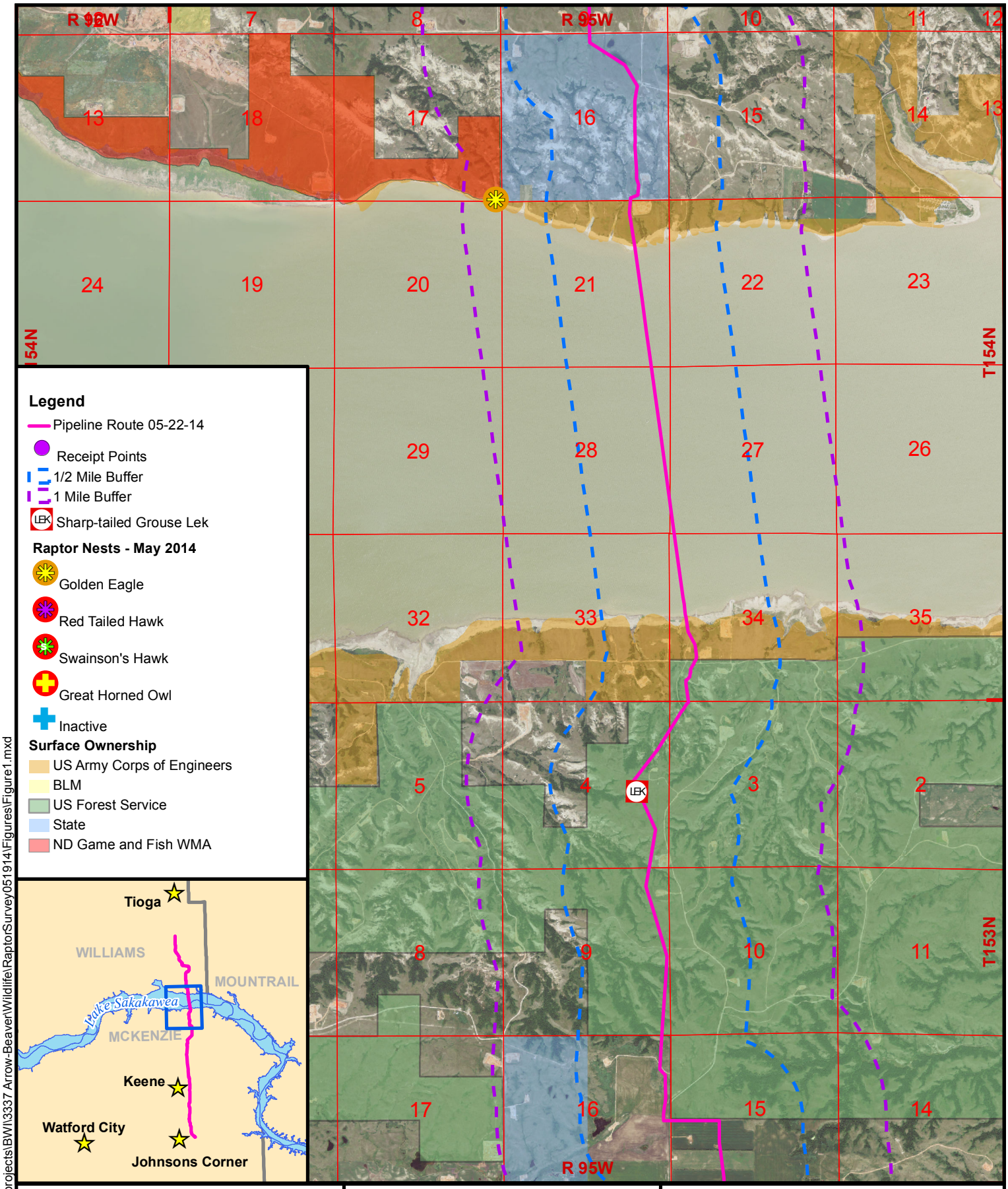

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Figure 4
Raptor and Prairie Grouse
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline, LLC

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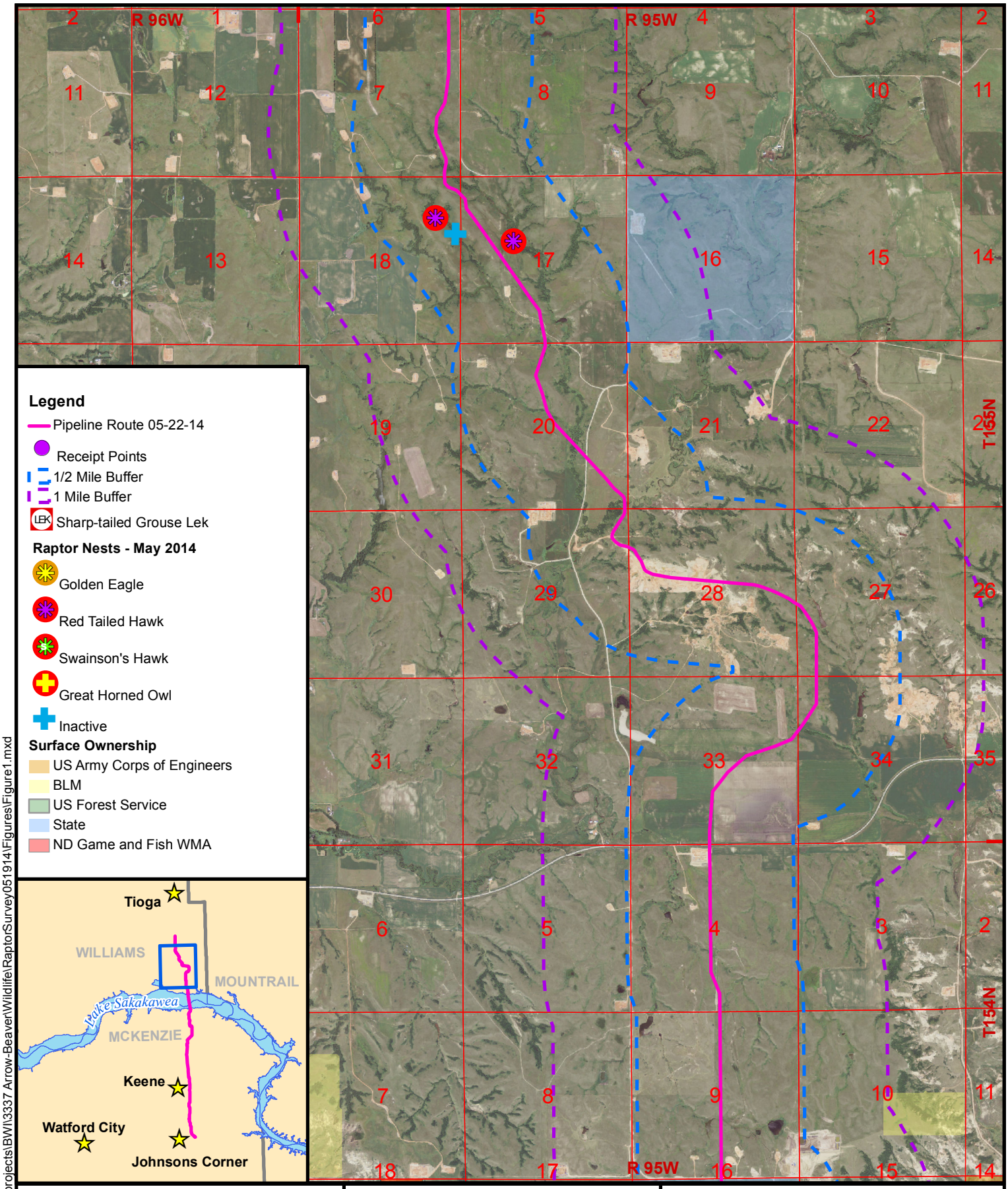
June 2014



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Basemap: ND GIS Hub Aerial Imagery 2012

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Figure 5
Raptor and Prairie Grouse
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline, LLC

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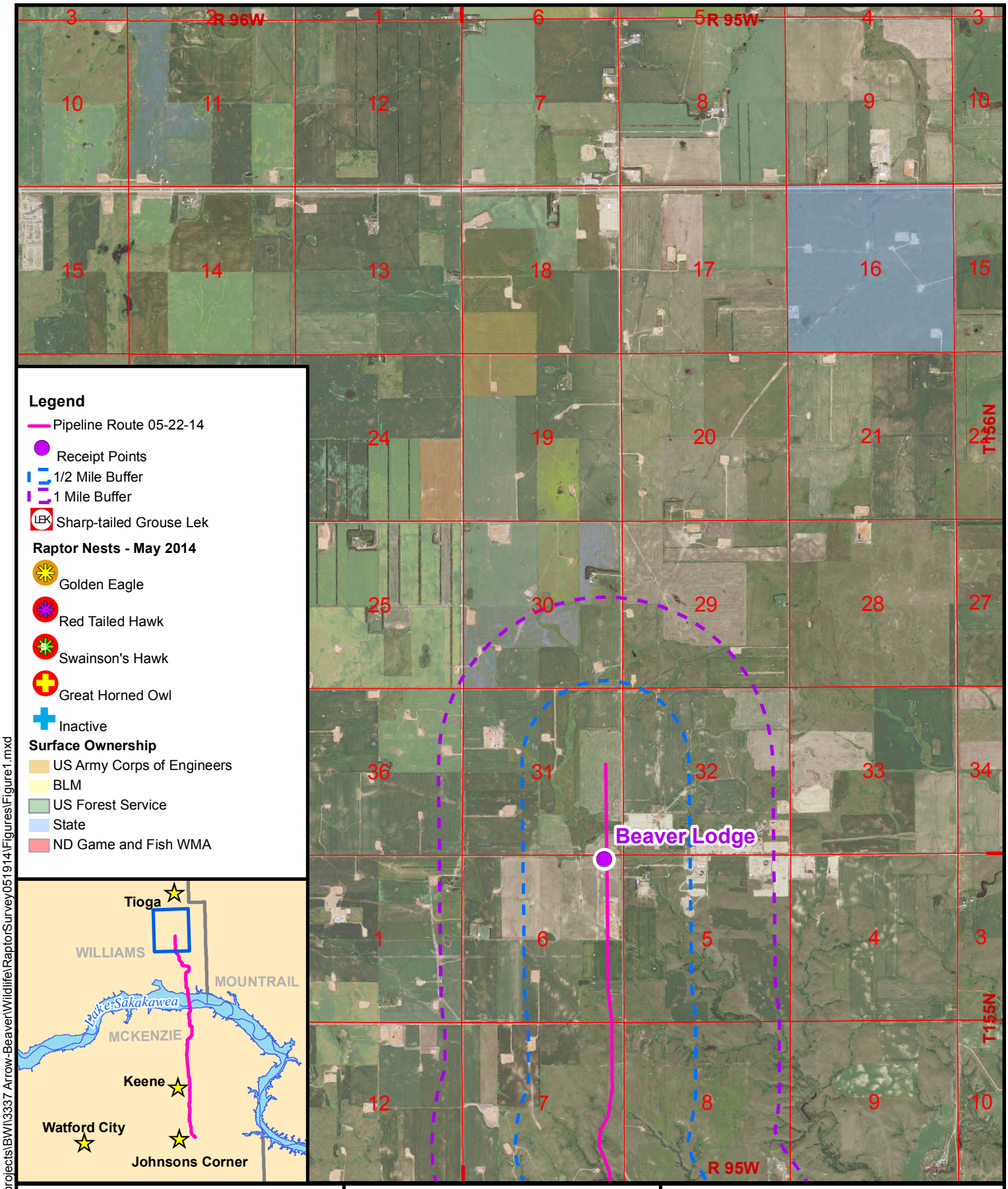

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Figure 6
Raptor and Prairie Grouse
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline, LLC

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June 2014

Appendix XXVII

BakkenLink Noxious Weed Control Plan

Noxious Weed and Aquatic Nuisance Species Control Plan

BakkenLink Pipeline LLC
Dry Creek Terminal to Beaver Lodge

MCKENZIE AND WILLIAMS COUNTIES, NORTH DAKOTA

September 2014

Noxious Weed and Aquatic Nuisance Species Control Plan
BakkenLink Pipeline LLC

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Appendix B North Dakota ANS Management Plan
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Appendix D USFS Stipulations for Herbicide
Approved Herbicides for Oil and Gas Use on the Little Missouri National Grasslands
Noxious Weed Seed Viability Quick Reference Chart
Pesticide Use Proposal (Form FS-2100-2)
Pesticide Use Proposal Attachment A, Supplemental Information (DPG-2100-2A)
Pesticide Application Records/Year End Report

1.0 Introduction

BakkenLink Pipeline LLC is proposing to build, own, and operate an approximately 37-mile long pipeline (Project) for the transportation of crude oil from existing and proposed truck receipt locations and pipeline gathering receipt stations. The proposed pipeline will be constructed in portions of McKenzie and Williams counties, North Dakota.

The spread of noxious weeds can be a significant issue in construction projects that involve land disturbance. Measures must be taken to prevent the spread of noxious weeds during construction and operation and maintenance (O&M). Earth moving activities and the use of contaminated fill, seed, or erosion control products contribute to the spread of weeds.

Likewise, the spread of Aquatic nuisance species (ANS) is potentially significant from construction in and through multiple water bodies and watersheds. ANS may be spread by using equipment used on/in other water bodies where ANS may attach themselves to the equipment. The pipeline and materials themselves are not a concern, as they will be new materials, manufactured specifically for this project.

Noxious weeds are present along the proposed right-of- way (ROW) (see Section 2.3). The disturbance from construction could introduce new noxious weed species or facilitate the spread of existing populations. It is important to note that much of the area where construction will occur is adjacent to pasture and agricultural lands that are already disturbed from grazing and agricultural land use practices. Disturbed pastures and barren, fallow agricultural fields provide abundant habitat for spreading noxious weed populations.

BakkenLink recognizes that prevention is the most cost-effective approach to noxious weed and ANS management. BakkenLink will assist federal, state, and local agency weed control efforts, comply with preventative requirements, and implement control measures on areas of the Project identified to be of special concern.

1.1 Plan Purpose/Objectives

This Noxious Weed Control Plan (Plan) is intended to address methods to prevent, mitigate, and control the spread of noxious weeds and ANS during construction and O&M of the proposed pipeline. BakkenLink and its contractors will be responsible for implementation of the methods described in this Plan.

BakkenLink will comply with State of North Dakota, County, and federal agency requirements implemented to prevent the spread of noxious weeds and ANS. BakkenLink will implement weed control measures in areas of the Project ROW where noxious weeds have been identified. Monitoring during construction and O&M will include the identification of areas along the ROW where noxious weeds are present. Monitoring will also include an evaluation of the prescribed control measures in their effectiveness of control.

2.0 Noxious Weeds and ANS

2.1 Noxious Weeds

Noxious weeds are opportunistic and often exotic (non-indigenous) plant species that readily invade disturbed areas, often producing monocultures and preventing native plant species from establishing communities. Noxious weeds also degrade agricultural productivity, soil and water, wildlife habitat, and recreational and wilderness values.

The North Dakota Century Code (NDCC) §4.1-47-01(6) defines noxious weeds as any plant propagated by either seed or vegetative parts which is determined by the commissioner, a county weed board, or a city weed board, after consulting with the North Dakota State University Extension Service, to be injurious to public health, crops, livestock, land, or other property. Currently, there are eleven species or species groups (some include more than one species and/or cultivars) in North Dakota (North Dakota Administrative Code §7-06-01-02). Pursuant to NDCC 4.1-47 the control and the spread of noxious and invasive weeds is mandatory, and dissemination of noxious weeds must be prevented.

North Dakota's noxious weed list (see description below) includes:

- Absinth wormwood
- Canada thistle
- Diffuse knapweed
- Leafy spurge
- Musk thistle
- Purple loosestrife
- Russian knapweed
- Spotted knapweed
- Yellow toadflax
- Dalmatian toadflax
- Saltcedar

An identification guide to these and other potentially harmful weeds is included in Appendix A.

McKenzie County has developed a county noxious weed list with additional species that warrant control within their jurisdiction.

McKenzie County's noxious weed list includes:

- Black henbane
- Common burdock
- Houndstongue
- Halogeton
- Baby's breath

2.2 ANS

ANS are aquatic and terrestrial organisms, introduced into new habitats throughout the United States and other areas of the world, that produce harmful impacts on aquatic natural resources in these ecosystems and on the human use of these resources. Control of the spread of ANS is delegated under the noxious weed control laws in North Dakota to the North Dakota Game and Fish Department, which regulations are written in Chapter 30-03 of the North Dakota Administrative Code (NDAC). The North Dakota ANS Management Plan is incorporated into this plan by reference and included as Appendix B.

ANS have not been identified in any of the waterbodies or wetlands along the ROW. However, it is imperative that the prescribed measures identified in the North Dakota ANS Management Plan for cleaning of equipment being transported to the site, and working in or travelling through wetlands and waterbodies, be followed. Wetlands and waterbodies are identified on the construction line drawings. Further information, including lists of wetlands and waterbodies identified by milepost can be found in the Construction Mitigation and Reclamation Plan (CMRP).

2.3 Noxious Weed Inventory

Biological surveys for noxious weeds were conducted during 2014 to determine noxious weed occurrence along the proposed ROW. The surveys focused on a 200-ft wide corridor centered on the Project centerline. Noxious weed locations and the extent of localized populations were delineated and recorded using global positioning system (GPS) equipment. Locations where noxious weeds were present are depicted on the figures in Appendix C. The locations (by milepost) are summarized in Table 2.

Table 2. Noxious weed locations

MP	County	Acres	Species (Common Name)
Dry Creek Terminal to Beaver Lodge			
0.1	McKenzie	0.19	Canada Thistle
0.2	McKenzie	0.04	Canada Thistle
0.2	McKenzie	0.11	Canada Thistle
0.9	McKenzie	0.03	Common Burdock
0.9	McKenzie	0.03	Canada Thistle
0.9	McKenzie	0.04	Canada Thistle
1.2	McKenzie	0.17	Canada Thistle
1.4	McKenzie	0.05	Canada Thistle
2.6	McKenzie	0.03	Common Burdock
2.6	McKenzie	0.03	Canada Thistle
2.6	McKenzie	0.01	Canada Thistle
3.7	McKenzie	0.54	Canada Thistle
3.8	McKenzie	0.03	Canada Thistle
3.8	McKenzie	0.03	Canada Thistle
3.8	McKenzie	0.03	Canada Thistle

MP	County	Acres	Species (Common Name)
3.8	McKenzie	0.01	Canada Thistle
3.9	McKenzie	0.07	Canada Thistle
4.5	McKenzie	0.01	Common Burdock
4.5	McKenzie	0.01	Common Burdock
4.5	McKenzie	0.01	Common Burdock
4.5	McKenzie	1.04	Canada Thistle
5.1	McKenzie	0.04	Canada Thistle
5.1	McKenzie	0.05	Canada Thistle
5.4	McKenzie	0.04	Canada Thistle
5.4	McKenzie	0.01	Common Burdock
7.2	McKenzie	0.01	Black Henbane
7.6	McKenzie	0.01	Canada Thistle
9.1	McKenzie	0.11	Canada Thistle
10.0	McKenzie	4.65	Canada Thistle
10.4	McKenzie	0.23	Canada Thistle
12.2	McKenzie	0.01	Canada Thistle
12.3	McKenzie	0.03	Canada Thistle
12.4	McKenzie	0.01	Canada Thistle
12.4	McKenzie	0.01	Canada Thistle
12.5	McKenzie	0.04	Canada Thistle
12.5	McKenzie	0.01	Canada Thistle
13.4	McKenzie	0.05	Canada Thistle
13.4	McKenzie	0.05	Canada Thistle
15.1	McKenzie	0.15	Canada Thistle
16.7	McKenzie	0.61	Canada Thistle
16.9	McKenzie	0.01	Canada Thistle
17.1	McKenzie	0.01	Canada Thistle
17.6	McKenzie	0.39	Canada Thistle
18.7	McKenzie	0.01	Canada Thistle
20.5	McKenzie	0.01	Canada Thistle
20.7	McKenzie	0.15	Common Burdock
21.0	McKenzie	0.02	Canada Thistle
21.6	McKenzie	0.01	Canada Thistle
23.2	McKenzie	0.01	Canada Thistle
23.2	McKenzie	0.01	Canada Thistle
25.5	Williams	0.01	Canada Thistle
25.5	Williams	0.01	Canada Thistle
25.5	Williams	0.01	Canada Thistle
25.6	Williams	0.10	Canada Thistle
25.6	Williams	0.01	Canada Thistle

MP	County	Acres	Species (Common Name)
25.6	Williams	0.17	Canada Thistle
25.6	Williams	0.14	Canada Thistle
25.6	Williams	0.02	Canada Thistle
25.6	Williams	0.20	Canada Thistle
25.6	Williams	0.12	Canada Thistle
25.6	Williams	0.07	Canada Thistle
25.7	Williams	0.01	Canada Thistle
25.7	Williams	0.04	Leafy Spurge
25.7	Williams	0.01	Canada Thistle
25.7	Williams	0.01	Leafy Spurge
25.7	Williams	0.01	Canada Thistle
25.7	Williams	0.02	Leafy Spurge
25.7	Williams	0.22	Canada Thistle
25.7	Williams	0.01	Leafy Spurge
25.7	Williams	0.61	Canada Thistle
25.8	Williams	0.01	Leafy Spurge
25.8	Williams	0.01	Leafy Spurge
25.8	Williams	0.01	Leafy Spurge
25.8	Williams	0.01	Leafy Spurge
25.8	Williams	0.01	Canada Thistle
25.8	Williams	0.01	Leafy Spurge
25.8	Williams	0.01	Leafy Spurge
25.9	Williams	0.01	Canada Thistle
25.9	Williams	0.01	Canada Thistle
25.9	Williams	0.01	Canada Thistle
26.1	Williams	0.01	Musk Thistle
26.5	Williams	0.01	Leafy Spurge
26.5	Williams	0.02	Leafy Spurge
26.5	Williams	0.04	Leafy Spurge
26.8	Williams	0.01	Leafy Spurge
26.8	Williams	0.42	Leafy Spurge
27.2	Williams	0.12	Canada Thistle
27.9	Williams	0.08	Leafy Spurge
28.1	Williams	0.03	Canada Thistle
30.4	Williams	0.01	Canada Thistle
32.0	Williams	0.11	Canada Thistle
32.1	Williams	0.03	Canada Thistle
32.1	Williams	0.05	Canada Thistle
32.6	Williams	0.07	Canada Thistle
32.6	Williams	0.01	Canada Thistle

MP	County	Acres	Species (Common Name)
32.6	Williams	0.01	Canada Thistle
32.6	Williams	0.01	Canada Thistle
32.7	Williams	0.02	Canada Thistle
32.7	Williams	0.01	Canada Thistle
32.7	Williams	0.01	Canada Thistle
33.0	Williams	0.25	Canada Thistle
33.1	Williams	0.05	Canada Thistle
33.7	Williams	0.03	Canada Thistle
33.7	Williams	0.01	Canada Thistle
33.7	Williams	0.08	Canada Thistle
34.9	Williams	0.01	Leafy Spurge
35.0	Williams	0.11	Canada Thistle
35.0	Williams	0.03	Canada Thistle
35.0	Williams	0.01	Canada Thistle
35.0	Williams	0.01	Canada Thistle
35.0	Williams	0.01	Canada Thistle
35.1	Williams	0.01	Canada Thistle
35.1	Williams	0.01	Canada Thistle
35.1	Williams	0.01	Canada Thistle
35.1	Williams	0.01	Canada Thistle
35.1	Williams	0.01	Canada Thistle
35.2	Williams	0.05	Canada Thistle
35.2	Williams	0.01	Canada Thistle
35.2	Williams	0.01	Canada Thistle
35.2	Williams	0.01	Canada Thistle
35.3	Williams	0.01	Canada Thistle
35.3	Williams	0.01	Canada Thistle
35.4	Williams	0.03	Canada Thistle
35.4	Williams	0.01	Canada Thistle
35.4	Williams	0.07	Canada Thistle
35.4	Williams	0.01	Canada Thistle
36.7	Williams	0.02	Canada Thistle
36.7	Williams	0.01	Canada Thistle
36.7	Williams	0.01	Canada Thistle
36.7	Williams	0.16	Canada Thistle
36.9	Williams	0.60	Canada Thistle
37.4	Williams	0.27	Canada Thistle
37.4	Williams	0.06	Canada Thistle
37.4	Williams	0.01	Canada Thistle
Access Roads			

MP	County	Acres	Species (Common Name)
41st Street	McKenzie	0.02	Canada Thistle
41st Street	McKenzie	0.01	Canada Thistle
41st Street	McKenzie	0.01	Canada Thistle
41st Street	McKenzie	0.02	Canada Thistle
41st Street	McKenzie	0.01	Canada Thistle
41st Street	McKenzie	0.01	Canada Thistle
41st Street	McKenzie	0.01	Canada Thistle
41st Street	McKenzie	0.01	Canada Thistle
41st Street	McKenzie	0.01	Canada Thistle
Moe Access	Williams	0.26	Canada Thistle
Moe Access	Williams	0.23	Canada Thistle
Pipe yards			
Moe pipe yard	Williams	0.06	Canada Thistle
Moe pipe yard	Williams	0.19	Canada Thistle
Moe pipe yard	Williams	0.13	Canada Thistle
Moe pipe yard	Williams	0.10	Canada Thistle

These locations are not the only locations where weeds may be present. The figures and table only depict locations where noxious weeds were present at the time of the 2014 survey(s). Noxious weeds may be present at other locations along the ROW due to their invasive nature and potential for spreading from other areas.

Qualified biological monitors or environmental inspectors will be used to conduct on-site biological monitoring before and during construction. In addition, BakkenLink will provide its Contractors with information and training regarding noxious weed management and identification prior to construction. The contractors will be required to report possible weed populations that have not been recorded prior to disturbing the area.

3.0 Best Management Practices

BakkenLink will implement Best Management Practices (BMPs) for conducting noxious weed and vegetation control where necessary before and after construction. Generally, these include:

- BakkenLink will conduct awareness training to Project personnel regarding identification, prevention, and control methods. No personnel will be allowed to enter the ROW before training.
- Treat or contain weed populations that may be impacted or disturbed by construction activity.
- Use only certified weed-free straw/hay or use fiber roll logs for sediment control.
- Use only certified weed-free straw/hay for mulch.
- Clean all equipment of dirt and vegetation. The contractor shall pressure wash all construction equipment prior to mobilizing/demobilizing from the Project. This includes timber mats, cars, transporting trailers and trucks, and recreational equipment brought on-site.
- Wash, or using an air compressor, blow clean all vehicles (including tires and undercarriage) before leaving weed-infested areas.
- The Contractor shall implement pre-construction treatments such as mowing prior to seed development or herbicide application to areas of noxious weed infestation prior to other clearing, grading, trenching, or other soil disturbing work at locations identified in the construction drawings.
- Minimize ground disturbance and vegetation removal as much as possible or practical.

Further discussion of specific BMPs is included in the following sections.

3.1 Construction Methods

Prior to construction, BakkenLink will mark all areas of the ROW, which contain infestations of noxious, invasive species, or soil-borne pests. Such marking will clearly indicate the limits of the infestation along the ROW. During construction, the Contractor shall clean the tracks, tires, and blades of equipment by hand (track shovel) or compressed air to remove excess soil prior to movement of equipment out of weed or soil-borne pest infested areas or utilize cleaning stations to remove vegetative materials using water under high pressure.

In areas where infestations are identified in the field, the Contractor will stockpile cleared vegetation and salvaged topsoil adjacent to the area from which they were stripped. Gaps in the topsoil stockpile shall be maintained to keep stockpiled topsoil separate from topsoil where infestations are not present. The Contractor will return topsoil and vegetative material from infested sites to the areas from which they were stripped. The Contractor will not be permitted to move soil and vegetative matter outside of the identified area of infestation.

Off-ROW areas related to the Project (construction/storage yards) will be kept weed free. Inspection will be conducted on a regular basis to confirm weeds are not present. Weeds at off-ROW areas will be treated in the same manner as ROW locations.

3.2 Treatment Methods

Noxious weed control measures will be implemented in accordance with existing regulations and jurisdictional land management agencies or landowner agreements. Treatment methods will be based on species-specific and area-specific conditions (e.g., proximity to water, wetlands, riparian areas, or agricultural areas) and time of year. Most noxious weeds identified along the ROW may be treated by herbicide application. Mechanical methods of weed control including mowing, discing, and hand pulling of small, localized and/or isolated infestations of noxious weeds. Mechanical methods may be selected in lieu of herbicide treatment for select locations. Discing will not be applied in native habitat areas.

3.3 USFS-Specific Requirements

The United States Forest Service (USFS) has specific requirements for noxious weed control on USFS managed land. Guidelines provided by the USFS as they pertain to the BakkenLink project are included in Appendix D. These guidelines include:

- USFS Stipulations for Herbicide
- Approved Herbicides for Oil and Gas Used on the Little Missouri National Grasslands
- Noxious Weed Seed Viability Quick Reference Chart
- Pesticide Use Proposal (Form FS-2100-2)
- Pesticide Use Proposal Attachment A, Supplemental Information (DPG-2100-2A)
- Pesticide Application Records/Year End Report

The location of noxious weeds within the pipeline ROW will be reported to the managing USFS field office. The appropriate weed control procedures, including target species, timing of control, method of control, and obtaining the appropriate authorizations will be determined in consultation with USFS personnel.

3.3 Reclamation Methods

Reclamation specific BMPs include:

- Revegetate disturbed areas as soon as possible. Revegetation includes topsoil replacement, planting, seeding, fertilizing, and weed-free mulching as necessary.
- Seeding will be conducted on disturbed areas that have reached final grade or that will remain undisturbed for 30 days.
- Use seed and other plant materials that have been certified as weed free. Seed mixes shall conform to the managing land agency specification(s).
- Use native materials where appropriate and feasible.
- Treat weeds adjacent to newly seeded areas prior to planting and treat planted areas for weeds in the first growing season.

Monitoring will be conducted to assess ROW stability, revegetation progress, and percentage of vegetative cover. Monitoring will assess whether applied treatment methods are effective in controlling weeds and make recommendations for further treatment.

3.4 Post-reclamation Methods

Post-reclamation specific BMPs include:

- Re-vegetate or otherwise prevent the establishment of weeds in the Project ROW and documenting all ground-disturbing operations in noxious weed infested areas.
- Herbicide applications to noxious weed infestation areas after grass species are established.
- Treatment methods other than herbicide application, such as mowing and biological methods, will be considered during the post-reclamation process.

Following pipeline construction, on any construction ROW over which BakkenLink will retain control over the surface use of the land after construction (i.e., valve sites, metering stations, pump stations, etc.), BakkenLink shall provide for weed control to limit the potential for the spread of weeds onto adjacent lands. Any weed control spraying performed by BakkenLink shall be done by a state-licensed pesticide applicator.

3.5 ANS Provisions

Any equipment, including recreational, to be used in water must follow precautions to avoid the introduction of ANS. The Contractor shall implement the provisions of the North Dakota ANS Management Plan (Appendix B). The provisions include, but are not limited to:

- Remove all plants, animals, or fragments of plant or animals.
- Drain all water from motors, pumps, bilges, or other containers. If the equipment has been drained for less than seven (7) days prior to arrival on site, a chemical or hot water treatment sufficient to kill ANS organisms shall be utilized.
- Visually inspect to detect any presence of ANS.
- Equipment to be cleaned and inspected includes transporting trailers and trucks.

4.0 Herbicide Application, Handling, Spills, and Cleanup

4.1 Herbicide Application and Handling

Herbicide treatment of selected areas along the ROW will be carried out where noxious weed species are problematic and form a significant portion of the vegetation community in comparison to adjacent areas. In areas where the occurrence of noxious weeds adjacent to the ROW makes eradication impossible, no herbicide treatment will be applied; however, other weed control methods will be employed.

Only herbicides approved for use within treated lands will be used (permitted by the relevant land management agency). The selected herbicide and application method will be adapted to target only noxious weeds and therefore preserve and retain native plants. If weeds are found near sensitive sites, proper buffers will be used to prevent the spread of herbicides to these areas. The Contractor shall not use herbicides in or within 100 feet of a wetland or waterbody, unless the herbicide is approved for such application. No treatments will occur without prior coordination with and approval of the land managing agency and landowner.

All herbicide applicators will be licensed in the State of North Dakota. Application of herbicides will be suspended during any of the following conditions:

- Wind velocity exceeds ten miles per hour (mph) during application of liquids or 15 mph during application of granular herbicides;
- Snow or ice covers the foliage of noxious weeds; or
- During precipitation events or when precipitation is expected within 24 hours.

Herbicides will be applied using vehicle mounted sprayers (e.g., handgun, boom, and broadjet nozzle injector) mainly in open areas that are readily accessible by vehicle. Hand application methods (e.g. backpack sprayer) that target individual plants will be used to treat small or scattered weed populations in rough terrain. Calibration checks of equipment will be conducted at the beginning of spraying and periodically during that use to ensure that proper application rates are achieved.

Herbicides will be transported to the Project site daily with the following provisions:

- Only the quantity needed for that day's work will be transported;
- All herbicides will be transported in the original container, in a manner that prevents tipping or spilling, and in a compartment isolated from food, clothing, and safety equipment;
- Mixing will be done at equipment/storage yards and at a distance greater than 200 feet from open or flowing water, wetlands, or other sensitive areas. No herbicide will be applied at these areas unless authorized by appropriate regulatory agencies; and
- All herbicide equipment and containers will be inspected for leaks daily.

4.2 Herbicide Spills and Cleanup

All reasonable precautions will be taken to avoid herbicide spills. In the event of a spill, cleanup will be immediate. Contractors will follow the provisions in the Spill Prevention Containment and Countermeasure (SPCC) Plan developed for this Project. Contractors will keep spill kits in their

vehicles and in herbicide storage areas to allow for quick and effective response to spills. Items to keep in the spill kit(s) are:

- Protective clothing and gloves;
- A minimum of 20 pounds of suitable commercial adsorbent and barrier materials;
- Plastic bags and bucket:
- Shovel;
- Fiber brush and screw-in handle;
- Dust Pan;
- Caution tape; and
- Detergent.

Response to an herbicide spill will vary depending on the material spilled and the size and location of the spill. The order of priorities after discovering a spill are to protect the safety of personnel and the public, minimize damage to the environment, and conduct cleanup and remediation activities.

4.3 Spill Reporting

All personnel applying herbicides will have readily available copies of the appropriate material safety data sheets (MSDS) and the herbicide label(s) for the herbicides being used. All herbicide spills will be reported in accordance with applicable laws and requirements. Further information regarding spill response and reporting can be found in the SPCC Plan.

5.0 Monitoring

Monitoring of noxious weeds will be conducted as part of on-going O&M inspections. BakkenLink will maintain ongoing communication with individual landowners, counties, and land management agencies regarding noxious weeds. These parties will also be supplied with BakkenLink contact information to report noxious weeds along the ROW. BakkenLink will maintain operations personnel trained in the identification of noxious weeds, who will contribute to monitoring reports by documenting noxious weeds observed during the normal course of O&M.

Monitoring will continue for a period of three (3) years after any ground disturbance takes place. Monitoring will be conducted on an annual basis, or as needed following a report of an infestation. Known infestation sites will be monitored on an ongoing basis or until noxious weeds at the site are controlled. BakkenLink shall be responsible for reimbursing all reasonable costs incurred by owners of land adjacent to aboveground facilities when the landowners must control weeds on their land that can be reasonably determined to have spread from land occupied by BakkenLink's aboveground facilities.

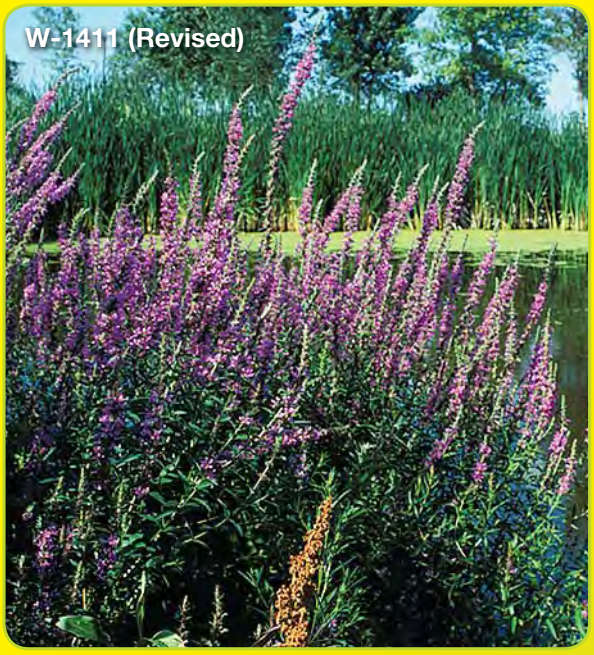
Monitoring records will:

- Identify and evaluate noxious weed conditions in the first and second growing seasons following construction, with particular attention given to any infestations occurring in previously unaffected areas;
- Identify and evaluate locations where additional remedial action or treatment may be required and recommended treatment actions; and
- Record noxious weed control treatments carried out in the reporting period.

Appendix A

Identification and Control of Invasive and Troublesome Weeds in North Dakota

W-1411 (Revised)



Identification and Control of INVASIVE AND TROUBLESOME WEEDS in North Dakota

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This publication was made possible by collaboration of the authors, the North Dakota State University Extension Service and the North Dakota Department of Agriculture, with funding from the U.S. Forest Service for printing. This publication is intended to help land managers properly identify and control noxious and invasive weeds found in the state. The current list of 11 noxious weeds are included, as well as species listed by various counties as noxious. Other species included are either invasive weeds found in bordering states with the potential to move into North Dakota or are commonly misidentified native species that do not require control efforts, such as the native thistles.

Control recommendations are current at publication, but options change rapidly. Before beginning any management program, please consult with your local county Extension agent and/or weed officer for the latest chemical, cultural and biological control recommendations. Chemical control recommendations are updated annually and printed in the "North Dakota Weed Control Guide," Extension publication W-253, and are updated more frequently on the Web at www.ndsu.edu/weeds.

For the latest in biological control options, contact the North Dakota Department of Agriculture and/or the local staff of the U.S Department of Agriculture - Animal and Plant Health Inspection Service in Bismarck.

Photo credits

All photos in the publication are by Rodney G. Lym, North Dakota State University, except as noted below.

Page 8. Black henbane plant, rosette and pineapple-shaped fruit courtesy of Weeds of the West, Tom Whitson, editor.

Flower photograph courtesy of Washington State Noxious Weed Control Board.

Page 10. Photos from Richard Old, XID Services Inc.

Page 14. Common tansy photos courtesy of Celestine Duncan, Weed Management Services, Helena, Mont.

Page 18. Downy brome infestation photo courtesy of Leslie J. Mehrhoff, IPANE.

Panicle photograph courtesy of J.C. Schou, Biopix.dk

Ligule photograph from Virginia Tech Weed Guide.

Page 22. Halogeton photos courtesy of Blake Schaan, North Dakota Department of Agriculture, Bismarck, N.D.

Page. 24. Hoary cress photos from Richard Old, XID Services Inc.

Page 28. Russian knapweed bracts courtesy of Steve Dewey, Utah State University.

Page 30. Spotted and diffuse knapweed bracts courtesy of Steve Dewey, Utah State University.

Page 32. Kochia seedling courtesy of Richard Zollinger, North Dakota State University.

Pages 34 and 36. Insect photos from Biological Control of Leafy Spurge CD, USDA-APHIS and USDA-ARS, TEAM Leafy Spurge's IPM information series No. 1.

Page 50. Marsh sowthistle flower photo from Richard Old, XID Services Inc.

Page 52. St. Johnswort photo courtesy of Corie Lund, Selfridge, N.D.

Page 66. Photos from Richard Old, XID Services Inc.

Pages 70 and 71. Toadflax photos courtesy of Steve Dewey, Utah State University.

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ABSINTH WORMWOOD

(*Artemisia absinthium* L.)

ABSINTH WORMWOOD

State Noxious Weed List: **Yes.**

Absinth wormwood is a member of the sagebrush family, which is easily recognized by the strong sage odor. The plant also is known as American or common wormwood, mugwort or madderwort, and wormwood sage. Unlike other plants in the sagebrush family, absinth wormwood dies back to the root crown each winter, with new shoots emerging each spring. Absinth wormwood is grown in herb gardens for the sage flavor of the leaves. The young flower heads are the source of aromatic oil used to prepare vermouth and absinth. The oil of absinth wormwood is also an active ingredient in antiseptic liniments.

Identification and growth form:

Absinth wormwood is a perennial fragrant forb or herb. The plant commonly grows 3 to 5 feet tall at maturity. Absinth wormwood is woody at the base and regrows from the soil level each spring from a large taproot. Leaves are light to olive green, 2 to 5 inches long and divided two or three times into deeply lobed leaflets. Leaves and stems are covered with fine, silky hairs that give the plant a grayish appearance. Flower stalks appear at each upper leaf node and produce numerous yellow flower heads 1/8 inch in diameter, which appear from late July through mid-August in North Dakota. Each fruit contains one seed, which is less than 1/16 inch long, smooth, flattened and light gray-brown. These small seeds are scattered easily by wind, water and animals, and in hay. Absinth wormwood is a prolific seed producer but also can spread by short roots. The plant is most often found on dry soils, in overgrazed pasture and rangeland, wastelands and roadsides.

Why is this plant a concern?

Absinth wormwood causes economic losses by reducing available forage, tainting the milk of cattle that graze it, and medically as a pollen source for allergies and asthma. Absinth wormwood can reduce forage production severely in pasture and rangeland and is especially troublesome when land is overgrazed. Allergy sufferers should avoid walking through absinth wormwood infestations when the plant is flowering in late July and August.

How do I control this plant?

Chemical. A variety of auxin-type herbicides, including products that contain clopyralid (Stinger, Transline or Curtail), dicamba (various), Milestone (aminopyralid), 2,4-D, Tordon (picloram) and glyphosate (various), will control absinth wormwood. These herbicides should be applied when the plant is at least 12 inches tall and actively growing. Herbicides applied too early in the growing season generally result in poor control. Herbicides applied from late June until mid-August have given better residual control the following growing season than either spring or fall treatments. If a fall treatment is desired, the plants should be mowed in early to midsummer to promote active regrowth and to improve herbicide coverage.

Cultural. Livestock generally will not graze absinth wormwood except in early spring. Mowing and cultivation do not control this weed.

Biological. No biological control agents or pathogens are available for this weed.

BABY'S BREATH

(*Gypsophila paniculata* L.)

BABY'S BREATH

State Noxious Weed List: **No.**

Baby's breath is an ornamental plant of Eurasian origin introduced to the U.S. in the 1800s. The plant is a member of the Pinks or Carnation family and is used by the floral industry as a filler in bouquets. The plant escaped cultivation and now infests pasture and rangeland in several areas of the West.

Identification and growth form:

Baby's breath is a perennial with widely branching stems. The plant often grows to 3 feet tall and is easily identified by the presence of many small white flowers. The leaves occur in pairs of up to 4 inches long and end with a point. The number of leaves decreases with increasing plant height and during flowering. The flowers are small, about 1/8 inch, and generally white and five lobed, often with a purple midstripe. Flowering occurs from late June to late August in North Dakota.

Seeds are black, with two to five contained in capsules, and resemble pepper. The seeds can germinate in 10 to 15 days and plants grow rapidly. Each plant can produce 10,000 or more seeds, which are spread when the branches dry, break off and are moved in the wind similar to Russian thistle and kochia. The plant has a large, deep taproot that allows it to grow well in dry and poor soil conditions.

Why is this plant a concern?

Baby's breath forms dense stands and displaces desirable grasses and forbs. Because of the large taproot and the ability to produce millions of seeds in a small area, this plant is difficult to remove once it has established in an area. Baby's breath has been listed as a noxious weed in several Western states.

How do I control this plant?

Chemical. Baby's breath can be controlled with herbicides that contain metsulfuron (Escort or Ally) applied during the bolt to preflower growth stage.

Cultural. Hand-pulling this weed is not practical because of the large taproot. Baby's breath has not become a problem in cropland that is cultivated.

Biological. No biological control agents or pathogens are available for this weed.

BLACK HENBANE

(*Hyoscyamus niger* L.)

BLACK HENBANE

State Noxious Weed List: **No.**

Black henbane is native to Europe and was cultivated as a medicinal and ornamental plant. In 1670, the plant escaped cultivation in the United States and became sparingly naturalized by 1859. Black henbane has since spread throughout much of the United States, particularly in the Northeast, Midwest and the Rocky Mountains. Two alkaloids in black henbane tissues (hyoscyamine and scopolamine) are useful sedative or anti-spasmodic drugs when used under controlled conditions.

Identification and growth form:

Black henbane is an annual or biennial plant that can range in height from 1 to 3 feet. Rosette leaves are alternate and have petioles almost as long as the leaf blades. Stems of mature plants are erect, leafy, thick, coarse and widely branched. Leaves are alternate, oblong to ovate, coarsely toothed to shallowly lobed and grayish green. The foliage is covered with fine, sticky hairs and has a foul odor. Flowers are funnel-shaped, five-lobed, brownish yellow with dark purple veins, and arranged in long, leafy, spikelike clusters. Fruit of the plant is pineapple shaped, approximately 1 inch long, and contains hundreds of tiny, black seeds.

Seeds germinate and develop a rosette with a large, whitish branched taproot the first growing season. During the second growing season, the plant bolts and flowers from June to August. The plant produces hundreds of seeds from July to October that can remain viable for five years or more.

Why is this plant a concern?

Black henbane contains alkaloids (hyoscyamine, hyoscine or scopolamine, and atropine) that have caused occasional livestock poisoning. The plant is not usually grazed by animals unless more palatable forage is unavailable. All parts of the plant, including the seeds, contain the alkaloids that can be toxic to humans and animals if eaten. Even just smelling the flowers can cause headaches and nausea in some people.

How do I control this plant?

Chemical. Herbicides recommended for black henbane control include 2,4-D, dicamba (various), Tordon (picloram) and glyphosate. Herbicides should be applied prior to flowering to prevent seed production.

Mechanical. Hand pulling, cutting or digging small infestations of black henbane can be effective. Wear gloves and protective clothing when handling these plants. Disking or plowing should be repeated annually because seeds can persist in the soil for an extended period of time.

Biological. No biological control agents or pathogens are available for this weed.

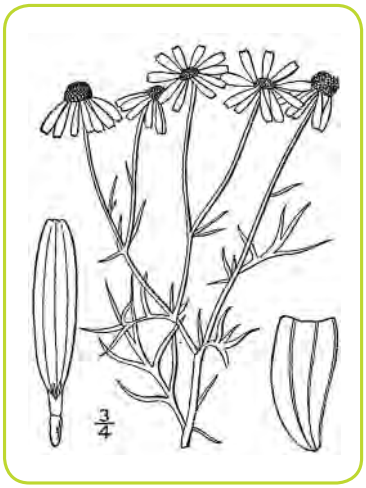
FALSE and SCENTLESS CHAMOMILE

(*Matricaria chamomilla* L. and *Matricaria maritima* L.)

State Noxious Weed List: **No.**

False chamomile

False chamomile (*Matricaria chamomilla* L.) and scentless chamomile (*M. maritima* L.) are members of the aster family and have flowers that resemble the common daisy. Some taxonomists place these plants in the genius *Anthemis*. Both plants are native to Eurasia, are considered naturalized in the northern Great Plains and are common in the region. The most obvious difference between the two species is the pleasant aroma of false chamomile, while, as the name implies, scentless chamomile has very little odor when crushed.



False chamomile
(from NRCS plants database)

Scentless chamomile
(from NRCS plants database)

Scentless chamomile

FALSE and SCENTLESS CHAMOMILE

False chamomile has been used for medicinal purposes for hundreds of years and most often is consumed today as chamomile tea, which reportedly has relaxation benefits. As with many homeopathic medicines, chamomile is credited with curing a variety of aches and illnesses, including soothing and calming of nerves, reducing inflammation and aching muscles, and reducing hay fever, asthma and morning sickness. Today chamomile commonly is found in air fresheners, cosmetics, insect repellents and potpourri.

Identification and growth form:

Both chamomile species are annual herbs and have white daisylike flowers. False chamomile blooms from May through August, and scentless chamomile blooms somewhat later from June through September. Plants grow 6 to 18 inches tall and commonly are found in wet sites, road ditches, old gardens and weedy (waste) areas. Scentless chamomile flowers tend to be larger (1 to 1.5 inches across) than false chamomile (0.5 to 1 inch across). Seeds are approximately 2 millimeters long, dark brown, with three ribs on one side and a broad brown central area on the other. Both plants have very finely divided leaves from 0.75 to 2.3 inches long, but scentless chamomile generally has more leaves and appears more bushy than false chamomile.

Why is this plant a concern?

False chamomile was a candidate for the North Dakota state noxious weed list in the late 1970s and early 1980s because the weed was spreading fast in cropland, especially in the north-central region of the state. Many farmers were concerned because false chamomile was tolerant to all herbicides then available for use in crops. However, with the introduction of Glean (chlorsulfuron), landowners had an effective herbicide for false chamomile control. This plant is listed on several county noxious weed lists. Spring and fall-emerging plants can reduce wheat yields by 20 percent to 60 percent if left unattended. In addition, scentless chamomile has poor nutrition value and is not palatable to livestock.

Several other members of the "daisy" family, including pineapple-weed [*Matricaria matricarioides* (Less.) Porter], oxeye daisy (*Chrysanthemum leucanthemum* L.) and dog fennel or mayweed chamomile (*Anthemis cotula* L.), also can become weedy. Of these species, oxeye daisy has been the most invasive and is included on several state and provincial noxious weed lists.

How do I control these plants?

Chemical. Today, chamomile species can be controlled easily with any sulfonylurea herbicide such as Ally, Cimarron or Escort (metsulfuron) and Telar (chlorsulfuron). Bromoxynil plus MCPA and Tordon (picloram) also provide good chamomile control.

Mechanical. Hand-pulling can be an effective control method in small infestations of chamomile. Mowing early in the growing season or before plants flower will reduce populations but should be repeated often. Shallow tillage is recommended during hot, dry weather.

Biological. Several biological control agents have been researched for scentless chamomile control. The seed-head weevil, *Omphalaplon hookeri,* feeds on developing seeds of the plant, thereby reducing seed production. The stem-boring weevil, *Microplontus edentulous,* feeds on the interior of the stem and produces hollow areas that reduce the vigor of the plant. *Rhopalomyia tripleurospermii,* the scentless chamomile gall midge, forms a gall on the plant, which acts as a nutrient sink that can interrupt and stunt the growth of the plant. Research still is being conducted on these biocontrol agents to predict effectiveness in reducing plant population.

COMMON BURDOCK

[*Arctium minus* (Hill) Bernh.]

COMMON BURDOCK

State Noxious Weed List: **No.**

Common burdock, also referred to as wild rhubarb, is a member of the Asteraceae or sunflower family. Common burdock is native to Europe and now is established throughout much of North America. A tea once was made from the roots to treat gout and rheumatism. The plant is able to spread to new areas by seeds that are found within burs of the plant that cling to hair, fur or clothing of passing animals or people.

Identification and growth form:

Common burdock often is found growing along roadsides and ditch banks and in pastures and waste areas. Burdock is a taprooted biennial that reproduces only by seed. In the first year of growth, the plant forms a rosette of large, heart-shaped, thickly hairy leaves similar to rhubarb. Burdock plants bolt in the second year of growth and grow 3 to 10 feet tall. Leaves of the plant are alternate and large with the broadest leaves located at the base. Leaves are dark green above and whitish green and woolly-hairy beneath with margins that are toothed or wavy. Flowers of the plant are pink, lavender, purple or white and 0.75 inch across. Numerous flower heads present are borne in leaf axils or at the end of branches. The heads are enclosed in a prickly bur that is composed of numerous smooth or woolly bracts that are tipped with hooked spines.

The head, or bur, of the flower breaks off and scatters the seeds. Achenes are gray to brown, mottled, oblong, about 0.25 inch long, flattened and slightly curved. Flowering and seed production occur from July to September. One plant is capable of producing 15,000 to 60,000 seeds.

Why is this plant a concern?

The plant is a host to powdery mildew and root rot that can spread to economically important plants. Burs of common burdock can become entangled in the wool of sheep and significantly damage the quality. Burs also can become entangled in the hair of livestock, allowing seeds to be distributed to new areas. The burs can cause eye disease, mouth sores and skin infections. In addition, milk products may become tainted if the plant is grazed in large quantities.

Common burdock has been used as a medicinal herb; however, the plant has been listed as a poisonous plant due to its diuretic effects. The bristles of the plant also may cause localized allergic reactions for some individuals.

How do I control this plant?

Chemical. Burdock is controlled easily by herbicides such as 2,4-D, dicamba (various) and Escort (metsulfuron). However, the plant usually grows in areas difficult to reach with spray equipment. Herbicides are most effective when applied in the first year during the rosette growth stage of the plant.

Cultural. Hand-pulling or digging can be an effective control method for small infestations if conducted prior to seed production. The plant will not survive in areas that are tilled. Mowing or cutting can eliminate seed production if conducted after the plant has bolted but prior to flowering.

Biological. The burdock moth *Metzneria lappella* Zeller provides some control of seed production. The larvae feed on burdock seed but damage varies greatly from year to year since the number of healthy larvae per bur ranges widely. The adults emerge in late June to early July and have pale brown wings approximately 0.5 inch across.

COMMON TANSY

(*Tanacetum vulgare* L.)

COMMON TANSY

State Noxious Weed List: **No.**

Common tansy, also referred to as garden tansy, golden buttons and bitter buttons, is a member of the Asteraceae or sunflower family. Common tansy is native to Europe and first was introduced to the United States as early as the 1600s as an ornamental plant and for medicinal purposes. The plant contains alkaloids that can be toxic to humans and livestock if consumed in large quantities. However, animals rarely ingest common tansy due to the strong smell of the plant. Illnesses in humans have been reported after hand pulling, suggesting toxins may be absorbed through unprotected skin. Common tansy still is used in some medicines and is listed in the United States Pharmacopoeia as a treatment for colds and fever.

Identification and growth form:

Common tansy is an aromatic perennial forb or herb that commonly grows from 1.5 to 6 feet tall. The plant reproduces both by seed and creeping rootstocks. Roots of the plant are fibrous and produce rhizomes. Stems of the plant are purplish-red. Leaves are alternate, smooth to slightly pubescent, 2 to 10 inches long and 1.5 to 3 inches wide, and deeply divided into numerous narrow, toothed segments that appear fernlike. Glandular dots on the leaves of the plant produce the strong, unique odor of the plant. Flowers of the plant are yellow, 0.25 to 0.5 inch across and buttonlike in flat-topped, dense clusters. Each head is composed of mainly yellow disk flowers that are arranged at the stem top in a flat-top cluster in which the outer flowers bloom first. Flowering typically occurs from July to September. Flower heads turn brown and maintain their shape at seed set. Seeds are yellowish brown with short five-toothed crowns.

Common tansy sometimes is confused with tansy ragwort (*Senecio jacobaea* L.). However, tansy ragwort is nonaromatic, has ray flowers and does not have the sharp, toothed leaves found on common tansy.

Why is this plant a concern?

Common tansy is an aggressive plant that can form dense vegetative colonies on disturbed sites and generally is found on roadsides, fence rows, pastures, vacant lands, stream bank, and waste areas. Disturbances can promote the colonization and spread of the plant. Common tansy reduces overall pasture productivity because the plant displaces desirable grasses and forbs and animals are reluctant to graze it. In addition, unpleasant tasting milk may result when dairy cattle graze the leaves of common tansy. Wildlife habitat also is affected negatively by the plant.

How do I control this plant?

Chemical. Herbicides for common tansy control include Escort (metsulfuron) and Telar (chlorsulfuron). Chaparral (aminopyralid plus metsulfuron) works well when infestations of common tansy also include thistle species. Herbicides may be most effective when applied in the spring during early bud development.

Cultural. Hand-pulling or digging may provide control for small infestations of common tansy if the entire root system is removed. However, gloves and protective clothing should be worn to prevent absorption of toxins through the skin. Mowing can reduce seed production if conducted during the bud stage; however, plants are able to regrow from rootstock.

Biological. No biological agents or pathogens are available for this weed.

DAME'S ROCKET

(*Hesperis matronalis* L.)

Fall rosette

DAME'S ROCKET

State Noxious Weed List: **No.**

Dame's rocket is an escaped ornamental from Eurasia and most often found along roads, streams, near woods and in thickets. The first introductions to North America began in the 1660s and the plant is now considered naturalized. However, infestations have been increasing rapidly in the north-central states.

Identification and growth form:

Dame's rocket is a biennial or occasionally short-term perennial herb in the mustard family. The plant resembles phlox, but has four petals, not five. The plant grows 2 to 4 feet tall; the stems are erect and often branched. Leaves are alternate, lanceolate, sharply toothed and pubescent. Dame's rocket flowers are found from early May through June, fragrant and generally purple but occasionally pink or white. Seeds are produced in long pods typical of the mustard family. Dame's rocket overwinters as a rosette.

Why is this plant a concern?

Even though this common garden flower has been in the U.S. since colonial times, it is now becoming invasive in many areas of the north-central Plains, especially in woody areas. Dame's rocket is in the same family as garlic mustard, an invasive plant that has invaded woody areas and forests in neighboring states such as Minnesota and Wisconsin. Dame's rocket aggressively competes with native species and has been listed as a noxious weed by the USDA.

How do I control this plant?

Chemical. Herbicides used for mustard control in cropland such as MCPA and 2,4-D will kill Dame's rocket and can be used in wooded areas as long as the herbicide is not applied to the tree bark. Typical pasture and rangeland weed control herbicides such as Tordon, dicamba and Transline will not control Dame's rocket.

Cultural. Hand-pulling or digging Dame's rocket is an effective control measure. Seeds remain in the soil for several years, so sites should be revisited each year to keep the plant from reestablishing.

Biological. No biological control agents or pathogens are available for this weed.

DOWNY BROME

(*Bromus tectorum* L.)

DOWNY BROME

State Noxious Weed List: **No.**

Downy brome is native to the Mediterranean region and is thought to have been introduced first near Denver, Colo., as a contaminant in packing material. The plant now is distributed widely throughout North America. Downy brome often is found as a contaminant in grass and crop seed and is difficult to separate from the desirable species.

Identification and growth form:

Downy brome is an annual or winter annual grass that can range in height from 4 to 30 inches. Seedlings are bright green with conspicuously hairy leaves. Stems are erect, slender and glabrous or slightly hairy. Foliage and seed heads of mature plants often change color from green to purple to brown or tan as the plant dries. A single downy brome plant can be comprised of one or two tillers or as many as 20 tillers. Inflorescence is dense, slender, usually drooping, one-sided, and 2 to 6 inches in length. Spikelets are nodding, slender and up to 0.75 inch long. Plants have five to eight florets per spikelet. Long, straight awns are attached to florets that are 3/8 to 5/8 inch long and are usually purple at maturity.

Seedlings germinate in the fall or winter at very high rates as soon as moisture conditions are favorable. Downy brome grows rapidly until late fall when the soil freezes, although above-ground growth may continue during warm or rainy conditions. The root system often will continue to develop throughout the winter. In the spring, the plant develops rapidly and produces heads in late April to early May, flowers within a week and produces seed by mid to late June. Downy brome is a prolific seed producer with production ranging from 25 to 5,000 seeds per plant.

Why is this plant a concern?

Downy brome can thrive in a variety of habitats and the plant quickly displaces desirable plant communities and lowers plant diversity. Downy brome can be a ready fuel source for fires because the plant grows in high densities and dries down very early in the season. Downy brome is palatable to livestock but only for a brief period during the spring and early summer. The seeds have long awns that may cause sores in the mouth and eyes of livestock that graze it and reduce wool values when it attaches to sheep as they walk through an infested area. Downy brome can become especially weedy in winter wheat.

How do I control this plant?

Chemical. Several herbicides, including Everest (flucarbazone), Olympus (propoxycarbazone) and Beyond (imazamox), are labeled for downy brome control in cropland. Plateau (imazapic) applied in the fall will control downy brome in pasture and rangeland.

Mechanical. Hand-pulling small infestations may eliminate current seed production. Disking is often ineffective, unless tilled 4 to 6 inches deep in order to bury seeds and prevent germination. Mowing may reduce plant production but seeds already may be viable and plants may regenerate new culms if conducted during the early growth stage.

Biological. No biological control agents or pathogens are available for this weed.

FIELD BINDWEED

(*Convolvulus arvensis* L.)

State Noxious Weed List: **No.**

Field bindweed (creeping jenny) is a member of the morning glory family and is well-adapted to the North Dakota climate and environment. Field bindweed is a native of Europe and western Asia and was introduced to this country during colonial days when it was referred to as devilgut. Field bindweed primarily is a problem in the dryland farming areas of the Great Plains and Western states. Field bindweed is found in both cropland and pasture and rangeland in North Dakota.

Identification and growth form:

Field bindweed is a long-lived perennial that produces a dense ground cover. The twining stems vary from 1.5 to 6 feet or more in length. Leaf size and shape are variable, but generally the leaves are 1 to 2 inches long, smooth and shaped like an arrowhead. Flowers are funnel-shaped, about 1 inch diameter and white or pink. The flower stalk has two small bracts located 0.5 to 2 inches below the flower. The bracts, along with leaf shape and smaller flower size, distinguish field bindweed from hedge bindweed.

Field bindweed also may be confused with wild buckwheat because of similarities in leaf shape and vining habit. However, wild buckwheat is an annual rather than a perennial and has a very small (about 1/8 inch diameter) greenish-white flower.

Roots of established plants may extend 20 to 30 feet laterally and be excavated as deep as 30 feet below the surface. Buds along the root system can send up shoots that start new plants. The root system contains a large quantity of carbohydrates that provide energy for both above- and below-ground plant growth. Buds located all along the root can send up new shoots or establish a new patch when roots are cut and moved, such as from cultivation.

Seeds of field bindweed vary from dark to brownish gray and are about 1/8 inch long. The fruit is a small, round capsule that contains up to four hard-coated seeds that can remain viable for at least 50 years. Field bindweed produces numerous seed in growing seasons with high temperatures and low rainfall and humidity.

Field bindweed can be spread by seed, root fragments carried by farm implements, infested soil adhering to the roots of nursery stock, root growth from infested areas and by animals.

FIELD BINDWEED

Why is this plant a concern?

Field bindweed has a deep root system that competes with crop plants for water and nutrients. Vines climb on plants and shade crops, cause lodging of small grains and make harvesting difficult by clogging machinery. Dense field bindweed infestations may reduce crop yields by 50 percent to 60 percent. Land infested with field bindweed is reduced in value.

How do I control this plant?

Established field bindweed is difficult to control. An effective control program should prevent seed production, kill roots and root buds, and prevent infestation by seedlings. This plant is very persistent and a successful control program must be more persistent.

The best control of field bindweed is obtained with a combination of cultivation, selective herbicides, and competitive crops or forage grasses.

Chemical. Long-term control of field bindweed from herbicides depends on movement of a sufficient amount of herbicide through the root system to kill the roots and root buds. This requires use of systemic (movement throughout the plant) herbicides. Examples of herbicides that will reduce field bindweed infestations are products that contain dicamba (various), Paramount (quinclorac), Tordon (picloram) and glyphosate (various).

Successful control of field bindweed requires a long-term management program. A herbicide applied once never will eliminate established stands; rather, several re-treatments are required to control field bindweed and keep it suppressed. Because of long seed viability and tremendous food reserves stored in the roots, repeated chemical and/or mechanical control measures must be used.

Herbicides should be applied when field bindweed is growing actively and stems are at least 12 inches long. Herbicide performance can vary greatly due to environmental conditions in which the plants have been exposed. Plants growing under moisture or heat stress usually have smaller leaves with a thicker cuticle and slower biological processes than plants growing in more favorable conditions. As plant stress increases, herbicide uptake and translocation decreases, which in turn decreases herbicide performance. This is the reason why field bindweed is harder to control in the more semiarid area of central and western North Dakota than in the eastern region.

Cultural. Intensive cultivation controls newly emerged seedlings, may kill young field bindweed infestations and contributes to control of established stands. Timely cultivations deplete the root reserves of established plants and stimulate dormant seeds to germinate.

Intensive cultivation alone is not practical because crops cannot be grown during the tillage period, and repeated tillage exposes the soil to erosion. However, applying herbicides in combination with cultivation has been successful in reducing both field bindweed infestations and the number of tillage operations.

Biological. Two non-native insects have been released to control field bindweed with very minimal success. The bindweed gall mite *(Aceria malherbae)* is microscopic in size and feeding by nymphs causes galling of field bindweed stems. The larvae of the bindweed moth *(Tyta luctuosa)* feed at night on field bindweed flowers and leaves. Several native insects occasionally feed on this weed but damage to the plant has not been long-lived. No insect has been released to feed on field bindweed roots, which would be the most likely method of success in controlling this weed.

HALOGETON

[*Halogeton glomeratus* (M. Bieb.) C. A. Mey.]

HALOGETON

State Noxious Weed List: **No.**

Halogeton is a poisonous, noxious weed introduced from Eurasia and first was reported in Nevada in 1934. Since then it has spread to millions of acres in the western U.S., especially in range and wildlands. This plant often is found in alkaline soils and semiarid regions, particularly when the areas have been disturbed by overgrazing, off-road vehicles, new roads and similar disturbances. Halogeton was reported in North Dakota for the first time in 2009, but because of the size of the infestations, it likely has been in the state for some time.

Identification and growth form:

Halogeton is an annual weed in the goosefoot family and grows from a only a few inches to more than 24 inches tall, depending on location and moisture. Each plant has about five main stems that grow out and then up from the crown, branching out similarly to Russian thistle, which this plant resembles. The blue-green leaves are small and sausage-shaped, and have a short bristle or spine at the end. The flowers are found in the leaf axils, greenish and not showey. Even though the plant is an annual, the taproot can grow nearly 2 feet down and out from the crown. Mature plants have red stems. The brown-black seeds are contained in a bracted pouch that often are mistaken for flowers and give the plant a "wooly" appearance at maturity. Halogeton produces as many as 75 seeds per inch of stem and seeds are viable from one year (early season production) to more than 10 years (developed after mid-August).

Why is this plant a concern?

Halogeton contains soluble sodium oxalates that are poisonous to sheep and cattle. The plant is not palatable when green but may be consumed in toxic quantities in late summer, fall and winter. Dried plants may contain 30 to 40 percent sodium oxalate, and the lethal dose for an adult sheep is reached when the animal consumes 0.3 to 0.5 percent of total body weight in a short time. Cattle are not likely to eat enough to be poisoned unless feed is short. Sheep can develop a tolerance to halogeton through time and consume this weed without illness if foliage from other plants is also part of the diet.

How do I control this plant?

Chemical. 2,4-D will control plants if applied very early in the spring prior to flowering. Escort (metsulfuron) is very effective and can be applied throughout the growing season. Plateau (imazapic) also will control this weed and can be applied both pre- and post-emergence. Spike (tebuthiuron) provides total vegetation control for several years and may be desirable for use on railroad ballast and oil field locations, where halogeton often is found.

Cultural. Halogeton is an early invader of disturbed sites. Avoid overgrazing an area and reseed disturbed sites to native grasses and forbs to prevent halogeton from becoming established. Halogeton competes poorly with established perennial vegetation.

Biological. No biological control agents or pathogens are available for this weed.

HOARY CRESS

[*Cardaria draba* (L.) Desv.]

HOARY CRESS

State Noxious Weed List: **No.**

Hoary cress (also called whitetop) is native to the Balkan Peninsula, Armenia, Turkey, Israel, Syria, Iraq and Iran. The plant is widely introduced and naturalized throughout Europe and all other continents. Hoary cress first was introduced to the United States at Long Island, N.Y., in 1862 through a ship's ballast or contaminated seed.

Identification and growth form:

Hoary cress is a deep-rooted perennial forb that can grow up to 2 feet tall. Stems of the plant are erect, branching above, glabrous or slightly to densely pubescent below, and appear gray. Hoary cress has both basal and stem leaves. Basal leaves have scattered to dense pubescence, are irregularly toothed to entire and taper to a short stalk that attaches to the crown of the plant near the ground. Middle and upper stem leaves are sparsely pubescent, have two lobes clasping the stem and are grayish green. Flowers of the plant are white, four-petaled and borne on slender stalks. Seed capsules are shaped like an inverted heart and usually contain two seeds. The seeds are oval or round at one end, narrow to a blunt point at the other and reddish-brown.

Seedlings of hoary cress germinate in the fall and overwinter as rosettes. The perennial root system is established the following spring and consists of vertical and lateral roots. Both root types can produce adventitious buds that develop into rhizomes and new shoots. Plants flower from May to June and begin producing seeds by July. A single plant can produce between 1,200 and 4,800 seeds each year, with a single flowering stem capable of producing as many as 850 seeds. Seeds can remain viable in the soil for approximately three years.

Why is this plant a concern?

Hoary cress is an aggressive plant that can form dense monocultures on disturbed land. Disturbances such as grazing, cultivation and especially irrigation can promote the colonization and spread of the plant. Hoary cress can displace native plant species, thereby reducing biodiversity and forage production. Whitetop contains glucosinolates that can be toxic to cattle but livestock only graze hoary cress in the spring if more palatable forage is not available.

How do I control this plant?

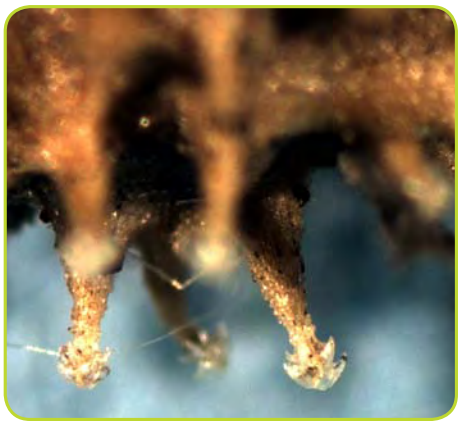
Chemical. Hoary cress is in the mustard family so herbicides commonly used to control mustards generally work well on this weed. Escort or Ally (metsulfuron), Oust or Telar (chlorsulfuron), MCPA and 2,4-D have been used to control the plant. However, timing of herbicide application is important and should be done in early spring or in the fall after seed germination.

Mechanical. Digging can provide control for small infestations of hoary cress if the entire root system is removed. Hand-pulling generally is not effective because the root system may not be entirely removed. Cultivation is the major factor for the spread of the plant because root fragments that are left behind can produce new plants. Cultivation can eradicate plants if cultivations are repeated frequently throughout the growing season for a period of two to four years.

Biological. No biological control agents or pathogens are available for this weed.

HOUNDSTONGUE

(*Cynoglossum officinale* L.)



HOUNDSTONGUE

State Noxious Weed List: **No.**

Houndstongue is a biennial poisonous herb that is native to Eurasia. The plant is a member of the Borage family, which includes more commonly known plants such as Virginia Bluebells, Forget-Me-Nots and the fiddlenecks. Houndstongue commonly is found in disturbed areas, including roadsides, trails, and in pasture and woodlands following soil disturbance or overgrazing.

Identification and growth form:

Houndstongue is a biennial that forms a rosette the first year of growth and bolts and flowers the second season. The plant only reproduces from seed, but can spread great distances because the barbs on the nutlets cling to clothing, machinery and animals. The leaves are oblong, very pubescent and rough, which resembles a hound's tongue. Plants bolt during early summer, the second year of growth, to a height of 1 to 4 feet and flower in mid-June. The flowers are small, arranged in clusters and not showy. Flower color ranges from red to burgundy. Each flower produces three to four nutlets, which are flat and tear-drop shaped with a very hard seed coat and numerous barbs. Plants generally are found along trails and roadsides, on the edge of wooded areas and in disturbed habitats. Infestations often establish near areas where cattle and other livestock rub against something such as fence posts and trees or shrubs.

Why is this plant a concern?

Houndstongue tends to be a nuisance weed rather than a noxious plant unless infestations grow to become large patches. The nutlets often become imbedded in the wool or hair of livestock, which can cause a loss of value of the wool and/or increase costs to remove the burs. Eye damage can occur if burs become embedded in the eye or eyelids. The burs can be problematic for hikers, hunters and fishermen and also to their pets.

Houndstongue contains alkaloids that are especially toxic to cattle and horses. The plant is rarely eaten in the green state; however, animals will eat the dried plant in hay. Sheep are more resistant to the pyrrolizidine alkaloids than other livestock, while horses, especially when confined to small areas infested with houndstongue, are more likely to ingest toxic levels. Fatal liver disease in horses occurred following two weeks of feeding hay with as little as 6 percent houndstongue.

How do I control this plant?

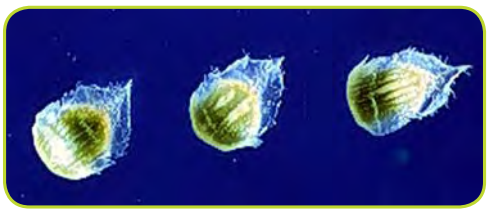
Prevention is the best method to keep houndstongue from invading North Dakota. Use only certified weed seed-free hay and eradicate new infestations before the plant can spread.

Chemical. Escort (metsulfuron) is very effective for controlling houndstongue and can be applied throughout the growing season. First-year houndstongue rosettes are easily controlled with 2,4-D applied from late May to mid-June. Second-year plants are much less susceptible to 2,4-D. Plateau (imazapic) at high rates will control houndstongue both pre- and post-emergence, but grass injury, especially to the cool season species is likely when Plateau is applied at the maximum rate.

Biological. A root weevil, *Mogulones cruciger,* has been released for control of houndstongue in Canada. The insect has become well-established in Alberta and has greatly reduced the houndstongue infestation in that province. However, this biological control agent has not been approved for release in the U.S. Several other insects are being evaluated for biological control of houndstongue, including a seed weevil *(M. borraginis),* a stem weevil *(M. trisignatus),* a root beetle *(Longitarsus quadriguttatus)* and a root fly *(Cheilosia pasquorum);* however, initial results are not nearly as promising as those of the root weevil.

RUSSIAN KNAPWEED

[*Acroptilon repens* (L.) DC.] syn. (*Centaurea repens* L.)



RUSSIAN KNAPWEED

State Noxious Weed List: **Yes.**

Russian knapweed is the most widespread of the knapweeds in North Dakota. It also is the only perennial of the noxious knapweeds and is the most difficult to control. Russian knapweed often is found in poorly drained and saline/alkaline soils with supplemental water sources such as rivers and streams. This persistent weed often is found in southwestern North Dakota, but increasingly infestations have been found statewide. Russian knapweed grows especially well in areas with supplemental water sources such as the Little Missouri and Heart rivers in North Dakota.

Identification and growth form:

Russian knapweed is a long-lived, deep-rooted perennial with growth characteristics similar to Canada thistle. The weed emerges in the spring from roots and grows to 2 to 3 feet tall and is shrublike with spreading branches. Once established, Russian knapweed spreads mainly by underground root stocks as seed production is limited compared with other knapweed species. The leaves are alternate and lobed lower on the plant while upper leaves are entire. Flowering occurs from June to September and flowers vary from light pink to lavender. The stems die back to the soil surface each year.

Two key characteristics distinguish Russian knapweed from spotted and diffuse knapweed. First, the flowers have rounded bracts with transparent tips that are quite different in appearance than the dark bracts of spotted and diffuse knapweed. Second, the root of this perennial is dark brown to black, scaly as if the plant had been burned, and can grow to depths of greater than 20 feet. The flowers of Russian knapweed vary from light pink to lavender.

Why is this plant a concern?

Russian knapweed can spread rapidly and is very competitive with native species. Russian knapweed will reduce forage production to near zero as the site often becomes a monoculture. Russian knapweed also will infest roadsides, pasture and rangeland and is the only knapweed in the state that causes significant losses in cropland.

How do I control this plant?

Russian knapweed is one of the most difficult perennial weeds to control. If the plant is found in cropland, then a combination of cultivation and herbicide treatments will suppress the plant. However, herbicides at labeled rates for cropland use will not control Russian knapweed.

Chemical. Tordon (picloram) is one of the most effective herbicides used for Russian knapweed control. The best control is obtained when picloram is applied following several hard frosts (mid-October). Russian knapweed plants may be dormant with gray stems and no leaves, but control the following spring is nearly 100 percent. Application in mid-September or during flowering in midsummer provides shorter-term control than late applications. Other herbicides used for Russian knapweed control include Escort (metsulfuron) and Milestone (aminopyralid).

Cultural. Livestock generally will not graze Russian knapweed. Mowing and cultivation do not control this weed.

Biological. Exploration and evaluation of biocontrol agents for Russian knapweed are in progress.

SPOTTED and DIFFUSE KNAPWEED

[*Centaurea stoebe* spp. *micranthos* (Gugler) Hyek] and (*C. diffusa* Lam.)

Diffuse knapweed flower with spiny bracts

Spotted and diffuse knapweed

Spotted knapweed flower with black bracts

SPOTTED and DIFFUSE KNAPWEED

State Noxious Weed List: **Yes.** (both species).

The knapweeds are one of the most rapidly spreading invasive species in the western U.S. Knapweeds already infest more acreage than leafy spurge in Montana and Minnesota, and have been found in more than 25 counties in North Dakota. Knapweeds are related to thistles and can spread even faster. For instance, spotted knapweed infested approximately 25 acres in eight North Dakota counties in 1984 and had spread to more than 1,000 acres in 14 counties by 1997. Aggressive control programs have kept the infestation at approximately 1,200 acres since then, but more than half the counties in the state now have spotted knapweed infestations. Diffuse knapweed can spread as quickly as spotted knapweed but has been kept in check in North Dakota and infests less than 300 acres.

Identification and growth form:

Both are short-lived perennials or sometimes biennial plants reproducing solely by seed. Seed remains viable in the soil five years or more, so infestations may occur a number of years after vegetative plants have been eliminated. The seeds can germinate from spring through early fall. Seedlings emerging in the fall often overwinter as a rosette of leaves, resuming growth again in the spring. The plants grow 2 to 4 feet tall with one or more stems. The leaves are pale green and 3 to 4 inches long. Rosette leaves are deeply lobed. The physical appearance of these two knapweed species is similar, except diffuse knapweed is generally shorter and more highly branched. Plants flower from early July through August and produce 1,000 or more seeds per plant.

These species are distinguished by the bracts below the flower. Spotted knapweed has stiff, black-tipped bracts while diffuse knapweed has a rigid terminal spine about one-third of an inch long with four to five pairs of shorter, lateral spines (crablike). If the plant is not flowering, search for last season's flower stalk and identify the plant based on the flower bracts. Both species have pink to light purple and occasionally white flowers.

Why is this plant a concern?

Spotted and diffuse knapweed are aggressive, introduced weed species that rapidly invade pasture, rangeland and fallow land and cause a serious decline in forage and crop production. Spotted knapweed has few natural enemies and is not preferred by livestock as forage. Knapweed infestations in North Dakota largely can be traced to seed or hay brought in from neighboring states. Researchers in Montana have observed that spotted knapweed may remain in a confined location for several years and then spread rapidly to adjacent areas. Controlling spotted and diffuse knapweed plants when they are first observed and monitoring the site for several years to prevent reinfestation from seed are important

How do I control these plants?

Chemical and Cultural. Spotted and diffuse knapweed confined to small, well-defined areas should be pulled by hand or treated with a herbicide as soon as detected to avoid spread of the weed. First, all visible knapweed plants should be removed and destroyed by burning or mulching. Then the areas should be treated with a herbicide to prevent reinfestation from seedlings. The most effective herbicides for spotted and diffuse knapweed control include Milestone (aminopyralid), Tordon (picloram) and dicamba (various). Treat an extra 10 to 15 feet around the knapweed patches to control seedlings. A careful follow-up program is necessary to control missed plants and seedlings. Many attempts to control knapweed have failed because follow-up treatments were not applied.

Biological. In general, the knapweed infestations are small enough that herbicide and hand removal are the best and most cost-effective treatments in North Dakota. Biological control agents have been introduced in neighboring states to control spotted knapweed with limited success.

KOCHIA

(*Kochia scoparia* L.)

KOCHIA

State Noxious Weed List: **No.**

Kochia, also referred to as fireweed, summer-cypress or Mexican firebush, is a member of the Chenopodiaceae or goosefoot family. Kochia is native to Eurasia and was introduced to the United States in the early 1900s as an ornamental. Kochia is palatable to livestock and has good forage quality when grazed early in the season. Kochia sometimes is referred to as tumbleweed.

Identification and growth:

Kochia is a taprooted annual forb that typically grows from 1 to 6 feet tall. Stems of the plant are erect and spreading, much branched from the base and usually soft-hairy, but occasionally smooth. Stems are usually yellowish-green to green and often turn red with maturity. Leaves of the plant are alternate, lance-shaped and 0.5 to 2 inches long and have fringed hairs on the margins. The upper surface of the leaf is usually smooth and the lower surface usually is covered with soft hairs. Kochia flowers are inconspicuous and greenish and form short, dense, terminal, bracted spikes. Flowering generally occurs from July to September.

Kochia reproduces only by seed with more than 14,000 seeds produced per plant. Seeds are oval or egg shaped, dull brown, slightly ribbed and dispersed in the fall when the plant becomes a tumbleweed. Seeds germinate in the spring and have little or no seedbank viability and either germinate or decay in one year.

Why is this plant a concern?

Although kochia has been grown as a drought-resistant forage and may have reclamation value on disturbed land, the plant is a serious cropland weed. Kochia is an exceptionally competitive weed and a few uncontrolled plants can cause severe yield losses. Kochia is highly adaptable and can be found on pasture, rangeland, road sides, ditch banks, wastelands and cultivated fields.

Kochia can contain high nitrate levels and is toxic if overgrazed. Nitrate poisoning in livestock causes bloat and photosensitization. Toxic substances identified within the plant include saponins, alkaloids, nitrates and oxalates. Kochia is a main contributor to fall hay fever sufferers.

How do I control this plant?

Chemical. Kochia has become resistant to several commonly used herbicides. ALS herbicides provide good kochia control unless resistant populations are present. Tank-mixing ALS herbicides with other broadleaf herbicides with differing modes of action is required to reduce the risk of resistant kochia becoming established. Starane (fluoxypyr) provides excellent control of ALS-, triazine- and dicamba-resistant kochia. Dicamba plus MCPA or bromoxynil plus MCPA will control small kochia plants. In many fields, 2,4-D and MCPA no longer control kochia due to repeated use and near eradication of susceptible kochia biotypes.

Mechanical. Early tillage in the spring provides good control when conducted during the seedling stage of the plant. Mowing kochia prior to flowering reduces seed production but may not kill the plant.

Biological. No biological agents or pathogens are available for this weed.

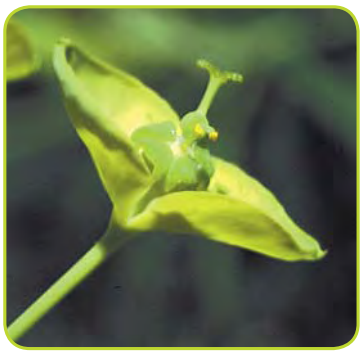
LEAFY SPURGE

(*Euphorbia esula* L.)

State Noxious Weed List: **Yes.**

Leafy spurge was once the most difficult noxious weed to control in North Dakota and infests all 53 counties. Scientists at the North Dakota Agricultural College (NDAC) recognized leafy spurge could be a problem soon after it was first identified in the state, growing along a Fargo street in 1909. However, the plant was not added to the state noxious weed list until 1935, when leafy spurge was found growing in all but 10 counties. The largest single infestation at that time was estimated to be 193 acres in Foster County.

Latex is found in all plant parts



True flower

Leafy spurge gall

Aphthona lacertosa

Aphthona nigriscutis

LEAFY SPURGE

Despite several control programs led by the State Agriculture Department and the Agriculture Extension Service, leafy spurge doubled in acreage every 10 years, reaching nearly 1.8 million acres in the 1980s. A coordinated integrated program of biological, chemical and cultural methods directly led to the first-ever reports of a decline in leafy spurge infestation in the state in the 1990s.

Identification and growth form:

Leafy spurge is a long-lived perennial that normally grows 2 to 3 feet tall from a woody crown from below the soil surface. Each crown area produces several upright stems, giving the plant a clumplike appearance. The plant bears numerous linear-shaped leaves with smooth margins. The leaves have a characteristic bluish-green color but turn yellow or reddish orange in the fall. Stems originating from crown buds and roots begin growth in late April, making leafy spurge one of the first plants to emerge in the spring. The early and rapid growth gives leafy spurge a competitive advantage over crop and pasture plants. All parts of the plant contain a milky juice called latex, which is a useful identifying characteristic.

Leafy spurge produces a flat-topped cluster of yellowish-green petal-like structures called bracts, which surround the true flowers. The showy, yellow bracts appear in late May and early June, giving the plant the appearance of "blooming." However, the true flowers, which are small and green, do not develop until mid-June. Spring-applied herbicides are more effective on plants with developing true flower parts than on plants with developed bracts but undeveloped flowers.

Seeds are borne in pods, which contain three gray-brown, oblong, smooth seeds. After the seed has matured, the seed pods burst explosively and throw seeds up to 15 feet from the parent plant. An average of 140 seeds is produced per stem, and seeds may remain viable in the soil at least eight years.

Leafy spurge seeds may germinate to re-establish infestations where total control of leafy spurge tops and roots has been achieved. The peak period of germination is late May and early June, but seeds can germinate and seedlings become established throughout the growing season. Leafy spurge seedlings have a remarkable capacity for vegetative reproduction and can reproduce vegetatively within seven to 10 days after emergence. Seedlings typically do not flower during the first year.

The root system of leafy spurge is extensive and consists of numerous coarse and fine roots that occupy a large volume of soil. Roots are most abundant in the upper foot of soil, but some roots can extend to a depth of 15 feet or more. The roots are woody and durable in structure, with numerous buds capable of producing new shoots. The root system contains a large nutrient reserve capable of sustaining the plant for years.

Why is this plant a concern?

Leafy spurge infestations may have more than 200 stems per square yard in sandy soil and even higher densities in heavy clay soil. Patches of leafy spurge usually spread vegetatively from 1 to 3 feet per year and form dense stands that crowd out other plants by shading and competing for moisture and nutrients. Forage production may be reduced to 20 percent or less and most native plants are eliminated because they cannot out-compete this weed.

Leafy spurge contains a toxic substance that, when consumed by livestock, is an irritant, emetic and purgative. It causes scours and weakness in cattle and may result in death. The toxin has produced inflammation and loss of hair on the feet of horses from freshly mowed stubble during haying and has caused mortality of sheep that grazed leafy spurge exclusively. However, sheep and goats will graze leafy spurge as a portion of their diet and can be used as a form of cultural control. Animals will eat dried plants in hay, but many livestock, particularly cattle, avoid eating live plants

LEAFY SPURGE

Aphthona larvae

Longhorned beetle larvae

Leafy spurge hawkmoth

How do I control this plant?

Leafy spurge control must be considered a long-term management program. Generally, less than 6 inches of the root system is destroyed regardless if the control method is biological, chemical or cultural. Research at North Dakota State University has shown that more of the root system is killed when a combination of control methods are used, compared with any method used alone.

Chemical. Proper timing of herbicide applications is essential for good leafy spurge control. Leafy spurge is most susceptible to dicamba (Banvel and other trade names), Paramount (quinclorac) or Tordon (picloram) applied either when the true flowers and seeds are developing in June or after the stems have developed new fall regrowth in early to mid-September. Plateau (imazapic), fall-applied, provides better long-term control and less grass injury than spring or summer treatments. Combinations of Tordon plus Plateau or Tordon plus Plateau plus 2,4-D applied in June provide improved leafy spurge control compared with Tordon plus 2,4-D or Plateau applied alone in June. The Tordon plus Plateau combination is not recommended for use in the fall.

The combination of Tordon plus Overdrive also will improve leafy spurge control compared with Tordon used alone. Overdrive contains dicamba plus difluenzopyr, which is an anti-auxin compound that often improves broadleaf weed control when applied with auxinlike herbicides such as Tordon, dicamba and 2,4-D.

Glyphosate (various) applied for leafy spurge control has a different optimum application timing than the auxin herbicides (2,4-D, dicamba, picloram and quinclorac) or Plateau. Glyphosate is most effective for leafy spurge control when applied either after seed filling in midsummer or after fall regrowth has begun but before a killing frost. Glyphosate alone applied during spring growth stages generally provides poor long-term control.

Grazing. Sheep and goats provide an alternative for controlling leafy spurge top growth in pasture and rangeland. Grazing alone will not eradicate leafy spurge but will reduce the infestation, slow the spread of the weed and allow grasses to be grazed by cattle and horses. Grazing should be started early in the spring when the plant first emerges. On large infestations, pastures should be divided so animals can be rotated regularly and the entire infestation grazed in a timely manner.

Sheep and goats are best suited to control leafy spurge on large infestations or along waterways and tree areas where chemical control is restricted or cost is prohibitive and/or where success with biological control agents has been minimal.

Leafy spurge provides good forage value and compares favorably with widely used regional forages such as alfalfa (*Medicago sativa* L.), smooth brome (*Bromus inermis* Leyss.) and crested wheatgrass (*Agropyron desertorum* Fischer ex Link). Before moving animals to a leafy spurge-free area, they should be contained for three to five days so viable seed can pass through the digestive system.

Biological. Biological control of leafy spurge was initiated in the mid-1980s. To date, 10 species of insects have been released in North Dakota for control of leafy spurge, and six have become established. Four of the six established insects are flea beetles (*Aphthona* spp.), which have reduced the leafy spurge density more than any other agent.

The first flea beetle released in North Dakota was *Aphthona flava* Guill in 1986. This flea beetle has established at only a few sites in the state and occurs at densities too low to be effective. In 1988, a mixed population of *Aphthona czwalinae* Weise and *Aphthona lacertosa* Rosenhauer were released near Valley City, N.D. By 1995, the majority (greater than 90 percent) of this mixed population was *A. lacertosa.* Two additional flea beetles, *Aphthona cyparissiae* Koch and *Aphthona nigriscutis* Foudras, were released the following year. *A. lacertosa* and *A. nigriscutis* were established in almost every county in North Dakota by 1996 and have become the major biocontrol agents used for leafy spurge control.

Although *Aphthona* spp. adults feed on leafy spurge foliage, the major damage to the plant occurs when the larvae feed on the roots. Larvae feed on both the fine feeder roots used by the plant to absorb water and nutrients and the storage tissue of the root crown. This feeding both destroys root tissue directly and causes the plant to be more susceptible to other methods of control, such as herbicides and infection from soil borne pathogens.

Research at North Dakota State University found flea beetle establishment was best on silt loam, silt clay loam, clay loam and clay soils with an organic matter content of 6 percent to 9.5 percent. Flea beetles were least productive in fine sand to loamy fine sand soils with an organic matter content of 1 percent to 3 percent. In addition, the release area needs to be well-drained and not subject to frequent prolonged flooding or standing water, which will kill the larvae. Generally, flea beetles have not been very successful in controlling leafy spurge growing along waterways, in shaded areas or in very sandy soil.

The *Spurgia esulae* gall midge causes stem tip galls on leafy spurge, thereby decreasing seed production. It has been most successful near wooded areas. However, a second control method was needed to reduce the original leafy spurge infestation and to prevent spread from roots. A stem-boring beetle, *Oberea erythrocephala* Shrank, has been released and established in North Dakota in the 1980s, but to date, the population never has increased to sufficient numbers to decrease leafy spurge. The spurge hawkmoth (*Hyles euphorbiae* L.), a foliar feeder, was introduced in the 1970s but generally has not survived and when it did survive, control was too late in the growing season to be very useful.

Limitations to biological control. Although flea beetles have become established throughout North Dakota, they have not been successful in all environments. To date, approximately 30 percent of the releases have established and the leafy spurge stem density has been reduced. In another 30 percent of the releases, the insects have become established but the population density is too low to be effective. In the remaining releases, flea beetles have not established.

Cultural. Cultural control of leafy spurge includes properly timed cultivation and/or planting of competitive grass species. Cultural methods that only control leafy spurge top growth include mowing and fire. All cultural control methods are more successful when combined with herbicide treatments than when used alone.

Leafy spurge infestations must be controlled with herbicides such as glyphosate prior to seeding grass species. Some perennial grass species that have competed effectively to provide leafy spurge control include: Bozoisky Russian wildrye [*Psathyrostachys juncea* (Fisch.) Nevski] and Luna pubescent wheatgrass [*Elytrigia intermedia* (Host) Beauv.], Rebound smooth brome (*Bromus inermis* Leyss.) and Rodan western wheatgrass (*Pascopyrum smithii* Rydb.). They are examples of grass species that can compete relatively well with leafy spurge. Not only were the grasses very competitive with leafy spurge, but they also provided high yields and good nutritive value for grazing. Grazing following grass establishment should be limited and conducted at the proper growth stage of the grasses or leafy spurge will re-infest the seeded area rapidly.

Mowing and burning have been ineffective for reducing leafy spurge infestations, but may result in uniform regrowth that allows a more timely herbicide treatment. Also, mowing will reduce seed production if repeated every two to four weeks during the growing season.

COMMON MILKWEED and SHOWY MILKWEED

(*Asclepias syriaca* L. and *Asclepias speciosa* Torr.)

Common milkweed flower

Common milkweed

Monarch butterfly larvae

Showy milkweed flower

COMMON MILKWEED and SHOWY MILKWEED

State Noxious Weeds List: **No.**

Common and showy milkweed are native to North America. Both species are robust, fleshy perennial plants that flourish in orchards, waste places and along roadsides. Milkweed has been used for medicinal, industrial, decorative and even for food purposes, despite having some degree of toxicity. Milkweed is best known as a primary food source for the monarch butterfly.

Identification and growth form:

As the common name implies, both species contain a thick, white, milky latex throughout the plant. Flowers are arranged in clusters at the top of the plant and are pink to white. Common milkweed flowers are held in tighter clusters and are more pink than white compared with showy milkweed. Showy milkweed flowers also have long lobes that stand upright, which are not found on common milkweed. Both species grow 2 to 4 feet tall and have large opposite leaves 3 to 5 inches wide and 6 to 10 inches long, which are covered with fine pubescence. These perennial plants have shallow fibrous roots. Milkweed grows over a wide range of soil moisture conditions, but can become dense under medium or high moisture levels.

Seed pods are 3 to 5 inches long and contain dozens of flat, reddish-brown seeds with tufts of hairs that allow the seed to travel long distances in the wind. An established market exists for milkweed seed floss as a nonallergenic fill to replace imported duck and goose down in comforters and for seed sales in prairie restorations and butterfly gardens. Most commercial milkweed supplies still are collected from the wild.

Why is this plant a concern?

Common milkweed can be aggressive in cropland areas given the right conditions. Reasons for the increase in milkweed densities in cropland include spread by the extensive root system, farmers using less tillage, several years of high rainfall and tolerance to most commonly used herbicides. Given the opportunity to spread and become established, common milkweed is extremely difficult to control.

How do I control these plants?

Since milkweed plants are native and a major food source for the monarch and other butterfly species, control is discouraged. However, if the plant becomes established in cropland, crop yield loss may occur and control would be warranted.

Chemical. Tordon (picloram) plus 2,4-D at high rates will reduce milkweed density but cannot be used in cropland. Glyphosate will suppress milkweed temporarily in cropland while Express (tribenuron) can be applied with 2,4-D plus dicamba for spot treatment.

Cultural. Cultivation will reduce milkweed species in cropland but care must be taken not to spread the roots to noninfested areas.

Biological. Monarch butterfly larvae feed heavily on milkweed and often remove a majority of the leaves on a plant.

ORANGE HAWKWEED

(*Hieracium aurantiacum* L.)

ORANGE HAWKWEED

State Noxious Weed List: **No.**

Orange hawkweed is native to northern and central regions of Europe. The plant first was introduced in North America in Vermont in 1875 as an ornamental. Orange hawkweed escaped from landscape plantings, gardens and cemeteries and now occurs throughout the eastern seaboard, into the Midwest, extending west to Minnesota and Iowa and south to Virginia and North Carolina, and has been steadily spreading to the West. Orange hawkweed is described as the worst weed problem in the northern Minnesota Iron Range and has become a major weed problem in the Pacific Northwest.

Identification and growth form:

Orange hawkweed is a herbaceous perennial that contains a milky sap and commonly grows up to 12 inches tall. In the vegetative stage, the plant appears as a basal rosette with many hairy leaves. Leaves are 4 to 6 inches long, dark green above, light green beneath, narrow and spatula-shaped. Each rosette is capable of producing 10 to 30 flower stems. Stems of the plant have short, stiff hairs and may have one to three small, clasping leaves located below the midpoint of the stem.

Orange hawkweed produces between five and 30 red-orange flower heads that are 0.5 to 0.75 inch diameter. Flower heads are arranged in a flat-topped cluster. Orange hawkweed seeds are tiny and black, and have a tawny tuft of bristles on the flattened end. The plant spreads primarily vegetatively through runners (like strawberries) and rhizomes and to new sites by seed.

Why is this plant a concern?

Orange hawkweed is an aggressive species that quickly can develop into large, dense patches, thus reducing native plant communities. The plant colonizes rapidly, forming a solid mat of rosettes. Orange hawkweed may have allelopathic effects on neighboring plants.

How do I control this plant?

Chemical. Orange hawkweed can be controlled with Tordon (picloram), products that contain clopyralid (Curtail, Stinger, Transline), Milestone (aminopyralid) or dicamba plus 2,4-D. Monitor infested areas for several years to control new seedlings.

Mechanical. Pulling or digging is not recommended unless the infestation only consists of a few plants because digging stimulates the growth of new plants from rhizomes, stolons and fragmented roots.

Biological. No biological control agents or pathogens are available for this weed.

POISON IVY

[*Toxiodendron rydbergii* (Small ex Rydb.) Greene]

POISON IVY

State Noxious Weed List: **No.**

Poison ivy is a native species commonly found in wooded areas and in brushy areas, especially those along streams or lakes. It can grow as a small shrub or vine and is found in North America from Canada to Mexico. The first published records of poison ivy in North America date back to the 1600s. A similar plant called poison oak *(T. diversiloba)* is found only in states along the Pacific coast.

Identification and growth form:

Poison ivy is a perennial native small shrub that spreads by both rhizomes and seeds. The leaves are alternate with trifoliate leaflets. Remember the rhyme: Leaves of three — let it be! The leaves are shiny green in the spring and turn yellow and deep red in the fall. The flowers grow in axillary panicles, are yellow-green and not showy. The fruit is globed shaped, resembling small pumpkins, and turns yellow or light brown when mature.

Why is this plant a concern?

The "poison" in this plant is from a white oil called urushiol found in the phloem that causes an allergic contact dermatitis in about 85 percent of the population. Plants retain urusiol even after desiccation and smoke from burning poison ivy can carry the oil. The reaction is to the oil, not the plant itself, so one can react by touching objects that have come in contact with the plant, such as tools, and when removing footwear. Since it is an allergic reaction, people not sensitive to poison ivy can become sensitized through time.

How do I control this plant?

The best control is avoidance, but if the plant is found close to walking trails, near a home or in your favorite fishing area, herbicides that contain triclopyr such as Garlon are very effective.

PURPLE LOOSESTRIFE

(*Lythrum salicaria* L.)

State Noxious Weed List: **Yes.**

Purple loosestrife, a beautiful garden plant with an aggressive nature, first was introduced into North America in the early 1800s. The plant was sold in North Dakota by its genus name, *Lythrum,* for at least 50 years. Lythrum plants were brought to North Dakota for flower gardens because of their striking color, ease of growth, winter hardiness and lack of insect or disease problems. The garden varieties of purple loosestrife were sold by many cultivar names, including Morden Pink, Dropmore Purple and Morden Gleam. These garden cultivars were thought to be sterile but now have been shown to cross-pollinate with the wild *Lythrum* type and sometimes with other *Lythrum* cultivars.

Identification and growth form:

Purple loosestrife is a rhizomatous perennial forb. Wild infestations are associated with moist or marshy sites. The stems are erect (1.5 to 8 or more feet tall) and four to six angled, and can be smooth or pubescent with few branches. Leaves are simple (0.75 to 4 inches long, 0.2 to 0.5 inch wide), entire, and can be opposite or whorled.

The most identifiable characteristic of purple loosestrife is the striking rose to purple flowers. The flowers are

Galerucella spp. feeding on leaves

PURPLE LOOSESTRIFE

arranged on a spike, which can be a few inches to 3 feet long. Each flower has five to seven petals arising from a cylindrical green tube. The plant usually flowers from early July to mid-September in North Dakota. The seed capsule is two-celled and contains many very small seeds (1 millimeter long or less). The roots become thick and woody in mature plants. The aerial shoots die in the fall and new shoots arise the following spring from buds at the top of the root crown. Although the root crown expands and produces more shoots each year, the maximum growth of the root crown diameter is limited to about 20 inches.

Spread of purple loosestrife is primarily by seed, but the plant also can spread vegetatively from stem cuttings. Research at NDSU has shown that seed viability of purple loosestrife growing in North Dakota wetlands ranged from 50 percent to 100 percent. With approximately 2.7 million seeds produced per plant, purple loosestrife has the potential to spread rapidly once established in an area.

Why is this plant a concern?

The most destructive impact of purple loosestrife invasions is on the ecology of aquatic sites. Purple loosestrife forms dense monotypic stands as it displaces native wetland plants. Under optimum conditions, a small, isolated group of purple loosestrife plants can spread to cover aquatic sites in just one growing season. When purple loosestrife replaces native vegetation, it also can displace wildlife. Waterfowl, especially ducks, avoid wetlands that have become dominated with purple loosestrife. In addition, overall waterfowl production decreases as suitable nesting habitat is eliminated. The plant's growth is generally too compact to offer cover, and cover may be as crucial to wildlife as food.

How do I control this plant?

Several methods are available for purple loosestrife control, including mechanical, biological and chemical. The size and location of a specific infestation will determine the best control methods. In general, small infestations of a few plants can be controlled by digging, especially when plants are only a few years old. Larger infestations require treatment with herbicides and/or biological control agents.

Chemical. Herbicides can be used to control purple loosestrife in areas too large to be controlled by digging. Also, herbicides can be applied to individual plants selectively in landscape situations to prevent killing desirable plants. Infestations growing along streams or in marshy areas may require specialized equipment and application by trained professionals.

Glyphosate (various trade names) will provide good control of purple loosestrife when applied from July to early September. Many formulations of glyphosate are sold but only those labeled for aquatic use can be applied in or near water. Garlon (triclopyr) is a selective broadleaf herbicide that will not kill cattail or other desirable monocot species. Garlon will provide good to excellent purple loosestrife control when applied in the pre- to early flower or late-flower growth stages but should not be used in landscapes or flower beds because soil residual of the herbicide may prevent establishment of other horticultural plants. Milestone (aminopyralid) and Milestone VM (aminopyralid plus triclopyer) can be used in seasonally dry wetlands.

Biological. Three biocontrol insect species first were released in North Dakota in 1997. They are:

Galerucella pusilla — a leaf-feeding beetle
Galerucella calmariensis — a leaf-feeding beetle
Hylobius transversovittatus — a root-mining weevil

Of these insects, the two *Galerucella* spp. leaf-feeding beetles have been most successful. These insects overwinter as adults and lay eggs in early June in North Dakota. The adults and especially the larvae feed on the leaves and flowers of purple loosestrife. Following several summers of heavy feeding, purple loosestrife infestations have been reduced greatly. However, since the largest infestations in North Dakota are in urban areas, mosquito control programs have kept these insects from becoming well established.

SALTCEDAR

(*Tamarix* spp.)

SALTCEDAR

State Noxious Weed List: **Yes.**

Saltcedar is the common name for several introduced species of shrubs or small trees, including *Tamarix chinensis, T. parviflora* and *T. ramosissima.* Saltcedar is native to Eurasia and first was introduced into the U.S. to reclaim eroded areas and prevent further loss of stream banks, primarily in the southwest. Saltcedar has been sold in the horticultural industry, primarily for its wide adaptability and pink flowers. Saltcedar became established in North Dakota as escapes from ornamental plantings or from seed floating along rivers.

Identification and growth form:

Saltcedar is a shrubby bush or tree that can range in size from 5 to 20 feet tall. The bark is a reddish brown, especially on younger branches. The leaves are small and flat and resemble evergreen shrubs such as arborvitae. Flowers are pink to white and five-petaled, and appear from mid to late summer. The seeds are extremely tiny and similar in size and color to pepper. Each seed has a pappus, which allows it to float long distances in water or move in the wind. Seeds are short-lived and usually germinate within a few months after dispersal.

Once saltcedar seed germinates, it can grow rapidly to a small flowering shrub in one to two years. The plant is deciduous and very hardy, and horticultural varieties are advertised to grow "in sun or shade, and in wet or dry areas" from USDA hardiness zones 2 to 7. The plant quickly establishes a long, woody taproot to support a voracious thirst for water. The root system is capable of producing many new shoots if the top growth is removed by mechanical control methods or fire.

Why is this plant a concern?

Saltcedar can become a monoculture quickly along lakes and waterways. In the early morning and evening, moisture with high salt content is exuded from the foliage, causing the soil to become saline. Saltcedar can choke waterways and even has dried up entire lakes. Native riparian species are quickly displaced by saltcedar, which in turn causes displacement of native birds and animals that generally do not feed on the leaves or eat the saltcedar seeds. Saltcedar, even in the seedling stage, will tolerate short-term flooding and can establish away from waterways when seeds are washed in during flooding. Once established, the plants can become so thick cattle will not graze the area.

How do I control this plant?

Prevention is the best method to keep saltcedar from invading North Dakota wetlands and wildlands. Scouting along waterways and removal of ornamental plantings have been effective in reducing the spread of saltcedar in North Dakota.

Chemical. Arsenal (imazapyr) is the most widely used herbicide to control saltcedar. Arsenal also can be applied with a glyphosate formulation labeled for use in water. Do not remove saltcedar top growth for three years following herbicide application or resprouting will occur. Garlon (triclopyr) has been effective when applied in the spring or late fall.

Cultural. Control methods such as burning or bulldozing have not been successful.

Biological. The leaf beetle *Diorhabda elongata* Brullé defoliates the leaves of saltcedar. This insect feeds on the leaves of saltcedar and slowly reduces plant vigor. However, it has not been consistently successful in reducing saltcedar infestations. This insect has not been released in North Dakota because of the small size of the plants and low infestation level in the state.

ANNUAL AND SPINY SOWTHISTLE

[*Sonchus oleraceus* L. and *Sonchus asper* (L.) Hill]

Spiny sowthistle

Annual sowthistle

ANNUAL AND SPINY SOWTHISTLE

State Noxious Weeds List: **No.**

These sowthistle species are from Europe and now are established widely in the region. The plants often are mistaken for perennial sowthistle. However, perennial sowthistle has a creeping perennial root system and larger and longer leaves, and grows 4 to 6 feet tall. Annual and spiny sowthistle often are found along roadsides and in waste areas, gardens and cultivated fields.

Identification and growth form:

Annual and spiny sowthistle are both annuals and differ primarily in leaf form. Spiny sowthistle, as the name implies, has sharp, stiff prickles along the stem and leaves. Leaves clasp the stem with rounded basal lobes (auricles) that resemble a ram's horn. Annual sowthistle leaves are deeply toothed lower on the plant but progressively less so on the upper stem and auricles are distinctly pointed. Both species have yellow flowers, borne on a long vaselike involucre, with several in a cluster. Annual and spiny sowthistle contain a milky latex and both grow from a small taproot. Spiny sowthistle has slightly larger flower heads (0.5 to 1 inch across) compared with annual sowthistle (0.25 to 0.75 inch). The seeds for both are flattened with three to five ribs. Both species grow 2 to 4 feet tall.

Why is this plant a concern?

These annual sowthistle species can become competitive in cropland, but otherwise are more nuisance species than invasive. Because annual and spiny sowthistle often are found in waste areas and heavily used ground, such as parking lots and trails, they can be an indicator that land is being overgrazed or otherwise abused when these species start to appear in pasture and hay land.

How do I control these plants?

Annual and perennial sowthistle species are not true thistles and control options differ between these weed families.

Chemical. Products that contain metsulfuron such as Escort or Ally are very effective in controlling sowthistle species. Commonly used herbicides for Canada thistle control such as Milestone (aminopyralid), Tordon (picloram) and dicamba (various) are less effective and require higher use rates.

Cultural. Cultivation will control annual sowthistle species in cropland.

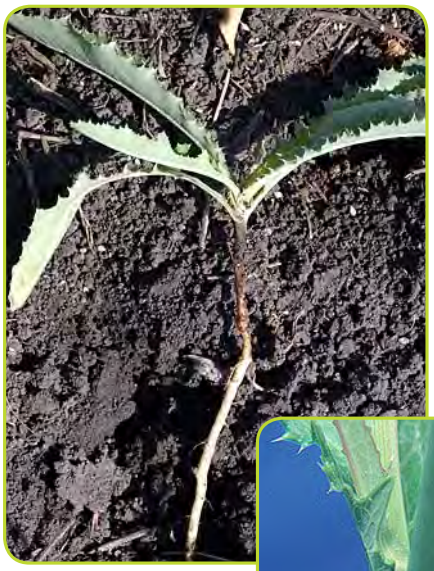
Biological. No biological control agents or pathogens are available for these weeds.

PERENNIAL and MARSH SOWTHISTLE

[*Sonchus arvensis* L. and
Sonchus arvensis ssp. *uliginosus* (Bieb.) Nyman]

Marsh sowthistle flower

Perennial sowthistle



PERENNIAL and MARSH SOWTHISTLE

State Noxious Weed List: **No.**

Perennial sowthistle was introduced from Europe and placed on the state noxious weed list in 1935 when it became a severe problem, especially in the northwestern part of the state. The weed subsequently was removed from the list in 1999 after revised farming practices and new herbicides had severely reduced the infested acreage. Most sowthistle infestations in North Dakota are annual not perennial species.

Identification and growth form:

Marsh sowthistle is a subspecies of perennial sowthistle and thus the plants are very similar in form and growth habit. Both species have bright yellow flowers similar to dandelion, but perennial sowthistle flower bracts are covered with gland-tipped hairs, while marsh sowthistle has smooth flower bracts. Both weeds have an extensive creeping root system. Leaves are lobed below, but less so above and have prickles on the margin and are 4 to 10 inches long (longer than the annual species). Generally, perennial sowthistle has fewer but larger flowers (1 to 1.5 inches across) than the annual species and end in a terminal cluster. Some taxonomists consider marsh a separate species from perennial sowthistle; others consider it a subspecies. Both contain latex and grow from 1.5 to 6 feet in height. Seeds are dark brown, with prominent ridges and have a tuft of white pappus or bristles.

Sowthistle generally flowers from July through September. Seed production is highly variable, but typically averages 30 seeds per flower head. Seed viability is relatively low for sowthistle and seeds usually do not survive longer than a year.

Perennial and marsh sowthistle can tolerate variable environments and can adapt well to wet areas with little soil disturbance. The plant commonly is found in cultivated areas, ditches, meadows, waste areas, sloughs, woods, lawns, roadsides, beaches, along rivers and lake shores. Sowthistle is adapted to many soil types, but seems to prefer low, fine-textured loam soils.

Why is this plant a concern?

Perennial and marsh sowthistle can displace native plant communities by invading disturbed areas and undisturbed natural habitats. Sowthistle can cause reduced crop yields, and lead to increased cultivation and herbicide costs.

How do I control these plants?

Annual and perennial sowthistle species are not true thistles and control options differ between these weed families.

Chemical. Products that contain metsulfuron such as Escort and Ally or Express (tribenuron) are very effective in controlling perennial sowthistle species. Preharvest applications of glyphosate and products that contain clopyralid or glufosinate will reduce perennial sowthistle. Tordon (picloram) and Milestone (aminopyralid) will control sowthistle species in noncropland.

Cultural. Cultivation will reduce perennial sowthistle species in cropland but care must be taken not to spread the roots to noninfested areas.

Biological. No biological control agents or pathogens are available for these weeds. Insects can be observed on the flower heads of these plants, especially perennial sowthistle, but they are feeding on sticky residue from the glands on the flower bracts, which does not harm the plant.

ST. JOHNSWORT

(*Hypericum perforatum* L.)

State Noxious Weed List: **No.**

St. Johnswort, also referred to as Klamath weed, is native to Europe, North Africa and parts of Asia and first was introduced to the United States in the late 1600s for ornamental and medicinal purposes. St. Johnswort is sold as an antidepressant, often in the form of tea. However, St. Johnswort is also well-known to cause photosensitizing in man and animals. Numerous cultivated hybrids are available.

Identification and growth form:

St. Johnswort is a taprooted perennial herb that typically grows 1 to 5 feet tall. Stems are multi-branched, smooth, reddish and woody at the base. The leaves are opposite, entire, linear to oblong with in-rolled edges and 3/8 to 1 inch long. The leaves are dark green above and light green below and dotted with tiny, translucent glands. The "spotted leaf" appearance is a key characteristic for identification.

St. Johnswort has opaque spots on the leaves

ST. JOHNSWORT

Flowers of the plant are yellow, starlike with five petals and 0.5 to 1 inch in diameter, with tiny black dots on the margins. Petals are twice as long as the sepals and numerous stamens arranged in three groups are apparent. The seeds are egg-shaped and are held within a three-valved capsule that bursts at maturity. Seeds are tiny, dark brown, 3/64 inch long, somewhat cylindrical, slightly pointed at the ends and coarsely pitted.

St. Johnswort spreads both by underground and above-ground creeping stems, and by seed. Annual seed production ranges from 15,000 to 33,000 up to 100,000 with a small percentage germinating and reaching maturity. Seeds may remain viable in the soil for up to 10 years. Germination occurs during the warm summer months; however, seedlings may require several years to reach reproductive maturity. Basal foliage that has overwintered may begin to bolt during early March and by early April, older plants will have produced floral shoots. Flowering generally occurs from May through September and may be dependant on soil moisture.

Why is this plant a concern?

Glands found on the plant produce oils that contain hypericin, a phototoxin. Once the plant is consumed, animals become overly sensitive to sunlight, which results in dermatitis, an inflammation of the mucus membranes causing itching, swelling, blisters and open sores. All growth stages of the plant are toxic, including dried plants in hay. Poisoning or hypericism has been reported in cattle, horses, sheep and goats, with symptoms detectable within two to 21 days following ingestion of the plant. Light-haired or unpigmented skin areas such as the mouth, nose, ears and hooves are the most sensitive.

Livestock that suffer from hypericism generally lose weight, are difficult to manage and possess reduced market value. Affected animals usually recover once consumption of St. Johnswort is stopped. St. Johnswort has become popular as an herbal stimulant and will induce photosensitivity in some people.

How do I control this plant?

Chemical. A variety of herbicides can be applied for St. Johnswort control and are most effective when applied to seedlings and young plants. Tordon (picloram) or glyphosate (various) are most effective when applied in the spring. Escort (metsulfuron) also will control St. Johnswort effectively. Herbicide treatments are most successful if applied at bud stage before flowering occurs and late in the fall when the plant is going dormant. Repeated applications often are required to achieve adequate management.

Mechanical. Hand-pulling or digging may be effective on small and isolated infestations if repeated several times per season and if conducted prior to flowering and seed production. In larger infestations, lateral roots of older plants left behind can give rise to new plants.

Biological. Several biological agents have been introduced into the United States for St. Johnswort control since the mid-1940s. The Klamath weed beetle *(Chrysolina quadrigemina)* was one of the first highly successful biological control insects introduced into North America. This insect is credited with controlling St. Johnswort on millions of acres in California and the Pacific Northwest.

However, the Klamath weed beetle has not been successful in all areas St. Johnswort occurs, so other agents have been introduced. The root-boring beetle *Agrilus hyperici* and the leaf bud gall-forming midge *Zeuxidiplosis giardi* have become established but the effectiveness has been quite variable. More recently, a St. Johnswort foliage- and flower-feeding moth, *Aplocera plagiata,* has been released and established in the northwestern United States.

BULL THISTLE

[*Cirsium vulgare* (Savi) Tenore]

BULL THISTLE

State Noxious Weed List: **No.**

Bull thistle is the least serious of the introduced thistles in North Dakota. Native Americans used bull thistle to treat hemorrhoids, which they likely learned from French fur trappers. Bull thistle often is referred to as edible. Many plant parts from the root to the flower are eaten. The flower petals are used as chewing gum.

Identification and growth form:

Bull thistle is a biennial that grows from a flat rosette of leaves the first year to a flowering stem the second year, often 5 feet or more in height. Plants are multibranched; stems have purple veins and are winged. The plant appears bushy rather than the candelabra appearance of plumeless or Canada thistle. A distinguishing characteristic of bull thistle is the leaves. Leaf margins are deeply toothed and toothed again (double dentate) with prominent stiff spines. The leaf surface has a distinct center vein with slight prickly hairs above and cottony pubescence below. The stems are very pubescent with dark purple veins. The rosettes of bull thistle are very pubescent with deeply lobed leaves and dark purple ribs.

Bull thistle flower heads usually are found singularly at the end of each stem branch. The flowers are gumdrop shaped, large (2 to 3 inches tall), with long, stiff, yellow-tipped spines. Bull thistle flowers from July to September, which is somewhat later than other thistles in the region. The flowers are generally purple but rarely a white form is observed. Achenes are 0.1 to 0.15 inch long, glossy light brown to pale yellow or white with narrow dark brown stripes and favored by birds.

Why is this plant a concern?

Bull thistle occurs in all 48 contiguous states and most of Canada, but is designated noxious in only a few states. Bull thistle generally is found growing singularly or in small patches in the northern and eastern counties of the state. The large size and showy flowers of the plant makes it quite noticeable in pasture and rangeland, but it has little economic or ecological consequence.

How do I control this plant?

Bull thistle seldom reaches high enough densities to warrant treatment.

Chemical. Fall is the preferred time for applying herbicides for bull thistle control. Fall treatment allows more time for herbicide application than in the spring and thistle control is generally best with fall treatments. Seedlings that emerge in summer after tillage or previous herbicide applications will not bolt but remain in the rosette stage. Bull thistles are most susceptible to herbicides in the rosette form.

Bull thistles can be controlled effectively with Milestone (aminopyralid), clopyralid (Stinger, Transline or Curtai), Tordon (picloram), or dicamba (various) or dicamba plus diflufenzopyr (Overdrive). Products that contain metsulfuron (Escort, Cimarron Max, others) will control bull thistles in the spring and will eliminate seed production when applied in the bolting to bud growth stages.

Cultural. Cultivation or hand-digging the rosette prior to bolting will kill the plant and prevent seed-set.

Biological. No biological control agents or pathogens are available for this weed.

CANADA THISTLE

(*Cirsium arvense* L.)

Female flower

Male flower

CANADA THISTLE

State Noxious Weed List: **Yes.**

Canada thistle was introduced in North America as a seed contaminant in both French and British colonies. The first legislation to control the weed was passed by Vermont in 1795. Canada thistle has the dubious distinction of being one of three weeds listed in 1885 by Dakota Territory as required of "every person" to be destroyed. The native distribution of Canada thistle includes Europe, North Africa and central Asia. It also is found in China and Japan and has spread so extensively that it is difficult to distinguish the plant's original native range. Canada thistle is considered to be naturalized in the northern Great Plains

Identification and growth form:

Canada thistle is a long-lived perennial that usually grows 2 to 3 feet tall and bears alternate, dark green leaves that vary in size. The leaves are oblong, usually deeply cut, and have spiny, toothed edges. Canada thistle has small (3/4 inch diameter), compact flower heads that appear on the upper stems.

Canada thistle has been classified into several varieties. Within these varieties are many ecotypes, which differ in growth characteristics, response to day length, and susceptibility to herbicides and cultivation. For example, leaf shape, head structure, and the number and size of spines can differ with ecotypes. Canada thistle requires a 14- to 16-hour photoperiod to bolt and flower (April 19 to Aug. 22 in North Dakota). Flower color can range from purple to light lavender or even white. Stem color also can differ from green to lavender.

Flowering occurs from June to September. Male and female flowers are produced on different plants, so cross-pollination is necessary for seed production. Flowers produce from 40 to 80 seeds per head, which can move long distances, although most seed remain in the head until winter and eventually germinate nearby.

The smooth, light brown seeds (achenes) have a conical point and are loosely attached to a tannish pappus at the tip, which aids in seed dispersal by wind. Seeds mature rapidly and are able to germinate within eight to 10 days after pollination. Canada thistle overwinters in the rosette growth stage.

Canada thistle has an extensive underground root system that may penetrate the soil to a depth of 10 feet or more and grow laterally 12 to 15 feet per year. Root buds occur randomly along the roots and initiate new shoots whenever environmental conditions are favorable. Root segments as small as 0.6 inch can initiate shoot growth and become established. Canada thistle is adapted to a wide range of soils, but it produces deeper roots in clay or muck soils than in sand, gravel or limestone soils.

Root bud development can occur nearly anytime during the growing season, but is greatest when soil temperatures are warm, air temperatures are cool and the photoperiod shortens to 13 hours. These conditions generally are found during the fall growing season. Therefore, more Canada thistle root-bud development occurs in the fall than any other time of the year. Canada thistle grows best in the northern regions of North America where temperature and rainfall are moderate. Growth ceases when temperatures exceed 85 degrees for extended periods.

Why is this plant a concern?

Canada thistle has the potential to form dense infestations rapidly through vegetative reproduction, and the spread of these clones may continue indefinitely, crowding out and displacing native grasses and forbs through shading, competition and possibly allelopathy. Canada thistle spread can change structure and species composition of natural areas and reduce plant and animal diversity. Infestations of Canada thistle may contribute to the elimination of endangered and/or endemic plant species. In wildlands, Canada thistle has the potential to increase fire frequency and perhaps severity as a result of its abundant and readily ignited litter and flammable above-ground biomass.

Canada thistle can reduce yield of many crops severely. Yield losses are directly proportional to the density and patchiness of the infestation, with more than $40 million annually lost in production in North Dakota alone. Wheat is a poor competitor and Canada thistle infestations often increase in a continuous-wheat farming program. Canada thistle also can be a severe problem in corn and soybean grown in rotation, with greater losses in soybean than corn.

CANADA THISTLE

How do I control this plant?

Canada thistle is the only thistle in North Dakota that has become a cropland pest. Control strategies differ for Canada thistle in cropland compared with pasture, range and wildland.

Chemical. *Cropland.* The best approach to Canada thistle control in cropland should include an in-crop herbicide treatment to suppress Canada thistle growth, minimize crop yield losses and prepare the thistle for a fall postharvest treatment. Preharvest and fall-applied treatments provide the most effective long-term control. The best herbicide to use will vary depending on crop rotation. However, the control program must be uninterrupted for two to three years if the infestation is to be reduced.

Glyphosate (various trade names) can be used to control Canada thistle in glyphosate-resistant crops. In-crop applications will not kill established thistle stands. However, when used as part of an overall management program, glyphosate can reduce infestations.

Herbicides that can be used for Canada thistle growing in small grains include 2,4-D, MCPA, dicamba (various trade names), products that contain clopyralid (various trade names) and products that include tribinuron. Products containing clopyralid will control Canada thistle in flax, sugar beet and corn. Canada thistle may be suppressed in corn with products containing dicamba, while Basagran (bentazon) can be used in soybean. A second application is required 10 to 14 days after the first for satisfactory suppression.

Pasture, range and wildlands. Herbicides that control Canada thistle in noncropland include products that contain clopyralid (various), Tordon (picloram), dicamba (various) dicamba plus diflufenzopyr (Overdrive), and Milestone (aminopyralid). Control is greatest when applied to Canada thistle at the early bud growth stage (early summer) or in the fall to plants in the rosette form. These herbicides applied at low rates may be the most cost-effective method for controlling dense infestations that require broadcast application. Re-treatment will be necessary for several years to obtain long-term control.

Cultural. *Cropland.* Canada thistle roots are much less winter hardy then many other perennial weeds and timely cultivation actually can increase winter kill. Soil temperatures of 20 degrees or colder can reduce Canada thistle regrowth from roots by more than 50 percent. Following crop harvest, cultivate fields before the Canada thistle is 3 inches tall and repeat before regrowth reaches 3 inches tall until freeze-up. This method has the combined advantage of decreasing carbohydrate root reserves and the bare ground from the tillage will lead to colder soil temperatures, which increases winter-kill.

An option for Canada thistle in row crops and fallow that includes both tillage and herbicides is known as the rosette technique. The objective is to prevent the plants from bolting by using tillage and/or herbicide treatments until the day length is less than 15 hours, the photoperiod required for most Canada thistle plants to bolt. The thistles then will regrow as rosettes only. Research at North Dakota State University has found herbicide absorption and translocation to the roots of Canada thistle is greater when applied to the rosette growth stage than when applied to bolted plants, making fall treatment of rosettes the most cost-effective method for long-term Canada thistle control.

The rosette technique for Canada thistle control in fallow includes the use of tillage and fall-applied herbicides, while control in row crops includes in-crop herbicide treatments, tillage and fall-applied herbicides. Periodic tillage in fallow is used to control Canada thistle shoots and other weeds until late July, when the day length is less than 15 hours. Herbicides used for Canada thistle control, such as glyphosate or clopyralid, then are applied to rosettes in late

September or early October. Research at NDSU has found that cultivation until late June prevented more than 90 percent of Canada thistle from bolting in corn and soybean.

Pasture, range, and wildlands. Repeated mowing will reduce Canada thistle infestations. Mow whenever the plants are in the early bud growth stage to prevent seed-set. Several mowings a year are needed because plant populations vary in maturity. Mow as close to the surface as possible. If plants are cut above the terminal bud before the stems elongate, they likely will regrow. Mowing before the flowers start showing color is important because plants mowed after that likely will produce some viable seed. Mowing for several years will reduce the root vitality of Canada thistle and will prevent seed production, reducing the seed reserve. Mowing should be combined with a chemical control program for best results.

Controlled burns often are used to help restore wildlands to a more natural plant community. Contrary to popular thought, research at North Dakota State University found that fall prescribed burns did not cause a long-term increase in Canada thistle density; rather, Canada thistle emerged earlier in the burned compared with the nonburned areas. The effect was short-lived and Canada thistle densities were similar regardless of burn treatment the second growing season after the burn. Also, no differences in Canada thistle control occurred when herbicides were used alone or combined with a prescribed burn.

Biological. Two biological control agents have been introduced for Canada thistle control, and a third was introduced accidentally. To date, none have been effective at reducing the weed on a large scale. The most widespread insect is *Ceutorhynchus litura* weevil, which first was released in North Dakota in the 1970s. The larvae feed on the underground parts of Canada thistle for a short time but infestations generally are not reduced. One may take advantage of the early season stress on Canada thistle from *C. litura* feeding by using additional control methods such as mowing or applying herbicides. In addition, natural soil pathogens may become more destructive due to multiple entry sites established by the insect. However, do not expect these insects alone to reduce a Canada thistle infestation.

A gall-producing fly, *Urophora cardui*, causes meristematic galls but does little long-term damage to the perennial thistle. The Canada thistle bud weevil *Larinus planus* was an accidental introduction into North America. The insect feeds on developing flowers to prevent seed production. Although *L. planus* can survive under a wide range of climates, it has not reduced established Canada thistle stands.

The painted lady butterfly *(Vanessa cardui)* can be a very effective biological control agent but only on an intermittent basis. Larvae of the butterfly feed on Canada thistle plants and can eliminate an infestation. However, the insect generally is found only in southern states such as Arizona and New Mexico and will build up populations large enough to migrate north only once every eight to 11 years. The insect will migrate north as far as Canada and those fortunate enough to reside within the migratory pathway will see a dramatic decrease in the Canada thistle population. Unfortunately, the insect feeds on many plants, including crops such as soybean and sunflower, and is not a candidate for long-term biological control of Canada thistle.

A native pathogen, *Pseudomonas syringae* pv. *tagetis* (Pst), causes the top of Canada thistle plants to turn yellow to white. This pathogen may release a toxin into the phloem of Canada thistle and kill the plant. The pathogen is most widespread during wet periods. Attempts to produce this pathogen as a commercial biocide have not been successful.

FLODMAN THISTLE

[*Cirsium flodmanii* (Rydb.) Arthur]

FLODMAN THISTLE

State Noxious Weed List: **No.**

Flodman thistle is a native species found from Saskatchewan and Manitoba to Iowa and Colorado. This thistle is a food source for a variety of insect and bird species. The stems of Flodman thistle can be peeled and eaten and were part of the Native American diet.

Identification and growth form:

Flodman thistle is a deep-rooted perennial and usually grows 3 to 4 feet tall. The leaves are shiny green on top with slight pubescence and are white and very pubescent below, alternate, rigid and deeply lobed. Each lobe has three points, one of which sticks out at nearly right angles, giving a flipping appearance, which is helpful to tell this plant from the often similar appearing wavyleaf thistle.

The rosettes are often 4 to 6 inches in diameter with oblong or lanceolate leaves that vary from deeply lobed to nearly complete. The leaves are green to gray and especially pubescent below. The flowers are deep purple to pink, rarely white, tube shaped and approximately 1 inch long. The flower heads have a strong yellow spine and a sticky secretion that attracts and catches insects. Flodman thistle usually flowers from mid-July through September in North Dakota. The achenes are about 0.1 to 0.15 inch long and oval, and vary from tan to brown and have a conspicuous yellow collar.

Why is this plant a concern?

Flodman thistle is more competitive than most other native species and has the potential to infest large areas. It is tolerant to high salt concentration in soil but not as tolerant as Canada thistle. Although it grows best under moist conditions as most thistles do, it can survive under drought conditions, which gives it a competitive advantage on semiarid rangeland.

How do I control this plant?

Native thistle species such as Flodman thistle seldom become weedy because of the variety of insects and birds that feed on the plant and several pathogens that cause a variety of diseases. However, of the native thistles found in the region, Flodman thistle is one that can form dense colonies, especially in dry years.

Herbicides that are effective for controlling Flodman thistle in noncropland include products that contain clopyralid (various), Tordon (picloram), dicamba (various), Overdrive (dicamba plus diflufenzopyr) and Milestone (aminopyralid). Control is greatest when applied to thistle at the early bud growth stage (early summer) or in the fall to plants in the rosette form. Herbicide treatment will not be necessary if one allows the native pests to build in population and reduce this thistle through time. Flodman thistle has not been a problem weed in cropland.

MUSK THISTLE

(*Carduus nutans* L.)

State Noxious Weed List: **Yes.**

Musk thistle is the most common biennial invasive thistle in North Dakota. Musk thistle is native in southern Europe and western Asia and was introduced into North America in the early 1900s. Two subspecies that differ in flower size and pubescence occur in North Dakota.

Identification and growth form:

Musk thistle likely is the most easily identified invasive thistle in North Dakota, yet many people confuse this plant with either bull thistle or plumeless thistle. Musk thistle often grows in excess of 6 feet tall, has very large flowers that tend to droop, and the flower has very characteristic brown bracts that resemble a pine cone. The flowers usually are deep rose, solitary and very large, ranging from 1.5 to 3 inches in diameter. Rosettes are dark green with a light green midrib, usually smooth and lacking pubescence and often grow 2 feet or more in diameter.

Musk thistle stems are usually very branched with spiny wings; however, the wings are interrupted and not complete along the stem as with bull or plumeless thistle. The leaves are oblong to lanceolate and lobed with slender spines along the margin. They generally have little pubescence underneath, which helps distinguish musk thistle from plumeless thistle. However, the subspecies *C. nutans macrocephalus* (Desf.) has very pubescent leaves.

Musk thistle flowers from July to late September. The average musk thistle plant produces in excess of 10,000 seeds per plant and, under favorable conditions, may produce 120,000 seeds per plant. Seed germination

averages 30 percent. The seed generally germinates in the summer and fall, and the plant overwinters as a rosette. The following spring, the plant resumes vegetative growth, bolts and flowers. After setting seed, the plant dies, thereby completing the life cycle. Occasionally biennial thistles have winter annual, annual or short-lived perennial characteristics.

Why is this plant a concern?

Musk thistle tends to invade overgrazed or otherwise disturbed pastures, rangeland, roadsides and waste areas. Movement into cropland is generally from nearby noncropland or roadsides. Musk thistle spreads rapidly and can form very dense stands that crowd out desirable forages and native species.

How do I control this plant?

Since biennial plants such as musk thistle reproduce only from seed, the key to a successful management program is to control the plants before flowering.

Chemical. Fall is the preferred time for applying herbicides for biennial thistle control. Fall treatment allows more time for herbicide application than in the spring and thistle control is generally best with fall treatments. Seedlings that emerge in summer after tillage or previous herbicide applications will not bolt but remain in the rosette stage. Biennial thistles are most susceptible to herbicides in the rosette form.

Biennial thistles can be controlled effectively with Milestone (aminopyralid), Stinger, Transline or Curtail (clopyralid), Tordon (picloram), or dicamba (various) or dicamba plus diflufenzopyr (Overdrive). Products that contain metsulfuron (Escort, Cimarron Max, others) will control biennial thistles in the spring and will eliminate seed production when applied in the bolting to bud growth stages.

Cultural. Repeated mowing will reduce musk thistle infestations. Mow whenever the plants are in the early bud growth stage to prevent seed-set. Several mowings a year are needed because plant populations vary in maturity. Mow as close to the surface as possible. Plants should be cut below the terminal bud before the stem elongates or the weed will regrow. Mowing before the flowers start showing color is important because plants mowed after that likely will produce some viable seed. Mowing should be combined with a chemical control program for best results.

Biennial thistles do not survive under crop rotation since they cannot tolerate tillage or crop competition. Planting infested areas to any crop will eliminate biennial thistles.

Biological. The seed weevil *Rhinocyllus conicus* was introduced from Eurasia to control musk thistle by reducing seed production. Larvae develop in the flower head and consume the seed as it develops. The weevils can reduce seed production by nearly 80 percent, but they are attracted more to earlier blooming rather than to later blooming flowers. The late-season flowers produce seeds with little damage from the weevil, which sustains the musk thistle population. Building a high enough population of insects to greatly reduce seed production takes five to 10 years. These insects first were introduced into North Dakota in the early 1970s. *R. conicus* is not specific to musk thistle and has been found feeding on other invasive thistles, such as Canada thistle. However, this insect also feeds on native thistles, including several that are on the protected or endangered species list.

The thistle crown weevil *(Trichosirocalus horridus)* was introduced into North America from Europe in the mid-1970s. Larvae of this insect feed on the growing tip as the musk thistle rosette bolts. While seldom effective by itself, it does help control musk thistle when combined with *Rhinocyllus conicus.* Feeding by *T. horridus* larvae on musk thistle growing tips causes the plant to produce multiple shoots. The resulting flower heads are reduced in size and produce fewer seeds, and the increased number of flower heads results in an increased population of *R. conicus*.

PLUMELESS THISTLE

(*Carduus acanthoides* L.)

PLUMELESS THISTLE

State Noxious Weed List: **No.**

Plumeless thistle first was introduced into North America in the 1870s along the East Coast as a contaminant in ship ballast. Plumeless thistle is one of the most common invasive thistles in the mid-Atlantic and upper Midwestern states. Although found as far west as Washington state, it is less common than musk and bull thistle and is not listed on the North Dakota state noxious weed list.

Identification and growth form:

Plumeless thistle is a winter annual or biennial and generally is found only in eastern North Dakota. Plumeless thistle tends to be shorter than other noxious biennial thistles and generally reaches 1 to 4 feet tall. The stems are winged and very branched, giving the plant a candelabrum appearance. The wings are very spiny and are continuous along the stem and not interrupted as musk thistle. The leaves are deeply lobed, narrower than musk thistle and very pubescent underneath. Each lobe has one to three very sharp marginal spines. Flower heads are small (0.5 to 1 inch) but very numerous and pink to purple or very rarely white. The bracts are very narrow and resemble spines. The heads can be singular or in clusters of two to five. The achenes are small, gray to light brown with a distinct, light apical collar and slightly curved.

Rosettes of plumeless thistle resemble musk thistle rosettes, but are more deeply lobed and much more pubescent. Plumeless thistle rosettes have wavy leaves with yellow spines along the white leaf margins and resemble holly. The plant bolts and flowers in late April to early May.

Why is this plant a concern?

Plumeless thistle can become very weedy and form dense colonies, especially along waterways, ditches and roadsides in summers following wet falls. Plumeless thistle seldom is found in cultivated fields, even when infestations are nearby in roadsides or pastures. The numerous spiny branches make walking through infestations by people or grazing by animals very difficult.

How do I control this plant?

Chemical. Fall is the preferred time for applying herbicides for plumeless thistle control. Fall treatment allows more time for herbicide application than in the spring and thistle control is generally best with fall treatments. Seedlings that emerge in summer after tillage or previous herbicide applications will not bolt but remain in the rosette stage. Plumeless thistles are most susceptible to herbicides in the rosette form.

Plumeless thistles can be controlled effectively with Milestone (aminopyralid), Stinger, Transline or Curtail (clopyralid), Tordon (picloram), or dicamba (various) or dicamba plus diflufenzopyr (Overdrive). Products that contain metsulfuron (Escort, Cimarron Max, others) will control biennial thistles in the spring and will eliminate seed production when applied in the bolting to bud growth stages.

Cultural. Repeated mowing will reduce plumeless thistle population but must be done prior to flowering or viable seed will be produced. Plumeless thistle will not survive tillage operations used in cropland.

Biological. Both *Rhinocyllus conicus* and *Trichosirocalus horridus,* which were released for musk thistle control, attack plumeless thistle.

SCOTCH THISTLE

(*Onopordum acannthium* L.)

SCOTCH THISTLE

State Noxious Weed List: **No.**

Scotch thistle is a native of Eurasia and has become naturalized in portions of western North America. Scotch thistle can thrive in well-drained, sandy or stony soils. The plant occurs in pastures, croplands, rangelands, roadsides and construction sites but prefers disturbed areas and sites near ditches. Scotch thistle has regal stature. During the reign of Malcolm I of Scotland, Norsemen attempted to capture the Staines Castle by wading across the moat in their bare feet, only to find the moat dry and overgrown with thistle. The painful cries by the warriors roused the castle guards and the Norsemen were defeated. To commemorate this victory, the flower became the emblem of Scotland.

Identification and growth form:

Scotch thistle is a biennial herb that can grow up to 12 feet tall. Stems of the plant are hairy or cottony, and have broad, spiny wings. Leaves are large, spiny and covered with fine, dense hairs that give Scotch thistle a grayish-green, cottony appearance. Upper leaves are alternate and have prominent triangular lobes that occur on the margins. Lobes of the leaf end with a prominent, sharp, green to white spines.

Flower heads are terminal, numerous and 1 to 2 inches in diameter. Flowers are pale purple to red and subtended with a series of overlapping bracts tipped with a spine. Seeds are oblong to obovate, four-angled, deep brown to black, about 3/16 of an inch long and wrinkled. Plants can produce 70 to more than 300 flower heads that can produce 100 to 200 seeds per head. Therefore, a single plant can produce 8,400 to 40,000 seeds. Seed viability can range from one to more than16 years, depending on seed burial depth.

Why is this plant a concern?

Scotch thistle is an aggressive species that can out-compete and decrease desirable forage. The plant also can degrade wildlife habitats and recreational areas. Scotch thistle infestations can become impenetrable, thorny barriers that severely limit land use by wildlife, livestock and man.

How do I control this plant?

Scotch thistle reproduces solely through seed production. Seeds generally germinate in late fall but germination can occur anytime throughout the year.

Chemical. Scotch thistle can be controlled effectively with Milestone (aminopyralid), Stinger, Transline or Curtail (clopyralid), Tordon (picloram), or dicamba (various) or Overdrive (dicamba plus diflufenzopyr). Products that contain metsulfuron (Escort, Cimarron Max, others) will control biennial thistles in the spring and will eliminate seed production when applied in the bolting to bud growth stages.

Mechanical. Hand-pulling small infestations of Scotch thistle can be an effective control method. Mowing prior to seed dispersal may limit the amount of seed available for germination. However, if the plant is cut after flowers begin to show color, viable seed may still be dispersed.

Biological. Research on biological control agents for Scotch thistle is in progress. *Lixus cardui* Olivier (Coleoptera: Curculionidae), a weevil from Europe, first was used by Australian researchers to control Scotch thistle. However, host-specificity testing needs to be researched further to ensure that native thistles are not affected by the release of this agent in North America.

WAVYLEAF THISTLE

[*Cirsium undulatum* (Nutt.) Spreng.]

WAVYLEAF THISTLE

State Noxious Weed List: **No.**

Wavyleaf thistle is a native species and is common in western North Dakota. Various Native American tribes used wavyleaf thistle to treat gonorrhea and syphilis. The remedy involved drinking a tea made from the plant and then elevating the body temperature to induce sweating. A tea also was made from the roots to treat diabetes and stomachache. The roots were boiled and used in soup.

Identification and growth form:

Wavyleaf thistle is a perennial native plant that often is confused with Flodman thistle. Wavyleaf thistle tends to flower from July to September, often a week or two earlier than Flodman thistle. Wavyleaf thistle tends to be more spiny and the leaves less deeply lobed than Flodman thistle. Also, wavyleaf thistle is found in well-drained soils, generally in drier locations than those occupied by Flodman thistle. Wavyleaf thistle grows 3 to 4 feet tall and often is associated with sagebrush communities and rangeland but is less common in moist meadows.

The leaves of wavyleaf are alternate and tipped with yellow spines. The leaves are very pubescent, giving the plant a gray cast, and are less deeply lobed than Flodman thistle. Leaves are strongly undulated or wavy, which gives the plant its common name. The stem of wavyleaf thistle is very pubescent and generally thicker than Flodman thistle. Rosette leaves are also very wavy and gray in appearance.

The flowers are most often pink or purple, but there is a white-flowered form, *f. album* Farwell. The flowers are usually more than 2 inches in diameter, with globe-shaped heads. The yellow spines on the heads lack the sticky secretion found on Flodman thistle. The achenes are brown without a lighter apical band or with only a very narrow lighter margin.

Wavyleaf thistle is a larger plant than Flodman thistle. Generally Flodman thistle is more common than wavyleaf in eastern North Dakota, but wavyleaf gradually becomes the predominant species in the central and western portions of the state.

Why is this plant a concern?

Generally wavyleaf thistle is kept in check by native insects and birds that feed on the plant as well as native pathogens that reduce plant vigor and growth. Wavyleaf has become a problem when the plant spreads beyond its normal range, such as the Pacific coast. Otherwise this plant does not warrant control efforts.

DALMATIAN TOADFLAX and YELLOW TOADFLAX

(*Linaria genistifolia* ssp. *dalmatica* (L.) Maire & Petitm. and *Linaria vulgaris* Mill.)

Dalmatian toadflax

Dalmatian toadflax has broad heart-shaped leaves

DALMATIAN TOADFLAX and YELLOW TOADFLAX

Yellow toadflax

Yellow toadflax has narrow linnear leaves

Yellow toadflax flowers have orange throats

DALMATIAN TOADFLAX and YELLOW TOADFLAX

State Noxious Weed List:
Dalmatian toadflax: **Yes.**
Yellow toadflax: **Yes.**

Both Dalmatian and yellow toadflax are escaped perennial ornamental plants that were introduced in the mid-1800s. Dalmatian toadflax is native to the Mediterranean region, specifically the Dalmatian Coast of Croatia, while yellow toadflax is from Eurasia. Yellow toadflax first was recorded in North Dakota by H.L. Bolley from a collection made in Fargo and described as "most abundant in Barnes County" in the 1940s by O.A. Stevens. The first record of Dalmatian toadflax is from Walhalla in Pembina County in 1937 by Stevens.

The toadflaxes are most likely to be found along highways, railroad tracks and other transportation or communication lines, or anywhere livestock is brought into the state. Often the origins of an infested area can be traced back to an escape from an ornamental planting. Dalmatian toadflax has been reported only as small patches in a few counties, generally in the western part of North Dakota. However, yellow toadflax has been found in many counties across the state and is on the verge of becoming a major problem for land managers in North Dakota.

Identification and growth form:

Dalmatian and yellow toadflax are members of the snapdragon family and thus easily recognizable by the bright yellow flowers, which have swollen corolla tubes that flare into two "lips" with an orange throat (yellow toadflax) and long spur. The flowers are 1 to 1.5 inches long with many flowers on a raceme. Both species have an extensive creeping rhizomatous root system that spreads like leafy spurge. The most distinctive difference between the species is that Dalmatian toadflax has broad, heart-shaped leaves that clasp a woody stem, whereas yellow toadflax has narrow, linear leaves with a narrow stem.

The plants begin regrowth from the roots as soon as the soil warms in early spring. Toadflax flowers from late June through August in North Dakota and single plants may produce more than 500,000 seeds that are dispersed by wind, rain, wildlife, and movement of forage and livestock. The seed is disk-shaped, 0.08 inch in diameter and dark brown to black, and often have irregular papery wings. Seed dispersal begins a few weeks after flowering and continues into winter. The roots of a single plant can extend 10 feet and give rise to daughter plants every few inches.

Why are these plants a concern?

The toadflax species are aggressive and will displace forage in pastureland and native species in wildland. Yellow toadflax can be mildly poisonous to livestock that graze it. Although the toadflaxes may be slow to establish, once plants take root, control is very difficult since most herbicides are ineffective.

Dalmatian toadflax seedlings are relatively poor competitors with grass species, but once established, the weed can become extremely invasive, especially on dryland sites, disturbed areas and roadsides. Yellow toadflax is adapted to more moist sites than Dalmatian toadflax and often is found in pasture, meadows and ditches.

DALMATIAN TOADFLAX and YELLOW TOADFLAX

How do I control these plants?

Prevention is the best method to keep Dalmatian and yellow toadflax from invading North Dakota pasture, rangeland and wildlands. Herbicides can be effective but require repeated treatments at high rates.

Chemical. Tordon (picloram), Plateau (imazapic) and Telar (chlorsulfuron) will control Dalmatian toadflax when applied at maximum use rates during flowering or late fall. No herbicide is labeled for yellow toadflax control, but research at North Dakota State University has found that a combination treatment of Tordon plus Overdrive (dicamba plus diflufenzopyr) applied in late fall will reduce yellow toadflax infestations for at least two years. See the latest edition of the "North Dakota Weed Control Guide" for application rate and timing recommendations.

Cultural. The long-term use of proper stocking rates to maintain competitive forage species has helped reduce the spread of toadflax into grazing lands. Burning is not effective because soil temperatures do not get high enough to kill the roots. Burning even may have a detrimental effect and cause an increase in the number of stems due to reduced cover.

Biological. Several insects have been introduced for toadflax control. The stem-boring weevil *Mecinus janthinus* has been the most successful and can reduce Dalmatian toadflax stands relatively quickly. *M. janthinus* larvae mine in Dalmatian toadflax stems, which slowly causes the plants to wilt and die. Repeated attempts to establish *M. janthinus* on yellow toadflax in North Dakota have failed, likely because the larvae cannot survive in the much narrower diameter stem of yellow compared with Dalmatian toadflax.

YELLOW STARTHISTLE

(*Centaurea solstitialis* L.)

State Noxious Weed List: **No.**

Yellow starthistle is an extremely invasive, fast-spreading member of the knapweed family and native of the Mediterranean region. Yellow starthistle first was collected in North Dakota in Grand Forks County in 1964 and was added to the state noxious weed list in 1999 after plants were observed in several newly seeded CRP fields. Yellow starthistle infests more than 15 million acres

YELLOW STARTHISTLE

in California and has displaced leafy spurge as the most invasive weed found in Idaho. Yellow starthistle presently has been found in the neighboring states of Montana, South Dakota and Minnesota.

Identification and growth form:

Yellow starthistle is an annual that often grows 3 feet or more tall and is branched with winged stems. Each stem terminates in bright yellow flowers with needlelike straw-colored bracts often up to 2 inches long. Lower leaves are deeply lobed while upper leaves are entire. Both stems and leaves are covered with pubescent hairs that give the plant a grayish appearance. Yellow starthistle reproduces (and thus spreads) only by seed. A single plant can produce as many as 150,000 seeds, of which 90 percent or more are viable and can remain dormant in the soil for a few years. Most yellow starthistle seeds are plumed and disperse when mature. However, some seeds are plumeless and stay in the flower head until winter storms disperse them in blowing snow. Yellow starthistle has a long tap root similar to spotted knapweed or dandelion.

Yellow starthistle seeds can germinate either in the fall following cool rains and overwinter as a rosette or in the spring after snowmelt. Yellow starthistle begins to bolt in late May to early June. Flowering starts in early to mid-July, similar to Canada thistle. Yellow starthistle often can go unnoticed until the plant begins to flower, but once the bright yellow, dandelionlike flowers bloom, the plant is easily detected. Flowering continues until mid to late August, then the plant dries to a straw color, the seeds mature and the cycle repeats.

Why is this plant a concern?

Livestock and wildlife will not graze where yellow starthistle grows because of the sharp spines around the flower. Yellow starthistle is adapted to a wide variety of environments and will out-compete most native plants for nutrients and moisture, reducing both native wildlife and plant diversity. Yellow starthistle can cause "chewing disease" in horses, which is a lethal neurological disorder. However, to present symptoms, such as the inability to eat or drink, stiff or trembling legs and a stiff, swollen, "frozen" face, a horse must eat an amount nearly equivalent to its body weight.

How do I control this plant?

Prevention is the best method to keep yellow starthistle from invading North Dakota cropland, rangeland and wildlands. Yellow starthistle is most likely to be found in recently seeded pastures or CRP fields; along highways, railroad tracks and other transportation or communication lines; or anywhere livestock is brought into the state. Previous infestations in the state can be traced to contaminated grass seed, including those used in CRP and contaminated hay, and from movement of out-of-state livestock and vehicles into North Dakota.

Chemical. The most effective herbicides for yellow starthistle control include Milestone (aminopyralid), Tordon (picloram) and dicamba (various). Treat an extra 10 to 15 feet around the infestations to control seedlings. A careful follow-up program is necessary to control missed plants and seedlings.

Cultural. Grazing, mowing, burning, cultivation and maintaining competitive forages can be used in conjunction with herbicides to keep yellow starthistle from establishing in North Dakota. Hand-pulling is also effective for control of this annual weed.

Biological. Biological control is in the research and implementation stage in states with large acreage of yellow starthistle such as California. However, biological control is not recommended in North Dakota because of the limited yellow starthistle acreage.

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Appendix B

North Dakota ANS Management Plan

North Dakota

STATEWIDE

AQUATIC NUISANCE SPECIES (ANS) MANAGEMENT PLAN

Bighead
Asian Carp

Common Carp

Rudd

Curlyleaf Pondweed

New Zealand
Brown Mud snail

Eloda

Protecting our aquatic resources for the future through education and responsible actions by the public, and the public officials entrusted to manage North Dakota's aquatic resources!

Goby

Zebra
Mussel

Prepared by
Lynn R Schlueter, principle author
Special Project Biologist
North Dakota Game and Fish Department

Eurasian
Watermilfoil

Ruffe

Spiny Water Flea

North Dakota

STATEWIDE

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2004 PROGRESS REPORT OF THE NORTH DAKOTA AQUATIC NUISANCE SPECIES MANAGEMENT PROGRAM by LR Schlueter, Special Project Biologist, North Dakota Game and Fish Department, Devils Lake, ND.

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EXECUTIVE SUMMARY

NORTH DAKOTA'S STATEWIDE AQUATIC NUISANCE SPECIES (ANS) MANAGEMENT PLAN

Each year more aquatic nuisance plants and animals enter the United States, and established populations are making their way closer to North Dakota. So far, North Dakota has a limited number of aquatic nuisance species (ANS), and then only in few isolated locations. ANS infestations affect more than just anglers, boaters and hunters, they have a negative influence on cities, power companies, water transfer projects, and landowners. In short, ANS impacts anything and anyone dependent on surface water. It is easy to understand the problem by picturing the fallout from noxious plants such as leafy spurge, musk thistle, and Canada thistle have had on agriculture. This is the same issue, but under the water's surface rather than on the land. North Dakota's natural resources will not be alone in feeling the impacts of ANS. If, for example, North Dakota was infested with zebra mussels, the cost for additional maintenance and monitoring for water intake facilities is estimated at $383,000 per year per intake, and $787,000 for each power plant cooling tower. These O/M costs will be passed on to the consumer. ANS infestations will affect communities and businesses relying on water-based recreation such as boating, hunting, and fishing. A 10 percent reduction in visits to North Dakota can equate to a loss of $3.2 million in direct hunting and fishing expenditures in the local economies. Water transfer and water pipeline projects can be blocked because of ANS concerns or operated only with expensive treatment facilities added to the intakes. Minnesota has spent approximately $1 million annually in its ANS control projects without eliminating the problems. ANS equates to irreparable damage to North Dakota's economics and its natural resources.

Aquatic nuisance species arrive in our state because of recreational, commercial, and consumer activities. There is increased interstate travel for recreation, which means more people, boats, and other equipment used in ANS infested waters are coming to North Dakota. Also, increased commercial importation of aquatic species is occurring in the pet trade, water gardens, and landscaping means it is easier for a noxious species to enter commercial markets and become widely distributed. The global market now provides a pathway for new noxious species to find their way to our doorsteps with a credit card, a phone call, and it can be delivered the next day to your doorstep.

The saying, "An ounce of prevention is worth a pound of cure," is a dramatic truism with ANS. The most important lesson learned from the experiences of other states is the wisdom that prevention is much more effective and much cheaper. Prevention requires intense and effective public education, developing partnerships, voluntary actions, and organization among state agencies. To date, most of North Dakota's ANS prevention and control efforts have been loosely organized and under funded.

North Dakota natural resource managers are slowly becoming more aware of this management challenge and are trying to address portions of the problem that fall under

their jurisdictions. The problem is that there is no clear authority or single agency charged with managing ANS problems. Most management efforts have focused on reacting to isolated infestations, not a comprehensive set of strategies to prevent the introduction of the problem(s). The current situation is much like a family that has a very basic insurance policy with limited coverage for catastrophic events. While some things are covered, there are many risks that are not, or can only be handled after extensive paperwork and a long wait which may prove fatal. Some of North Dakota's ANS problems are covered by existing state activities and funding, but there are many that are not. Most state agencies have only reacted to infestations that have become well established. The problem is a lack of coordination of ANS activities across public and private sectors, limited reach of projects that legitimately fall under current state agency mandates, and a lack of funding to allow consistent actions to protect North Dakota's natural resource. North Dakota is "under-insured" for the many different ANS risks it is facing.

The North Dakota Aquatic Invasive Nuisance Species Management Plan (ND-Plan) intends to:

- Form an advisory board, or Aquatic Invasive Species Committee (AISC), to North Dakota Game and Fish Department's Director to coordinate ANS prevention and control activities, and encourage state agencies and the private sector to become involved in ANS prevention and response;

- Develop a list of ANS that cannot be brought into or transported within North Dakota;

- Organize educational and outreach efforts for public and private sectors, and use a targeted audience approach to marketing ANS prevention;

- Monitor waters at high risk for ANS, and determine the pathways of high risk for importation of ANS into or within the state;

- Develop a monitoring program for early detection and rapid response to control a pioneering infestation;

- Inspect recreational boats, commercial vessels, and construction equipment used in aquatic situations, and determine owner/operator ANS precautions and awareness;

- Recommend legislative solutions that can help protect North Dakota's human and natural resource communities from ANS damage;

- Make North Dakota eligible for federal matching funds and a method(s) to prioritize funding of ANS prevention and control projects, leverage these funds with local communities, private entities, and governmental agencies; and

- Improve collaboration between national, regional, state, and local ANS prevention efforts.

The ND-Plan relies on state agencies and non-governmental partners working together to prevent or control ANS infestation and these groups having “ownership” in the outcome of ANS prevention in North Dakota. A cooperative effort is our best deterrent. This statewide management plan is based on all of us working to keep ANS from impacting our state.

INTRODUCTION

What are ANS?

Aquatic nuisance species (ANS) are nonindigenous, obligate aquatic plants or animals that threaten economic stability, human health, native or desirable species, or the ecological health of the state's waters. ANS infestations have negative impacts on commerce, agriculture, aquaculture, recreation, or just about any activity dependent on the state's waters. When noxious plants and animals are introduced, they can quickly become a problem as the new environments lack natural controls such as diseases and predators which allow colonizing populations to rapidly expand. The negative effects of ANS to native and desirable aquatic resources are difficult to measure, but those consequences are real and dramatic. In a recent study, invasive species, which include ANS, are imposing an economic burden of $137 billion per year in the United States (Pimentel et al., 1999). North Dakota's agriculture sector is already aware of the impacts of noxious species such as leafy spurge and various nonnative thistles. ANS are just the aquatic version of this problem, but they are able to impact any sector that relies on North Dakota's surface waters.

What is our situation?

North Dakota is a prairie state where water is often scarce. ANS invasions create risk to domestic, municipal, agricultural, and industrial supplies, and to recreational water use. Compromising water supplies threatens North Dakota cities and rural communities, disrupts economies, and damages natural resources.

Much of North Dakota's municipal water supplies are from rivers, reservoirs, and lakes. These resources are in jeopardy from ANS infestations. Imagine these supplies becoming fouled with a nuisance species such as zebra mussels. These animals clog water intakes, increasing annual maintenance costs for the consumer. When they die in large numbers, their shells litter beaches, and the smell of decay is in the air and water. When there is a large die-off, the dead mussels create a nuisance and human health risk – especially to potable water supplies. These die-offs disrupt recreation and reduce waterfront property values. By filtering plankton from the water, zebra mussels reduce desirable fish and wildlife through competition and the reallocation of trophic energies. In addition, waste from zebra mussels foul bottom substrates, greatly modifying habitats which further reduce desirable and native species.

Are there risks of zebra mussels becoming established in North Dakota? The reality is that zebra mussels are moving closer to North Dakota each year. In their wake, ANS have caused significant economic problems, ecosystem impacts, damaged natural resources, and spawned new social problems. The nearest infestation to North Dakota is less than 150 miles to the east in Lake Ossawinnamakee in Minnesota. An ounce of prevention is a good investment when dealing with ANS (Leung, et al., 2002).

The monies spent on prevention are much less than the cost of dealing with an ANS infestation.

There are five important points to consider for ANS prevention: 1) ANS are currently in isolated locations in North Dakota and there only three species in the state; 2) risks are real, are devastating, and ANS are closing in on North Dakota's borders; 3) prevention of ANS is more practical, more effective, and less expensive than control efforts, which are seldom successful (Leung, et al., 2002); 4) negative impacts will occur to all those who depend on water; and 5) additional and dedicated funds are needed to expand and improve North Dakota's ANS prevention efforts.

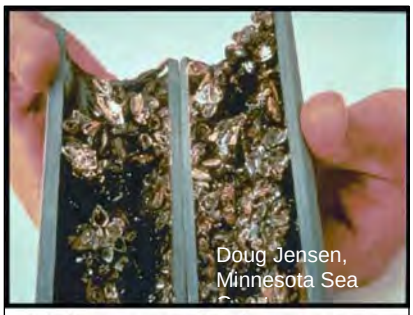
What is at risk?

While North Dakota has been lucky so far with having few ANS infestations (USGS, 2000), the long-term threat is apparent. Examples of the immediate economic and environmental risks include:

- Outdoor Recreation: Outdoor recreation is important to North Dakota's economy, contributing $4.7 million in 2001 from hunting and fishing alone (Bangsund and Leistritz, 2003). Nonresident anglers spent $31.9 million dollars in North Dakota in 2001-2002. If an ANS infestation reduces visitation by even a modest amount (say 10 percent) it would mean a significant loss of revenue to the state (about $3.2 million in this example). Salmon fishing in Lake Sakakawea supports approximately 13,000 angler days per year, which equates to a value of $1.8 million dollars annually (Power, 2004). The salmon population could be reduced by whirling disease, a viral pathogen found in states to the west.

Boat fouled with Eurasian milfoil.

- Water Users: Several North Dakota industries, all major cities, and many rural water pipelines rely on surface water supplies. An industrial water user has only to look to our neighbors to the east and the problems they are having, and then think about the risk to our state. ANS bivalve infestations in the Midwest and eastern part of the United States are costing $1 billion annually (Khalanski, 1997). In the upper Midwest, a medium-sized city spends about $383,000 per year per water intake (Jensen, 2004). To clean ANS from power



Zebra mussels clogging an industrial pipe.

cooling towers, the annual cost is nearly $787,000 per site (Jensen, 2004).

- Agriculture: Water flows in canals and irrigation pump intakes are clogged by Brazilian elodea (WASHINGTON DEPARTMENT of EOCOLOGY, 2004). This plant also creates problems for boaters and anglers. Heavy growth will displace native plants, and waterfowl production is curtailed in infested lakes and rivers. The same statements are true about the effects of Eurasian watermilfoil on water uses.

- Natural Resources: Even a modest zebra mussel infestation can reduce desirable fish populations by about 35 percent (Schlueter, 2004). Hetersporia spp. (a micosporidan) has been found in Minnesota and Wisconsin waters for about 15 years, affecting fish species such as fathead minnows, walleye, yellow perch, largemouth bass and channel catfish. In 1944, purple loosestrife was found in a few isolated locations along the Red River near Lockport, Manitoba, but now has invaded and displaced native species in thousands of acres of wetlands (Manitoba Purple Loosestrife Project, 2002).

Purple loosestrife clogging waterway.

- Property Values: People will pay more to live next to water, but lakefront property values in Pennsylvania dropped approximately 15 percent where Eurasian watermilfoil infestations occurred. The reductions in county property tax revenues were offset by increased tax rates on other items. Environmental and economic problems caused by the dense growth of these weeds include impairment of water-based recreation, navigation and flood

Eurasian water milfoil damaging waterfront property.

control, degradation of water quality and fish and wildlife habitat, and accelerated filling of lakes and reservoirs. Eurasian water milfoil is found within 150 miles of North Dakota's borders (Exotic Species Program, 2004).

- Un-infested waterbodies: As ANS are moved to new areas, the cost to control the problem also increases. Minnesota's first Eurasian water milfoil infestation was reported in 1987. This ANS spread because control efforts were not quickly put into place. Minnesota now has Eurasian watermilfoil in 152 lakes, reservoirs, streams and rivers (Exotic Species Program, 2004). It is estimated that Minnesota spends approximately $1 million annually to control Eurasian watermilfoil. Yet the problem has not been eliminated at this spending level. Movement of ANS into or within North Dakota will likely create similar costs. This means money and manpower reallocated from other recreational projects.

Who manages ANS?

States are in the lead. Most states have noxious weed laws and some level of management on other deleterious species. For ANS prevention and control efforts, the state's governmental agencies have become the focal point for managing ANS inside their borders. States are developing ANS management plans to coordinate different activities, setting priorities for intelligently allocating scarce resources, and creating adaptable management systems to meet changing needs.

Federal government is involved. The introduction and spread of ANS across state and international borders continues even though the problems – damage to ecosystems, degradation of natural resources, increased socio-economic costs to water users, and other impacts – are well known (Lassuy, 1994). As a result, the federal government has taken an active interest. In 1990, the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) began providing federal funds to implement states' ANS management plans. While programs created by this national legislation were initially directed at the Great Lakes region, the reauthorization of NANPCA in 1996 as the National Invasive Species Act (NISA) established a national goal of preventing the introduction and spread of ANS in all states. The NISA allowed for the development of various federal programs such as "Protect Your Waters", 100th Meridian Initiative, and others.

NISA contained language that encouraged states to develop their own management plans which were feasible, contained cost-effective management practices and measures that could be implemented by a state to prevent and control ANS infestations in an environmentally sound way. Approval of North Dakota's statewide ANS management plan (ND-Plan) will make federal funds available to North Dakota for its ANS prevention efforts; see National Invasive Species Act of 1996 (see Appendix A). Federal agencies, like the Department of the Interior, are to ensure that American Indian resources and federal lands are properly managed, protected, and conserved, including protection from ANS damage. Those federal agencies managing ANS on agency and tribal lands provide policy reviews and other technical services such as education and act as a liaison on ANS issues. This makes federal agencies and Indian tribes important partners in a state's ANS management efforts.

There is regional cooperation. Various regions of the United States have come to realize that one state's problem is really a problem that affects other states. It is easy for North Dakota to imagine this by considering that an ANS infestation in the Missouri River or the Mississippi River will not stop at a state's borders. In response to the ANS threat, the Western Governor's Association has been supportive of the Western Regional Panel and 100th Meridian Initiative. Both of these federal groups have been tasked with limiting the introduction, spread and impacts of ANS into western North America. Both groups are a combination of public and private sector participants working together to protect western water resources from ANS.

History of management in North Dakota. ANS problems in North Dakota have long been recognized by state and federal agencies and the private sector. Efforts to control ANS have been funded as an extra project, with some funds moved from other internal sources or from available federal funding sources. The North Dakota Game and Fish Department began working with the U.S. Fish and Wildlife ANS-Task Force, 100th Meridian, and Western Governors' Regional Panel in the mid-1990s to secure funds that were utilized in forming partnerships with other North Dakota natural resource agencies for ANS education and prevention activities. These funds were used to provide signs at boat ramps in North Dakota Department of Parks and Recreation areas and in areas operated by the U.S. Army Corps of Engineers (COE). Publications by the North Dakota Tourism Department contained educational information and were provided to individuals, both residents and nonresidents, requesting information about North Dakota. Posters to increase ANS awareness were developed and placed in bait shops, sporting goods stores, boat dealerships and at local chamber of commerce offices. Monitoring of waterbodies for ANS infestations was done by North Dakota Game and Fish Department field staff and COE staff. ANS impacts to North Dakota's resources and to long-term operational and maintenance impacts were discussed with the North Dakota Department of Health, State Water Commission, U.S. Fish and Wildlife Service-Fisheries Assistance Operation and Bureau of Reclamation. Local water resource boards were provided with information on ANS impacts to water management projects. Contracts with universities for studies on boaters' points of origin and travel destinations, comparison of ANS lifecycle requirements to conditions in North Dakota waters, and ANS precautions the boaters had done were vital to develop risk analysis reports. Those agencies, which issue permits for water projects, understand the importance of taking proactive steps and have begun to modify their permitting systems and operational procedures to include provisions to prevent ANS introductions.

It is difficult to track all of the ANS prevention expenditures in North Dakota to date. The North Dakota Game and Fish Department has spent $125,000 over the last five years. Monies spent by other agencies have not been tracked, and is extremely difficult to estimate. It is believed that their efforts were the result of funding the North Dakota Game and Fish Department and it's forming partnership with others. A number of partnerships developed which provided information to targeted audiences in order to inform the private sector of ANS impacts, and promote coordinated ANS prevention or monitoring activities. The partnership allowed a limited budget to cover more activities and reach a large number of people, private entities and state agencies.

STATE AUTHORITIES, REGULATIONS, AND PROGRAMS

In North Dakota, many state agencies have authority and regulatory roles in managing natural resources. While many agencies have some authority to regulate or preventing ANS, all public agencies have an ethical responsibility to prevent damage to North Dakota's resources and to act in the best interest of North Dakota's citizens. As a historical prospective, North Dakota's legislature has not recognize a single agency as the sole responsibility to regulate ANS. North Dakota's legislature could designate an agency to be the lead, but at this time there is no centralized authority or management structure that exists to coordinate ANS activities in North Dakota.

The authorities and regulations of various state agencies are summarized below (see Appendix B for an extensive listing of North Dakota Century Codes for various state agencies).

DEPARTMENT OF AGRICULTURE

The Commissioner of Agriculture or the commissioner's authorized representative, with the assistance of the North Dakota State University Extension Service, has powers over the management, control and eradication of pests, noxious weeds, rodent and insect management and the use and application of pesticides. Their primary function is to provide technical expertise to county weed boards and to provide funding for various weed control activities.

The Plant Pests Act [North Dakota Century Code: 4-33-01 through 4-33-12] provides the Department of Agriculture the power to suppress, control or eradicate the spread of plant pests in the state. The commissioner may temporarily quarantine areas that he believes necessary to prevent the spread of plant pests for up to 90 days without a public hearing, or longer with a public hearing. The commissioner is empowered to conduct a reasonable inspection of any premises or property within the state with a warrant issued by District Court or consent of the owner and may stop and inspect any means of transport or conveyance within the state if he has probable cause to believe it to contain or carry a plant pest or host.

The North Dakota Noxious Weed Control Act [North Dakota Century Code: 63-01.1-01 through 63-01.1-17] provides that the Agriculture Commissioner, working in conjunction with county weed boards and county weed officers, the authority for control, maintenance, and eradication of noxious weeds and pests throughout the state. The commissioner, after consultation with the North Dakota State University Extension Service, shall compile and keep current a list of noxious weeds and provide local authorities with information and a program for the control or eradication of noxious weeds. The act provides the Highway Patrol, sheriffs, and other law enforcement officers the power to stop and inspect vehicles suspected of transporting noxious weeds within the state, to prevent the dissemination of noxious weeds on highways, airways or waterways.

GAME AND FISH DEPARTMENT

The North Dakota Game and Fish Department [North Dakota Century Code: 20.1-02-01 through 20.1-02-28] provides the Director with the authority to regulate the importation, introduction and transplanting of fish, fish eggs, and other aquatic animals into state waters. The act provides that one must have a permit issued by the Director before introducing any fish or fish eggs into public waters, and the fish or fish eggs must be inspected for disease.

The Fish, Frog, and Turtle Regulation Act [North Dakota Century Code: 20.1-06-01 through 20.1-06-17] provides the Director with the power to remove and dispose of fish deemed undesirable. The Director may adopt rules governing the operation of private fish hatcheries, introduction and release of fish into the state, and the supervision of live bait wholesalers. Department rules prohibit the dumping of minnow buckets or any other container into public waters. [NDAC 30-04-04-05].

STATE DEPARTMENT OF HEALTH

The State Water Pollution Control Board, which includes the Director of the North Dakota Game and Fish Department, through the State Department of Health and with cooperation of the State Water Commission [North Dakota Century Code: 61-28-01 through 61-28-08] maintains and improves water quality of the state, formulates and issues standards of water quality, and provides for a system to classify North Dakota's waters [NDAC 33-16-02.1-04, 09]. The agency is to require the proper maintenance and operation of sewage and industrial waste systems to protect present and future use of such waters for, among other reasons, the propagation of fish and aquatic life and wildlife.

STATE WATER COMMISSION AND STATE ENGINEER

The Water Commission Act [North Dakota Century Code: 61-02-01 through 61-02-76] provides for the establishment of a State Water Commission, which has general authority over all surface and subsurface water within the state. This includes authority over water projects, which includes recreational use or wildlife conservation. The Commission appoints the state engineer. Anyone who wants to divert or appropriate water within the state must get a permit issued by the state engineer, unless the use is for domestic, livestock or for fish, wildlife (including purposes of propagating, sustaining fish and wildlife resources, and for the development and maintenance of water areas) or other recreational need [North Dakota Century Code: 61-04-01.1 through 61-04-32]. The state engineer does have the authority to control and supervise all water and wildlife conservation projects and wildlife reservations. [North Dakota Century Code: 61-15-03].

WATER RESOURCE DISTRICT ACT

This is the only agency with the power to order the removal of aquatic weeds and pests [North Dakota Century Code: 61-16.1-01 through 61-16.1-63]. Water Resource Boards have the power to manage water resources within their districts and order or initiate legal action to compel a person, user or controller of any bridge, or culvert to remove any weeds, shrubbery or other debris which hinders or decreases the flow of the water.

HIGHWAY PATROL AND OTHER LAW ENFORCEMENT

Statutes concerning the enforcement of laws regarding pests, pesticides, noxious weed control, weed control, and game and fish generally require other law enforcement agencies within the state to aide and assist in the enforcement of laws and regulations in these areas.

FEDERAL AUTHORITIES AND REGULATIONS

No single federal agency has clear authority over all aspects of ANS management. Many federal agencies have programs and responsibilities that address aspects of the problem such as importation, interstate transportation, exclusion, control, and eradication (see Appendix C). Federal activities on ANS management are coordinated through the National Aquatic Nuisance Species Task Force and Executive Order (EO) 13112, which requires all federal agencies to collaborate in developing a national invasive species management plan that will include terrestrial and aquatic species.

Executive Order 13112 on Invasive Species

President Clinton signed Executive Order (EO) 13112 on Invasive Species (64 Fed. Reg. 6183, Feb. 8, 1999), on February 3, 1999. The EO seeks to prevent the introduction of invasive species, provide for their control, and minimize their impacts through better coordination of federal agency efforts under a National Invasive Species Management Plan. The Order directs all federal agencies to address invasive species concerns, as well as refrain from actions likely to increase invasive species problems. The National Invasive Species Management Plan was finalized on January 18, 2001. The Plan can be found on the Council website at www.invasivespecies.gov. See Appendix D for full details on EO 13112.

Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA; Title I of P. No.101-646, 16 U.S.C. 4701 et seq.)

This Act established a federal program to prevent the introduction of, and to control the spread of, introduced ANS and the brown tree snake. The U.S. Fish and Wildlife Service, U.S. Coast Guard, Environmental Protection Agency, Army Corps of Engineers, and the National Oceanic and Atmospheric Administration share responsibilities for implementing this effort. They act cooperatively as members of an Aquatic Nuisance Species Task Force. The mandate is prevention, monitoring, and control with these activities supported by research and education. The Task Force conducts studies and reports to Congress:

- to assess whether ANS threaten the ecological characteristics and economic uses of U.S. waters other than the Great Lakes;
- to identify and evaluate approaches for reducing the risk of adverse consequences associated with intentional introduction of aquatic organisms.

Under NANPCA, state governors are authorized to submit comprehensive management plans to the Task Force for approval, which identifies areas or activities for which technical and financial assistance is needed. Grants are authorized to states for implementing approved management plans, with a maximum federal share of 75 percent of the cost of each comprehensive management plan. The state (or non-federal) contribution is 25 percent of total program costs.

National Invasive Species Act (NISA; No.104-332)

In 1996, NISA amended NANPCA to mandate regulations to prevent the introduction and spread of ANS into the Great Lakes through ballast water and other vessel operations. The act authorized funding for research on aquatic nuisance species prevention and control in the Chesapeake Bay, Gulf of Mexico, Pacific Coast, Atlantic Coast, and San Francisco Bay-Delta Estuary.

In addition, NISA required a ballast water management program to demonstrate technologies and practices to prevent aquatic nonindigenous species from being introduced into and spread through ballast water in U.S. waters. It modified: (1) the composition and research priorities of the Aquatic Nuisance Species Task Force; and (2) zebra mussel demonstration program requirements. See Appendix A for full details on NISA.

PROBLEMS AND CONCERNS

How do they get around? – The need for pathway management. Nineteen pathways for ANS to enter North Dakota has been described (Leitch and Tenamoc, 2001). It is recognized that the RISK ASSESSMENT FOR THE INTRODUCTION AND ESTABLISHMENT OF AQUATIC NUISANCE SPECIES IN NORTH DAKOTA (Brooks and Schlueter), the lists of ANS in other states or provinces, and travel patterns need to be periodically updated. The combing of such information will provide a reasonable risk assessment of each recognized ANS and its likely pathway.

Those areas which are believed to be the likely sources of ANS importation or movement will be a primary target, but educational efforts will continue on a broad approach as not to miss a source of ANS movement. Understanding the pathways allows prevention, education, and outreach efforts or other reasonable and effective prevention practices (REPPs) to focus on actual problems.

Effectively managing the risk of ANS will focus on prevention rather than attempting to control the problem after it is found in North Dakota. The spread of ANS to inland waters has many pathways. The first pathway of concern is from ANS hitchhiking, where organisms catch a free ride on aquatic recreational equipment, such as boats, trailers, and sporting equipment, from one waterbody to another. ANS hitchhikers can be moved into North Dakota or moved among North Dakota waterbodies. From the angler surveys conducted on North Dakota waters, it was found that the number of nonresident anglers has increased in recent years. Many of these anglers are coming from areas known to have ANS infestations, and some visitors have neglected to take ANS precautions to rid their equipment of ANS hitchhikers. To compound the problem, North Dakotans visit other states where ANS abound and could bring ANS back to North Dakota on their boats or equipment.

Another pathway is through commercial ventures, like the importation of live fishbaits, importing exotic fishes for aquariums, and importing exotics for aesthetic purposes such as aquatic gardens, landscaping and for food. In 2003-2004, exotic aquatic plants were observed for sale in local plant nurseries and home improvement centers in North Dakota. North Dakota Game and Fish Department staff checked and found that many of these plants were on the various lists of nonindigenous species or on the U.S. Department of Agriculture's Noxious Plant list. But since current North Dakota regulations did not list them as a noxious plant, no action could be taken. The concern is that these nursery plants can be released, accidentally or intentionally, into the wild and create ANS problems in the state's waters. The two classic examples of ornamental plants that become problems are purple loosestrife and salt cedar. Both are on the state's Department of Agriculture's noxious plant list, but can still be found in some commercial plant nurseries and via the internet sales. Both plant species now occur in the wild in many areas of North Dakota. The prodigy of "domesticated" plants or animals can easily escape or be released into the wild, become an established infestation, and cause significant problems.

The following is a general listing of ANS pathways in North Dakota:

- via watercourse or watershed connections such as ditches, channels, natural overland flows in high water events, and in streams and rivers;
- on or in recreational boats or equipment used for angling, hunting, boating, or vessels used in construction in aquatic situations;
- use of undesirable species or ANS as live fish baits and the disposal of unwanted baits in improper locations;
- commercial ventures, which includes aquaculture, pet industry, plant nurseries, landscaping and food markets, that utilize a live product,

service industry such as hunting lodges or fishing guides, and fish bait industry;

- natural carriers, such as seeds in bird feathers and animal fur, seeds or eggs stuck on muddy feet, or attached to another plant or animal;
- commercial vessels and construction equipment used in aquatic situations; and
- importation of plants or animals for personal enjoyment, as status symbols, ornamental use, and similar uses.

Bioterrorism is a concern and will not be considered to be a typical introduction pathway for ANS. Bioterrorism is a clandestine act meant to damage the region's natural resources, sabotage in its purest form.

Why are ANS moved from their native ranges? Three interrelated factors create conditions suitable for the spread of ANS:

1) Human demand. Consumer demand for live plants or animals used in human consumption, for display in gardens and aquariums, aesthetic pleasures, and commercial ventures (i.e., live food market, aquaculture, captive breeding);

2) Increased travel and trade avenues. This occurs when individuals have more discretionary money, a great deal of leisure time, and are willing to travel greater distances to enjoy their leisure, sightsee, and recreate. The increased distances people travel correlates to the likelihood they'll come in contact with an ANS. The increased ease of international trade (i.e., air mail delivery of species ordered over the Internet) also makes it possible for exotic species to effortlessly find their way to North Dakota;

3) Lack of citizen and private enterprise knowledge or apathy about taking the proper precautions. Mankind is often the unwitting and unknowing agent of unwanted movement of ANS. Individuals and businesses are unaware of ANS problems, but lack of knowledge is very concerning when one realizes the amount of the information that has been provided in different sources such as popular periodicals, television, radio, and newspapers. A greater concern is that individuals are aware of the problem, but are not taking the precautions needed to prevent ANS movement. It is not hard to imagine that some individuals are just not willing to take precautions as they assume the problem is inevitable or they just do not care about the consequences of ANS infestations; and

Establishment of new populations in new areas that create problems – Not all species cause problems in new locations.

The importation of an ANS to a new area does not always result in a new population being formed. As with any species, the introduced ANS must find compatible conditions in the new location. An easy example is those ANS that are from tropical regions, they will not survive in North Dakota's harsh winter climate. Suitable

biological conditions for the exotic animal or plant must be present in its new location or it will not survive. The introduced specie(s) must find an unfilled niche it can utilize. In addition, the new area must not have biological controls such as predators, diseases, etc., which overwhelm a new species that has no adaptations to their attacks. In the event that three controls are not in place, the introduced species survive, prosper, and can create problems. When the new specie out-competes a native or desirable species, it then becomes a problem and creates a rapid change in ecological conditions where it is established. As ecological interactions are common, impacts to secondary species can and do occur from the sudden change in the ecosystem.

The problem is from species from regions with similar weather and water conditions as North Dakota. These species are likely to survive and thrive in North Dakota. As with any new population, the number of individuals slowly increases until they reach a threshold level. At this point, there will be a rapid population expansion. While the new population is slowly building, genetic selection or shifting is occurring, those individuals which are best adapted to the new conditions prosper and multiply. A species' adaptation allows some introduced species to dominate in the new environment and out-compete other species. In many instances, the new species can interbreed with a closely related species. The resulting hybrid can be more of a problem than the original species.

The newly introduced populations are the most susceptible to control efforts – when they are below the threshold level for high expansion rates. To have effective control measures, the population must be found in this critical stage. When the species has passed this point, has begun to spread to new areas, it is now considered as common place, then it is basically uncontrollable. Once a population is well established, controlling or eliminating the established ANS population is impractical.

Who is in charge? – The need for agency coordination. While many government and private entities have some form of ANS responsibility, there is not a comprehensive and coordinated management capacity, nor is there a focus on effective prevention efforts. A new, robust vision of cooperation and deterrence will be required to meet the uncharted risks that ANS present to North Dakota. The many different laws, regulations, and policies with partial impact on ANS need to be woven into a comprehensive and cooperative program to protect the state's aquatic resources, and domestic, agricultural, and industrial water supplies.

The proposed program needs to be based on reasonable and effective prevention practices (REPPs) that meets North Dakota's needs. Examples of such increased activities for agencies and entities where REPPs or ANS prevention should be include:

- State Water Commission permits for construction of water transfer projects, water pipelines, water retention structures, water intake devices or similar activities where ANS introduction or spread could occur.

- Department of Health permits for water projects where the discharge of waters or the transfer of water between basins that present an ANS risk.

- Department of Agriculture to expand its inspection/monitoring of plant nurseries or garden centers for ANS plants and enforce appropriate ANS regulations on sales of aquatic plants.

- Game and Fish Department to ensure that imported species such as baitfish or fish for aquaculture or stocking are ANS free or not from areas with ANS infestations; continue inspecting bait wholesalers and retailers for ANS; work with the pet trade industry in implementing ANS prevention protocols; and enforce ANS regulations on transporting aquatic vegetation or organisms.

- Tourism and Commerce Department to provide information on ANS ecologic and economic risks, and the need for prevention in its trade publications, economic development information, and other educational materials.

- County Extension Agency to provide information on alternative water garden plants, which do not pose ANS risks.

- Department of Parks and Recreation to include information on ANS concerns, ANS introduction from park visitors, and enforce such ANS regulations on transporting aquatic vegetation or organisms.

- Department of Transportation to inspect large boats hauled by commercial carriers when they pass through ports of entry or at weigh stations, and enforce appropriate ANS regulations on the movement of aquatic plants and organisms.

- Water Boards or Natural Resource Boards to review water management permits to ensure ANS introductions will not occur and include ANS prevention protocols for equipment brought into an area. To quarantine waters, if needed, to prevent the spread of ANS to other waters.

- Municipal water users, lake owner associations, irrigation districts or conservancy districts would inform their groups of the impacts from ANS infestations, the costs to users associated to control or manage the problem, and the need to take action before ANS problem(s) becomes established and cannot be controlled.

The including of REPPs into agency responsibilities will only enhance existing duties and agency mandates to protect North Dakota's environmental and economic resources. While ANS problems are considered new for many agencies, ANS must be viewed as another problem that will negatively impact our state's future. ANS prevention must become a part of agency concerns, which means agencies must forgo the role of reacting only when there is a well-established problem. To prevent ANS

infestations and their problems, a strong, proactive, coordinated effort must be made among state agencies.

Preventing ANS introductions is the responsible action for the local and state agencies. We, entities representing the best interests of North Dakota citizens, who are involved with or entrusted with management of North Dakota's natural resources and economic viability, must be involved. To not become involved is to give up the trust and faith, and the responsibility that the public has given public agencies.

Involvement of the private sector. Success with a new set of coordinated activities from the government, especially to educate the public and business community, will require participation by those private-sector parties who have a stake in preventing ANS damage. While agencies frequently interact with the public, they do not do so nearly as often as the private-sector. Consequently, a large segment of those who will be impacted by ANS are not being reached. Some commercial activities such as water gardening, exotic pet importing, and the live fish bait industry, are at-risk pathways for introducing deleterious species. The power industry which supplies electricity for lights at work, television sets at home, and the computers in schools will have to pass higher operational costs on to their customers. These two examples show how ANS can have impacts to those not active in outdoor recreation.

Businesses must be willingly involved in ANS prevention to implement the best management practices for their industry, and in so doing, complement the limited reach of regulations. Industries are natural partners to create an environment where prevention can reap benefits for the expenditure side of their operations.

Partnerships are critical to the programs outcome. Outdoor recreators and the private sector must buy-in to taking preventive precautions to ensure their resources for the future. It is the three-way partnership between the public, private businesses, and state agencies which will allow for effective ANS prevention activities to be done. North Dakotans who will be impacted by ANS must willingly agree to prevention efforts and work for such efforts.

Any ANS prevention program can be successful if those impacted are willing to help. There are three major advantages to the partnership: 1) willingness of all affected parties to be involved; 2) increased levels of direct communications on the problem between all affected parties, finding realistic solutions, and understand the solutions' impacts on affected parties; and 3) leveraging a limited budget with matching dollars and in-kind services. Item number 3 will require the expenditure of funds on the best avenues to communicate problems to the public and private sectors which have the best results for ANS prevention.

WESTERN REGIONAL PANEL RECOMMENDATIONS ON STATE ACTIONS TO IMPROVE REGIONAL CAPACITY FOR MANAGING AQUATIC INVASIVE SPECIES

The Western Regional Panel (WRP) was formed to promote a cooperative regional response to the threat of ANS among member states. States have broad authorities and resources that are critically needed to combat invasive species. ANS impact states economically and environmentally. The WRP is attempting to assist member states by recommending actions that will reduce the risk of ANS for each state and the western region as a whole. The WRP encourages member states to implement actions to reduce the risk from ANS to the region. The following recommendations have been reviewed and approved by the WRP members.

I. Actions to build state capacity for managing aquatic invasive species.

1. Appoint a state Aquatic Nuisance Species Coordinator (ANS-Coordinator – Every state has multiple agencies, authorities and information sources that can be used to implement a wide variety of aquatic invasive species management programs. A coordinator is needed to integrate these efforts into an efficient, unified response, and to serve as an identifiable lead contact for the state on aquatic invasive species issues and related aquatic issues.

2. Establish state Aquatic Invasive Species Committees (AISC) – The challenges caused by invasive species can be so diverse, extensive and long-term that they require consistent attention over time by the full range of agencies that serve the affected public. A coordinating committee, especially if established through legislation, has the greatest ability to provide a stable long-term forum for key stakeholders to address ANS problems.

3. Create state ANS management plans – North Dakota statewide ANS management plans (ND-Plan) will be a well thought out, effective, action strategy that creates consensus and support from partners within the state and, when approved by the national Aquatic Nuisance Species Task Force, will make a state eligible for federal funding.

4. Appoint a representative to the WRP and provide the resources needed for participation – The problems caused by ANS cannot be solved by any one state or entity. International, national, regional, state and local initiatives are needed to affect meaningful solutions. Participating in the WRP panel provides members access to new, creative ideas, and facilitates coordination among state efforts and national and international programs. Informed state actions are better able to implement effective programs that are consistent with federal law.

II. Actions to improve state authorities and increase funding for implementation:

1. Provide a long-term, stable source of state funding that can be used as a match for federal funding to implement state ANS management programs. Some states have already implemented aquatic ANS management programs that are supported by fees, license revenues, or general fund dollars. Federal funding by itself is insufficient to address the problem, but it can serve as a catalyst for leveraging limited state funds. Each state should consider their various funding options and strive to secure long-term funding for ANS management.

2. Implement programs to prevent the spread of invasive species via boating as well as other pathways. The spread of ANS among fresh water lakes and rivers, coastal estuaries, and nearshore marine waters can be greatly reduced by implementing state prevention programs. These programs should have adequate funding for boater education and inspection programs, along with the authority to make the transporting of nonindigenous aquatic organisms on recreational or commercial boats illegal.

> a. Survey trailered recreational boats according to the 100th Meridian Initiative Guidelines. The 100th Meridian Initiative has a standard survey form which can be found at www.100thmeridian.org. The survey information shows the regions boats are coming from such as areas where there is ANS infestations, travel routes, and destinations. Western states can estimate where ANS infestations are likely to come from. This information, in a searchable database, can help focus educational activities along specific pathways.

3. Create a state early detection and rapid response plan with clear authority and funding to quickly respond to new invasions and new pathways for invasion. The WRP has created a model rapid response plan that should make it easier for each of our member states to create and implement state specific response plans.

4. Provide state authority to designate waters that contain ANS as “Infested Waters” and implement management actions to control the existing population and prevent its spread. It is not feasible to eradicate some invasive species populations if they become firmly established before control action is begun. Control of invasive species in certain waterbodies can become a long-term management commitment. The designation of “Infested Waters” (or any other special state designation) can allow managers to quantify the problem while implementing education, containment and control programs to limit the damages and long-term expense.

5. Implement a nonnative species classification program that may allow for the beneficial use of some nonnative species while screening out potentially invasive species prior to importation or release. The intentional importation and release of nonnative species has led to the introduction of numerous invasive species. New federal and state programs are needed to screen out harmful invasive species prior to importation or release. Screening programs can reduce the impact of invasive species while allowing for their beneficial uses.

THE OBJECTIVES AND STRATEGIES OF THE NORTH DAKOTA AQUATIC NUISANCE SPECIES STATEWIDE MANAGEMENT PLAN

The goal of the North Dakota ANS Management Plan is to:

Prevent the harmful ecological, economic, and social impacts from ANS being introduced into or spread within North Dakota.

This goal will be achieved through implementation of eight principle objectives and their associated strategies. For each objective, the action narrative addresses the concerns which must be accomplished. The strategies contain a list of potential actions that will provide the needed ANS prevention and information to make sound decisions. The Aquatic Invasive Nuisance Species Coordinator (ANS-Coordinator) and Aquatic Invasive Species Committee (AISC) will have work to together to ensure coordinated ANS prevention efforts across governmental and private sectors. If there has been some work on a particular strategy component, that effort will be identified in the attached 2004 PROGRESS REPORT- NORTH DAKOTA AQUATIC NUISANCE SPECIES (ANS) MANAGEMENT PROGRAM.

It is understood that the strategies contain a wide list of tasks needed to be accomplished, but many of these actions will be worked on over an extended time frame. It will be necessary to prioritize which strategies are to be accomplished based on authorities and funding, and which strategy will provide the best outcome and results in ANS prevention. Staffing is provided by the legislature, state agencies or entities, the federal government, and/or private sources. The prioritized strategies are identified in the Budget Section.

There are many different strategies to undertake for the effective prevention of ANS into North Dakota. Some strategies are interdependent on other sections of the ND-Plan and can only be undertaken if precursors are accomplished or in progress. Other strategies are independent and can be undertaken as needed or when an opportunity presents itself. The strategies and their order of listing doesn’t represent when they will or need to be accomplished.

It is not possible to envision or address all potential ANS invaders, their impacts, and possible constraints. It is important to realize that contingencies may develop quickly to address a problem. Consequently, these management actions are intended to be adaptable to changing circumstances and, necessarily, the high priority items from this list are among the first to be implemented.

The time frame of the ND-Plan is five years, and is broken down into five one-year segments for budgeting purposes. It is envisioned that the ND-Plan will continue beyond five-years. A new ND-Plan will be written to update the accomplishments of strategies listed in this management program, based on experiences and new knowledge gained in the state and across the nation. Periodic updating of the ND-Plan will allow adjustment to changes in public attitudes, new ANS problems, and opportunities. It is safe to say that ANS problems will not subside and ANS efforts will be needed into the future under a framework of continuous improvement of the ND-Plan.

OBJECTIVE 1: COORDINATION OF AQUATIC NUISANCE SPECIES ACTIVITIES AND PREPARING/IMPLEMENTING A COMPREHENSIVE MANAGEMENT PLAN.

Problem Addressed: There is no clear authority or agency charged with managing ANS problems in North Dakota. Most management activities focus on isolated problems and not comprehensive strategies to prevent or control ANS. The lack of coordination on ANS activities, limited oversight from various agencies, and lack of funding has allowed only a few ANS to become established in North Dakota. There are no effective plans in place to manage the risk(s) from existing or new ANS introductions.

Action: Develop a management plan that defines plant or animal species considered as ANS, include defined tasks and activities, and the authorities and resources to undertake effective prevention and management of ANS. Form an advisory board to the Director of the North Dakota Game and Fish Department to deal with ANS issues. Its purpose will be to serve as the focal point for communicating with, devising these continuous improvements, and making recommendations to government and the private sector. The make-up of the advisory committee will reflect the needs for ANS prevention and will be fluid with appointed seated-members, reappointments or new entities, on a rotational time frame. The AISC will also have standing-delegates which can be involved in decision making, but have not voting privileges on issues nor will be financially reimbursed for their activities. The advisory board will be chaired by a coordinator from the North Dakota Game and Fish Department.

Current agencies with activities or designated for future activities: Department of Agriculture, Game and Fish Department, Department of Health, Department of Parks and Recreation, State Water Commission, Department of Tourism, Natural Resource and Conservation Service, U.S. Fish and Wildlife Service, Department of Transportation

Strategy 1A: Coordination of ANS activities for all ANS management programs and activities within North Dakota through development of the Aquatic Invasive Species Committee.

1A1. The North Dakota Game and Fish Department will designate an Aquatic Species Coordinator (ANS-Coordinator or coordinator) and support this position with federal ANS Task Force funds and matching state funds. The coordinator will encourage communication between governmental entities, public, and private sector, provide information, archive appropriate ANS information, and provide the public with needed information for them to make responsible decisions. – Status: PARTIALLY COMPLETED – see 2004 Progress Report (attached)

1A2. The coordinator will identify key personnel in governmental, tribal, private, and the public sector with ANS responsibilities. These individuals will be invited to form the Aquatic Invasive Species Committee (AISC) to oversee ANS activities. The coordinator will be the chairperson of this advisory committee. The AISC will work to ensure that the ANS strategy is coherent and consistent throughout North Dakota. The AISC will develop ANS assessment guidelines as needed for local governments and cooperating entities. – Status: COMPLETED – see 2004 Progress Report (attached)

Strategy 1B: Prepare and implement a comprehensive statewide ANS management plan.

1B1. AISC will prepare a comprehensive, statewide ANS management plan for North Dakota (ND-Plan). The ND-Plan is to be reviewed by technical advisors and others prior to its submission to the North Dakota Governor's office. – Status: PARTIALLY COMPLETED – see 2004 Progress Report (attached)

1B2. Encourage water users, such as municipal, industrial, irrigation, lake associations and others, to become involved in the AISC's efforts to prevent the importation of ANS as such infestations could have a financial burden on them which will be passed on to their customers. – Status: PARTIALLY COMPLETED, ON-GOING EFFORT – see 2004 Progress Report (attached)

1B3. The state plan will allow for coordinating North Dakota ANS prevention efforts with those being done at a local level, in the region such as the efforts outlined in Montana's and Iowa's state plan and Minnesota's Sea Grant work, and on a national scale. – Status: PARTIALLY COMPLETED, ON-GOING EFFORT – see 2004 Progress Report (attached)

Strategy 1C: Participate in and support regional, federal, and international efforts to control ANS.

1C1. The coordinator will participate in the Aquatic Nuisance Species Task Forces' Western Regional Panel, 100th Meridian Project, Missouri Interstate Cooperative Resource Association-ANS Panel, and coordinate with Canadian

provinces and neighboring states on ANS issues. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

Strategy 1D: Develop partnerships and funding sources to leverage state and federal funds with nonfederal funds to increase ANS prevention efforts that will be undertaken.

1D1. Create stable funding sources for ANS management in North Dakota by seeking federal funding from the NANPCA Act as part of the North Dakota Plan. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

1D2. Develop partnerships with state and federal agencies, private enterprise, and the public to leverage existing funding sources to undertake additional ANS prevention and eradication efforts. Partnerships to fund ANS prevention information with local entities will create a buy-in for ANS prevention with those groups and an ownership in preventing ANS importation. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

Strategy 1E: Review and evaluate state efforts in addressing ANS.

1E1. Update the state ANS plan as needed, with annual progress reports and a five-year program report. – Status: PARTIALLY COMPLETED, ON-GOING EFFORT – see 2004 Progress Report (attached)

OBJECTIVE 2: PREVENT THE INTRODUCTION OF AQUATIC NUISANCE SPECIES INTO NORTH DAKOTA.

Problem Addressed: There are many pathways by which injurious plants and animals arrive in North Dakota. ANS species are often intentionally imported to provide perceived benefits such as sport fishing opportunities, bait for angling, erosion control, food, aesthetic enjoyment, and so on. These species are accidentally released or escape from holding facilities into the wild. Unintentional ANS introductions can occur as humans, through recreation, industrial development, or commerce carry ANS hitchhikers (e.g., zebra mussels on barges, camouflage on duck boats, etc.). ANS established in neighboring states and Canada may disperse into North Dakota by natural means.

There are limited programs that review and regulate the aquatic species movement into North Dakota. The pathways by which ANS can be unintentionally transported into or within North Dakota need to be defined to allow prioritizing management in the highest risk pathways. The components creating this problem include lack of funding for additional staff to inspect and monitor importation of aquatic species.

Action: Determine which pathways function as major and minor conduits for ANS into North Dakota. Create a list of which species that represent aquatic invasive organisms which will create problems for North Dakota. Take appropriate actions to prevent the introduction of ANS along the identified pathways.

Current agencies with activities or designated for future activities: Department of Agriculture, Game and Fish Department, Department of Parks and Recreation, Universities, 100th Meridian Group, Pacific States Marine Fisheries Commission, County Extension Service, Western Regional Panel, and US Fish and Wildlife Service

Strategy 2A: Research and address pathways of introduction.

2A1. Describe the potential pathways through which ANS can enter North Dakota via recreational, commercial, esthetic, and illegal pathways, and include judgments of the risks of introduction from specific pathways. – Status: PARTIALLY COMPLETED, ON-GOING EFFORT – see 2004 Progress Report (attached)

2A2. Estimate the potential for ANS introduction for each pathway by conducting a risk analysis for each specific pathway or pathways in combination. – Status: ON-GOING EFFORT – see 2004 Progress Report (attached)

Strategy 2B: Prevention of ANS along determined pathways of introduction.

2B1. Continue to educate relevant public and private groups identified in 2A1 and 2A2 as likely sources of ANS importation. – Status: PARTIALLY COMPLETED, ON-GOING EFFORT - see 2004 Progress Report (attached)

2B2. Educate the retailers and wholesalers of aquatic products of problems associated with the importation of ANS and their likely release into the wild. – Status: PARTIALLY COMPLETED, ON-GOING EFFORT - see 2004 Progress Report (attached)

2B3. Implement the HACCP (Hazard Analysis and Critical Control Point) training program for appropriate field and survey personnel for all Divisions of the North Dakota Game and Fish Department. Institute HACCP for fish brought into the state by or for state or federal fish hatcheries. – Status: PARTIALLY COMPLETED, ON-GOING EFFORT - see 2004 Progress Report (attached)

2B4. Work with fishing tournament officials to ensure boats and equipment undergo ANS prevention protocols. – Status: PARTIALLY COMPLETED, ON-GOING - see 2004 Progress Report (attached)

Strategy 2C: Increase enforcement awareness of existing laws, controlling the transportation, propagation, sale, collection, possession, importation, purchase, cultivation, distribution, and introduction of ANS.

2C1. Increase the priority of enforcing ANS regulations.

2C2. Educate enforcement personnel about ANS impacts to natural resources, to identify ANS, and the need to enforce ANS regulations.

2C3. Distribute information on ANS laws to businesses that import or sell aquatic plants and animals.

2C4. Publicize the penalties for the intentional introduction of any nonindigenous species to North Dakota's waters.

Strategy 2D: Prohibit, control, or permit the importation of non-indigenous aquatic species based upon their invasive potential.

2D1. Develop a non-indigenous species list for North Dakota. – Status: COMPLETED – see 2004 Progress Report (attached)

2D2. Develop an ANS list from the 2D1's list of species that are of high concern to North Dakota and develop preferred management strategies for dealing with these as listed by priority class. – Status: COMPLETED, TO BE REVIEWED AS REQUIRED – see 2004 Progress Report (attached)

2D3. Develop a North Dakota list of ANS that cannot be imported, moved, possessed or sold within North Dakota. Provide that information to the North Dakota Legislature for review and concurrence. – Status: COMPLETED, TO BE REVIEWED AS REQUIRED – see 2004 Progress Report (attached)

Strategy 2E: Promote legislation and regulatory rules that establishes or increases the state's authority to control the introduction of new species.

2E1. Establish the authority to detain and require cleaning of any vehicle, vessel or such equipment used in aquatic construction containing or infested with ANS that is being transported into North Dakota.

2E2. Increase the ability of the State to regulate the importation of aquatic plants, animals or other organisms where existing authorities are limited.

2E3. Establish the authority to quarantine waters to prevent ANS from spreading and to contain ANS for eradication.

2E4. Require that aquatic species imported by wholesalers or retailers to be free of ANS and/or originate from ANS free areas.

2E5. Require that fish imported for hatchery use or as fishbait be disease free or collected from areas free of ANS. Periodically review the status of ANS in areas that fish or live fishbait is collected or reared. Continue North Dakota's moratorium on importation from areas that have ANS infestations. – Status: ON-GOING EFFORT - see 2004 Progress Report (attached)

Strategy 2F: Research the potential to develop a list of aquatic species that can be imported into North Dakota as they pose no known potential for becoming an ANS based on species or genus characteristics, review the history of other introductions outside a species home range, inter/intra ecological impacts, and actual demand or need for a species introduction.

2F1. Research existing federal or other states' databases for appropriate information on exotic species that pose little or no danger of becoming an ANS. Compile a list (import list) of flora and fauna which will are unlikely to cause problems if introduced into state or region waters.

OBJECTIVE 3: DETECT A PIONEERING AQUATIC NUISANCE SPECIES AND MONITOR EXISTING POPULATIONS OF AQUATIC NUISANCE SPECIES.

Problem Addressed: Affordable and effective eradication and control requires that infestations of ANS be discovered early in their pioneering stage of infestation. The extent of the newly discovered infestation must be quickly determined so appropriate action can be taken. Currently, most state agency workers do not routinely look for new species or ANS problems when they are at state waters, inspecting water treatment facilities, monitoring a commercial venture, or doing routine sampling. Explicit ANS monitoring effort will require additional staff time or the reprioritization of existing work and funding.

North Dakota lacks an organized information and species identification infrastructure for suspect species to be quickly identified. Thus, "problem" species cannot be readily confirmed by field staff or individuals doing routine inspections. Control measures cannot be taken in a timely manner.

Action: Create a way for government personnel, private-sector field staff, and trained volunteers to report (use of standardized forms) suspected ANS species while they are visiting a waterbody or commercial venture. These efforts would include documenting uninfested waters to compare to future occurrence and the spread of ANS. Create a mechanism for recording and archiving information on ANS monitoring activities, infestations found, and ANS expansion in infested sites.

Current agencies with activities or designated for future activities: Department of Agriculture, Game and Fish Department, Department of Parks and Recreation, Universities, Department of Health, US Fish and Wildlife Service, United States Army Corps of Engineers, Bureau of Reclamation, US Coast Guard, Department of Health, State Water Commission, Disaster and Emergency Response, Weed Boards, Water Boards, and private individuals

Strategy 3A: Implement a monitoring and early detection program.

3A1. Encourage and train appropriate agency personnel to identify ANS, develop and implement a monitoring and reporting program for ANS in North Dakota waters.

3A2. Conduct an annual monitoring of high-risk waters and monitor other waters. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

3A3. Place colonization substrates (traps) in areas likely to be infested with zebra mussels or provide traps to other agencies or individuals. In addition, inspect for zebra mussels on boat docks or buoy lines removed from the waters. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

3A4. Conduct zebra mussel larval tows in areas that are likely to be colonized by adults and have those samples processed by a laboratory.

Strategy 3B: Develop an early response mechanism to deal with detected and potential invasive species.

3B1. Implement a Rapid Response Plan. – Status: COMPLETED, TO BE REVISED AS NEEDED – see 2004 Progress Report (attached)

3B2. Conduct periodic reviews of North Dakota's Rapid Response Plan to determine if ANS species of concern are included and update as needed.

3B3. Create a network of expertise to rapidly and accurately verify suspected new invasive species.

3B4. Include these efforts as part of North Dakota's Disaster and Emergency response activities to avert bio-terrorism on the state's natural resources.

Strategy 3C: Train volunteers to assist with monitoring public waters for ANS infestations.

3C1. Develop a program to recruit and train volunteers to monitor selected public waters, and report their findings to appropriate authorities.

OBJECTIVE 4: EDUCATIONAL CAMPAIGN TO PREVENT THE SPREAD OF AQUATIC NUISANCE SPECIES.

Problem Addressed: To effectively prevent ANS introduction into or movement within North Dakota, there must be strong outreach efforts to various targeted audiences with appropriate and factual information. The audiences are: 1) resident anglers and hunters; 2) nonresident anglers and hunters; 3) non-consumptive outdoor recreators; 4) water users, e.g., municipal water intakes, irrigators, power production, etc.; 5) tourism, both on a state and local level; 6) state agencies and entities such as the State Water Commission, Department of Agriculture, Department of Health, Water Resource Boards, Game and Fish Department, Department of Tourism, Department of Parks and Recreation, etc.; 7) private and public entities; 8) commercial ventures; and 9) youth programs.

Each targeted audiences' message must and will be tailored to produce the desired effect which is that they willingly accept or take ANS prevention efforts. This use of market-based outreach requires an understanding of the target audiences' values and needs, and how to best reach that audience with the information. This market-based outreach to a targeted audience is a departure from typical information

dissemination provided by state agencies. In addition, ANS prevention is a proactive concerted effort(s) rather than reactionary to a problem's appearance. This requires that the targeted audience understands the long term impacts of ANS on their activities.

The sectors mentioned above will need to realize that they have ownership in the outcome of ANS infestations. It is important that individuals or groups realize that ANS prevention will not always be done by someone else.

Action: Create a "market based" information and education capability that identifies the target audience or audiences, formulate messages and information specifically for the targeted market groups, and utilize appropriate educational instruments to deliver these messages.

Current agencies with activities or designated for future activities: Department of Agriculture, Game and Fish Department, US Fish and Wildlife Service, US Army Corps of Engineers, Coast Guard, Department of Parks and Recreation, Department of Tourism, County Extension Service, Natural Resources Conservation Service, State Water Commission

Strategy 4A: Educate resident anglers and hunters about ANS prevention protocols by providing focused information in the best avenues of dissemination.

4A1. Identify the key message, the best format to deliver the information, and where to best deliver the message to this group. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

4A2. Provide information and education (e.g., signs, posters, kiosks, banners, newspaper articles, articles in periodicals, on radio and television spots, and similar venues) on ANS risks and prevention protocols as found in 4A1. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

4A3. Determine the level of ANS awareness and precautions used. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

4A4. Provide the list of ANS and of waters with problems to this group. Promote media reporting on ANS and the importance of management.

Strategy 4B: Educate nonresident anglers and hunters of ANS prevention protocols by providing focused information in the best avenues of dissemination.

4B1. Identify the key message, the best format to deliver the information, and where to best deliver that message to this group. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

4B2. Provide information and education (e.g., newspaper articles, articles in periodicals, in tourism publications, on radio and television spots, and similar venues) on ANS risks and prevention protocols as found in 4B1. – Status:

PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

4B3. Determine the level of ANS awareness and precautions used. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

4B4. Provide the list of ANS and waters with problems to this group. Promote media reporting on ANS and the importance of management.

Strategy 4C: Educate non-consumptive outdoor recreators of ANS, the need to prevent the problems, and disseminate information in the best form and venue.

4C1. Identify the key message, the best format to deliver the information, and where to best deliver the message to this group. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS – see 2004 Progress Report (attached)

4C2. Provide ANS prevention information (e.g., newspaper articles, articles in periodicals, in publications, on radio and television spots, and similar venues) to those identified in 4C1.

4C3. Provide the list of ANS and waters with problems to this group. Promote media reporting on ANS and the importance of management.

Strategy 4D: Educate water users of ANS problems, the need to prevent the introduction or spread of the problem, and how to best provide that message.

4D1. Determine where the different water users such as developers, manufactures, irrigators, municipal facilities, etc. can be reached and in what form should the ANS message be delivered to be understood. – Status: PARTIALLY COMPLETED, ON-GOING EFFORT - see 2004 Progress Report (attached)

4D2. Provide information and education (e.g., articles in trade periodicals, direct mailings or letters, and similar venues) on ANS risks and prevention protocols to those identified in 4D1.

4D3. Provide the list of ANS and waters with problems to this group. Promote media reporting on ANS and the importance of management.

Strategy 4E: Provide tourism promotion groups, including state and local efforts which include guides and outfitters, fishing tournament promoters, etc., the information about the impacts of ANS, how ANS are moved into or within the state.

4E1. Determine which North Dakota groups are promoting tourism, what ANS prevention information should be provided in their publications or information packets.

4E2. Determine these groups willingness to provide additional information on ANS prevention methods. – Status: ON-GOING EFFORT - see 2004 Progress Report (attached)

Strategy 4F: Develop communication with public and private entities, such as the Garrison Conservancy District, water pipeline cooperatives, etc., about the potential impacts of ANS to their operation, the need for a cooperative approach to prevention, and heightened staff awareness.

4F1. Determine the level of awareness that these groups have regarding potential ANS problems and what ANS prevention and monitoring is currently being done**.**– Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

4F2. Provide information and education on ANS risks and prevention protocols to the various public and private entities.

4F3. Continue to communicate the value of ANS prevention as opposed to controlling infestations.

Strategy 4G: Educate the commercial sector such as plant nurseries, pet trade, landscaping operations, home improvement centers, aquaculture, fish rearing and bait collection, and similar groups, about ANS impacts, and how their actions can prevent the spread and introduction of ANS.

4G1. Determine the ANS awareness of the various groups mentioned above.

4G2. Develop and distribute information on ANS prevention.

Strategy 4H: Educate juveniles about ANS prevention protocols and the problems posed.

4H1. Establish an educational campaign, targeting fourth-graders to eighth-graders of the problems ANS cause.

4H2. Provide educational materials for the classroom.

OBJECTIVE 5: INSPECTIONS OF RECREATIONAL BOATS, COMMERCIAL VESSELS, AND EQUIPMENT USED IN AQUATIC SITUATIONS.

Problem Addressed: ANS can be carried into or within North Dakota on or in boats used for fishing, hunting, or pleasure, work and on construction equipment used in aquatic situations. Special construction equipment such as barges, tugs, large water pumps, and backhoes are frequently brought into North Dakota. This equipment may have been used in waters infested with ANS. Inspection of these boats, vessels, and equipment for ANS have not routinely been conducted or are ANS precautions routinely performed prior to launching or use of these carriers of ANS. The boats', vessels', and equipments' owners are often not aware of the problem or understand what ANS precautions should be undertaken. The inspections would allow for tracking where the carrier was last used, ANS precautions performed, and the owner's awareness of the problem.

Action: Inspect boats, vessels, and equipment for ANS hitchhikers prior to launching. This inspection will be an opportunity to educate the owners or operators about ANS problems and precautions. Recreational boats could be inspected at boat ramps as part of angler creel surveys or as a specific project such as a university or group interested in conservation. The numbers of commercial vessels or equipment used in aquatic situations brought into North Dakota is limited, but pose a unique situation as they would need to be inspected. These vessels need to be free of ANS prior to launching in North Dakota waters. Permits for construction need to contain provisions that require equipment to be free of ANS and made available for inspection by trained individuals prior to its use.

Current agencies with activities or designated for future activities: Department of Agriculture, Game and Fish Department, Department of Parks and Recreation, Universities, Department of Health, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Bureau of Reclamation, U.S. Coast Guard, Department of Health, State Water Commission, Disaster and Emergency Response, local weed boards and water boards, and private individuals

Strategy 5A: Implement an inspection program for boats used for fishing, hunting, or pleasure, vessels used in commerce, and equipment used in aquatic construction situations.

5A1. Develop and implement boat inspections at boat ramps to determine if ANS is present, where the boat has been, where the boat will be used, and the owner/operators awareness of ANS problems and prevention. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

5A2. Provide technical assistance to conservation organizations, volunteer groups such as scouting troops, 4-H, or wildlife clubs that wish to inspect and survey boaters at specific locations.

Strategy 5B: Implement an inspection program for vessels used during construction in aquatic situations.

5B1. Develop and implement requirements as provided in permits that vessels such as barges, tugs, work boats, tenders, or similar vessels be required to be ANS free prior to being launched or used on or in North Dakota's waters. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

5B2. Provide technical assistance to permitting agencies such as the Army Corps of Engineers, Department of Health, State Water Commission, water boards, and other agencies or entities that issue permits for construction on inspection protocols.

5B3. Owner/operator survey during the inspection will determine where the vessel has been, where the vessel will be used, and the owner/operators awareness of ANS problems and prevention.

Strategy 5C: Implement an inspection program for equipment used in construction in aquatic situations.

5C1. Develop and implement requirements as provided in permits that equipment used in aquatic situations are required to be ANS free prior to their being launched or used on or in North Dakota's waters. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

5C2. Provide technical assistance to permitting agencies such as Army Corps of Engineers, Department of Health, State Water Commission, water boards, and other agencies or entities that issue permits for construction on inspection protocols.

5C3. Owner/operator survey during the inspection will determine where the equipment was last used, where the equipment will be used, and the owner/operators awareness of ANS problems and prevention.

OBJECTIVE 6: WHERE FEASIBLE, CONTROL AND ERADICATE PIONEERING OR ESTABLISHED AQUATIC NUISANCE SPECIES THAT HAVE SIGNIFICANT IMPACTS ON NATIVE OR DESIRABLE SPECIES.

Problem Addressed: Well-established ANS populations are the most likely to be noticed and are the most difficult to address. ANS infestations are best controlled in the early stages of initial infestations. Usually, it is too late or too expensive to eradicate an invasive species once it has reached the threshold level where rapid expansion is occurring. While the common management solution for a well-established ANS infestation is learning to live with the problem. The public and the resource agency or field biologist is just willing to accept the loss of aquatic resources. This is not the preferred nor is it the professional approach to natural resource management. The resource and economic impacts outweigh the funds required to eradicate a new infestation.

The key to any eradication is to identify the problem early, cooperation among all involved parties, and take needed, effective steps to eliminate the problem. No single

agency or other entity is responsible for developing a comprehensive eradication and control plan to quickly and effectively deal with initial ANS infestations.

Action: Provide technical and planning support for the existing management infrastructure in North Dakota.

Current agencies with activities or designated for future activities: Department of Agriculture, Game and Fish Department, Department of Parks and Recreation, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Department of Health, State Water Commission, water boards, weed boards

Strategy 6A: Control known nuisance populations where economically and technically feasible.

6A1. Develop and implement aquatic nuisance weed management plans.
6A2. Develop and implement aquatic nuisance animal management plans.
6A3. Provide technical assistance to watershed councils, conservation districts, irrigation districts, lake associations, and other groups for development of management plans. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

OBJECTIVE 7: INFORM THE POLICY MAKERS ABOUT THE RISKS AND IMPACTS OF AQUATIC NUISANCE SPECIES.

Problem Addressed: Lawmakers must be informed about the negative impact of ANS to North Dakota's resources and that ANS problems will affect all North Dakotans. Inform legislators about the shortcomings of current laws and agency mandates. Provide interested legislators the framework of ANS laws to protect and conserve the state's resources.

Action: Provide concise and in-depth information to those who will be making decisions on ANS problems and formulating legislation on ANS control.

Current agencies with activities or designated for future activities: Game and Fish Department, Pacific States Marine Fisheries Commission, U.S. Forest Service, North Dakota State University, Extension Service, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, PPL North Dakota

Strategy 7A: Educate public officials about the problems of ANS and how ANS are spread.

7A1. Create media presentations and accompanying information on ANS concerns, impacts, and the need for proactive prevention efforts. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

7A2. Provide interested law makers pertinent points to be considered in crafting legislation to prevent the introduction or spread of ANS. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

OBJECTIVE 8: INCREASE THE AQUATIC NUISANCE SPECIES KNOWLEDGE BASE AND DISSEMINATE THAT KNOWLEDGE IN NORTH DAKOTA THROUGH COMPILING DATA, CONDUCTING RESEARCH, AND INFORMATIONAL PUBLICATIONS.

Problem Addressed: Little is known about the extent and magnitude of the ANS problems in North Dakota. In fact, there may be many nonindigenous species in North Dakota than are not recognized. Information and research is needed to quantify and clarify the effects that ANS are having or would have in North Dakota. The explicit threats to North Dakota posed by specific ANS and the mechanism responsible for transferring those organisms are not well documented. The ability to quickly and effectively respond to new ANS is hindered because quick access to information on taxonomy, management or eradication methods is not readily available. Managers lack quick access to knowledge about eradication and control methods.

Action: Complete monitoring of North Dakota waters to determine what ANS are present. Provide a technical and information infrastructure for managers to easily access.

Current agencies with activities or designated for future activities: Game and Fish Department, North Dakota State University, University of North Dakota, U.S. Fish and Wildlife Service, Pacific States Marine Fisheries Commission, Department of Agriculture

Strategy 8A: Research ANS for their impact on biota utilizing regional efforts and literature searches.

8A1. Develop a better understanding of life histories and the impacts of introduced aquatic plants and animals.

8A2. Evaluate the potential for aquarium and live food fish to serve as vectors of disease and parasites to native fish populations.

Strategy 8B: Research management alternatives for their effect on ANS and native species.

8B1. Investigate the relationship between human-induced disturbance of aquatic and riparian systems and ANS invasion, establishment, and impacts.

8B2. Investigate and develop or adapt existing traditional methods of managing problems to meet the challenges of ANS.

8B3. Compile a set of recommended and acceptable eradication and control methods for high risk species.

Strategy 8C: Facilitate the collection and dispersal of information, research, and data on ANS in North Dakota.

8C1. Create a central repository for reference materials and a central data base on ANS infestations. – Status: PARTIALLY COMPLETED, ON-GOING EFFORTS - see 2004 Progress Report (attached)

8C2. Maintain a list of taxonomic experts for ANS identification.

The objectives and strategies make up the core of North Dakota's statewide aquatic species management plan. The strategies are to be accomplished by the coordinator and AISC. Completion of these strategies will protect and conserve the state's public aquatic resources from degradation by ANS.

PUBLIC INVOLVMENT

North Dakota's aquatic resources are at risk from ANS and it is the public who has the greatest stake in any outcome and they will be the most affected by an infestation. It is important the public and private sectors understand the problems and impacts to them caused by ANS. This understanding can only come about with effective communication on ANS problems, what solutions exist, and the impacts from ANS solutions to all affected parties. Communication must be two-way and meaningful, which will result in impacted parties having ownership of solutions. It will be the responsibility of the agencies and entities that make up the AISC to communicate with groups they traditionally work with. These groups can use their established lines of communication to provide the quickest dissemination of information. The same lines of communication will be used to impacted groups to communicate with the AISC about problems and their solutions. It is important that the AISC includes a mix of state agencies, private entities, and the public sector. The AISC being a blend of groups and individuals will allow for the greatest public spectrum to be informed in the most efficient manner.

The AISC meetings will be open to the public, the public will be encouraged to attend those meetings, and all reports of those proceedings will be open to the public. Individuals' comments recorded during angler surveys will be another source of public input for the AISC. There will be a strong, continuous effort to have the public involved in AISC meetings and the direction that ANS prevention efforts are taking.

The public involvement will create the public's ownership and buy-in to ANS solutions resulting in achieving the desired results. Desired results can simply be stated as preventing ANS infestation in North Dakota and a continuation of the aquatic resources currently being enjoyed. To this end, the public must accept and participate in the solutions to stop the spread of ANS.

PRIORITIZING OBJECTIVES' STRATEGIES FOR

There must be a decision if: 1) each strategy will receive the same effort of man-power, time, and monies; 2) only focusing on the strategy(s) with the highest likelihood of completion; 3) do the strategy(s) with the best cost to likely prevention ratio; or 4) there be a balanced approach. The balanced approach is a combination of focusing on areas of high risk for a reasonable expenditure of man-power and monies, but an effort to address all likely avenues of ANS transfer. This balance method will be used in North Dakota's ANS prevention efforts. The prioritized strategies for North Dakota's balanced ANS prevention efforts are summarized below.

1. Designation of an Aquatic Nuisance Species coordinator (ANS-Coordinator) for the North Dakota Game and Fish Department. The position will be funded partially from federal ANS grants and matching monies. The coordinator will be responsible for the implementation of other objectives and strategies as funds are made available.

2. The ANS-Coordinator will develop the format and membership of the Aquatic Invasive Species Committee (AISC) which is an advisory board to the North Dakota Game and Fish Department's ANS prevention efforts. AISC will work with the ANS-Coordinator for ANS prevention, monitoring, enforcement, and research efforts undertaken by various state, public entities, and private organizations. Following the ND-Plan will allow for collaboration between local, regional, and national ANS prevention efforts.

3. The coordinator and AISC will work with state entities, private organizations, and impacted parties to heighten the awareness of ANS problems and the need to take proactive precautions before problems develop. Those entities with regulatory authorities will be encouraged to become involved by including prudent, reasonable, and practical prevention protocols for the importation or spread of ANS into or within the state.

4. The AISC, with the input of qualified individuals from state entities and impacted organizations, will develop a list of ANS for consideration by the Director of the North Dakota Game and Fish Department. The Director will establish North Dakota's list of ANS which will be reviewed annually.

5. Agencies will continue educational efforts to inform the public and the private sector of ecological and economical impacts resulting from ANS infestations. Agencies will increase outreach efforts in nontraditional venues like retail and service industries, municipal water plants, power generation facilities, and commercial ventures (i.e., pet trade, plant nurseries, live fish bait wholesalers and retailers, aquaculture, etc.). Outreach will include increased use of the media, with messages directed at target audiences. Also, promotional items will be used to encourage compliance with ANS prevention protocols. It will

take reoccurring educational messages placed in different formats, but having the same theme to provide the desired results of ANS prevention. The messages must give individuals and entities their ownership in solving the problem. The ANS prevention campaign is a combination of educating those who will be impacted, reinforcing the prevention message, using the right tools to achieve the desired results of education and compliance, and having the funds to accomplish these efforts.

6. Continue with the current monitoring efforts of North Dakota waters and the inclusion of questions in periodic angler/boater surveys at select waterbodies or in statewide questionnaires from individuals selected from a pool of fishing and hunting license holders. Expand monitoring efforts to include cooperating agencies and volunteers.

7. Continue to interview North Dakotans and nonresidents to determine their knowledge of ANS problems and awareness of prevention methods. These direct individual contacts will be part of routine surveys at select waterbodies and from a pool of names of resident and nonresident license holders.

8. Inspect boats used for fishing, hunting, pleasure, commercial vessels, and construction equipment if ANS are present. Provide verbiage to agencies or entities that issue construction permits to allow for the coordinator to inspect vessels or equipment used in aquatic situations.

9. Provide information and advice to the governor, the governor's cabinet, legislators, local governments, tribal governments, and members of the judicial system about ANS risks, prevention and management options. Providing technical support for modifications to laws and promulgation regulations that can help protect North Dakota from ANS damages.

10. Provide matching funds for partnerships between government and private sector such as angling clubs, chambers of commerce and tourism, power companies, and other groups that will be impacted by ANS, to increase collaboration on ANS prevention and management projects. The matching funds will allow for local groups to secure educational materials and to provide materials to targeted audiences.

11. Provide education for law enforcement institutions and solicit their cooperation to enforce existing laws and regulations. This need for enforcement may require some new legislation that deals with ANS problems and provides enforcement groups with the necessary authority to deal with ANS prevention and management.

BUDGETING

The funds used by the AISC and coordinator will be a combination of federal funds via the U.S. Fish and Wildlife Service's ANS Task Force or other federal funding resources, government grants (e.g., from the Western Regional Panel), funds provided as in-kind money or services by the North Dakota Game and Fish Department, other state agencies, or other entities (e.g., grants from Fish American Foundation, public trusts, or endowments). ANS efforts will require partnerships between state and federal agencies, public, and private interests where each bears part of the costs of preventing ANS infestations.

The proposed budget is based on being a reasonable initial funding. The ANS-Coordinator and AISC will focus efforts and money on those strategies that have been identified in the ND-Plan. Those areas identified in the ND-Plan are those known to provide the greatest level of ANS prevention and provide education on ANS problems in North Dakota. Table 1 summarizes the budget required for undertaking and completing these high priority strategies of the ND-Plan.

The budget is estimated at $225,000 per biennium ($125,000 annually) with 10 percent of the funding held in contingency by the coordinator. The ANS-Coordinator will utilize the contingency fund to cover unexpected expenses, activities of opportunity such as advertising at trade shows, educational seminars, and unknown events, which will benefit ANS prevention.

Implementation of these strategies is based on the ND-Plan being accepted and funding provided by the U.S. Fish and Wildlife Service's ANS-Task Force and appropriations made available and dedicated to ANS prevention by the North Dakota Legislature. Additional information on the budget, by topic and by year, can be found in Appendix E and includes a listing of what budgets and staffing will be needed by the ANS-Coordinator, AISC, and various state agencies, to conduct ANS prevention activities. When the ND-Plan is in place, it is likely that various agencies will request ANS funds for their agency activities associated with or in conducting ANS prevention activities.

North Dakota governor's approval of the ND-Plan is a necessary precursor for application for federal matching funds. The ND-Plan and the funding of those ANS prevention activities is based on receiving sufficient federal funds to accomplish the strategies outlined in this document.

Table 1. Annual budget required to complete selected Strategies from the ND-Plan that best utilize limited funding.

	Time Frame				
	Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*
	01 JUL 05 to 30 JUN 06	*01 JUL 06 to 30 JUN 07*	*01 JUL 07 to 30 JUN 08*	*01 JUL 08 to 30 JUN 09*	*01 JUL 09 to 30 JUN 10*
Overall man-yr	1.59	1.59	1.59	1.59	1.59

Accumulative Salaries	$60,150	$60,150	$60,150	$60,150	$60,150
Education: Field Staff and Law Enforcement of various agencies	$2,750	$1,750	$1,750	$1,750	$1,750
Educational Materials	$6,000	$500	$500	$500	$5,000
Mass Media	$14,500	$14,500	$14,500	$14,500	$14,500
Data Collection	$750	$750	$750	$750	$750
Signs	$2,250	$250	$250	$2,250	$1,000
Contracts	$7,500	$17,500	$17,500	$20,000	$5,000
Grants	$7,000	$7,000	$7,000	$7,000	$7,000
Promotional	$5,000	$5,000	$500	$500	$1,500
Meetings	$7,500	$7,500	$7,500	$7,500	$7,500
Monitoring Equipment	$500	$1,000	$1,000	$250	$250
Overall Funding and Strategy Implementation Costs	***$113,900***	***$115,900***	***$111,400***	***$115,150***	***$104,400***

* North Dakota Game and Fish Department, Department of Agriculture, North Dakota Department of Transportation, North Dakota Department of Parks and Recreational, Tribal resource management departments, Department of Health, State Water Commission, Natural Resource Boards, Water Boards, Irrigations or Conservancy Districts, city park boards, and similar agencies or entities

PROMOTING DEVELOPMENT OF AQUATIC NUISANCE SPECIES REGULATIONS

Part of AISC's role is to be a source of information and advice for North Dakota lawmakers. The information provided to North Dakota's Legislators will include both the environmental impacts of ANS, and the negative economic and quality-of-life consequences of ANS infestations. Legislators will be provided the concepts that will improve or provide authorities for ANS prevention, authorize funding for implementing management strategies – all with the intent of focusing first on prevention rather than reactive management once ANS problems become established. The goal is for state agencies with resource responsibilities to undertake ANS prevention as a part of their duties.

North Dakota represents a unique aspect for ANS management because of six factors: 1) the state has a small number of residents; 2) government entities have and do work well together to accomplish needed tasks; 3) environmental conditions preclude many ANS problems; 4) few ANS problems are already established; 5) private and commercial sectors are locally operated; and 6) the state's residents place a high value on outdoor recreational resources. In addition, North Dakota has begun the process of determining vectors of ANS importation, which allows focus on immediate problems of high-risk ANS introduction pathways. With these factors in mind, the ND-Plan will reflect those needs for North Dakota.

State agencies and entities have the authority and are responsible for the best management of the state's resources. The agencies are bound by the burden of "Public Trust.," which is not to allow damage to the resources they are to protect and to the state's other resources at the benefit of their mission. These agencies need to include involvement in ANS prevention and management as part of their efforts.

An example of issues needing attention by North Dakota's Legislature is provided in Appendix F. The following issues should be considered in ANS legislation and development of ANS regulations:

- Provide that agencies/entities that have a stake in the protection of the state's aquatic resources to be tasked with:
  - North Dakota Game and Fish Department should organize and chair the Aquatic Invasive Species Committee, and this group be recognized as the state's ANS coordinating mechanism, and to provide advisory services for state agencies, private entities, and the public sector.
  - Develop the list of aquatic species, plants, animals, and pathogens that are aquatic threats to North Dakota, and that these species should not be brought into or moved within North Dakota,
  - Provide the listing of those waters which have ANS infestations and provide protocols to prevent the spread of the problem.

- Provide agencies authorities/responsibilities/guidance for the following:
  - North Dakota Game and Fish to apply for available funding from state, federal or private sources for ANS activities.
  - State agencies should provide for reasonable and effective prevention protocols (REPPs) for ANS – examples are:
    - ✓ Department of Health's construction or water permits;
    - ✓ State Water Commission's construction permits, water projects, or water storage permits; and
    - ✓ Natural Resource Boards and Water Resource Boards in drainage or water course clean-out, and for the quarantining of waterbodies when ANS are present.
  - Department of Agriculture to include ANS inspections as part of their plant nursery and garden center inspections and enforce ANS regulations.
  - North Dakota Game and Fish Department to provide regulations on ANS prevention from the importation in baits, live fish used for rearing, stocking, or sale in the pet trade, fish transported into or within the state on or in boats, trailers, equipment or vehicles, associated inspections and enforcement of regulations.
  - Department of Parks and Recreation shall include ANS educational signs and materials in their published literature, and enforce ANS regulations on the movement of ANS into or within state lands.
  - Department of Tourism to include ANS educational material in literature on North Dakota's aquatic resources.

- Department of Transportation and State Highway Patrol include ANS prevention in their vehicle inspections and enforce ANS regulations.
- All agencies and other entities receiving public funds include ANS educational messages on their aquatic-oriented educational material.

- The Legislature should provide to state agencies:
  - Expanded authorities for agencies and entities involved in the management of North Dakota's resources to include ANS prevention and management.
  - Regulations promulgated to prevent ANS movement into or within the state.
  - Provide for a system of fines/legal forfeitures to make ANS infractions as a Class B misdemeanor.
  - Recognize the need for the coordinator and AISC as an advisory board to conduct ANS education/prevention for the state's aquatic resources

The preceding items can serve as a base for constructing North Dakota's regulations to prevent the importation and spread of ANS.

NORTH DAKOTA STATEWIDE ANS MANAGEMENT PLAN

The ND-Plan is a very reasonable approach to address ANS challenges facing North Dakota and its citizens. The North Dakota Game and Fish Department will organize the Aquatic Invasive Species Committee (AISC) and a designee from within the North Dakota Game and Fish will serve as coordinator for ANS prevention efforts. The AISC will be made up of public and private sectors, and of inter-agency staff, and be responsible to all North Dakotans and to all of North Dakota's needs. Appendix G provides a listing of those agencies or entities and individuals that make up the ad hoc AISC committee which developed the North Dakota statewide aquatic nuisance species management plan (ND-Plan). This group should become the nucleolus for the AISC as they can continue ANS prevention efforts.

The ND-Plan will be effective as it will be responsive to public, agency or entity input, and natural resource involvement. The AISC will be a clearing house to provide information to others or the collection of information and input to make informed decisions on ANS prevention. Appendix H provides a summary of the information flow for the AISC. Appendix I contains the details on the two-way communication that agencies and entities will be responsible, with affected parties and organizations that they typically work with. The use of the various agencies for communication utilizes established lines of communication and the knowledge of specific needs of impacted or affected parties. Two-way communication is critical for the ND-Plan to provide for effective prevention of ANS and for educational needs.

The ND-Plan was developed through a series of meetings by the AISC, public meetings, and review of existing information on other states' ANS plans, and other information. See Appendix J for additional information on the meetings held to develop the ND-Plan. The public was made aware of the ND-Plan during the North Dakota

Game and Fish Department's eight advisory board meetings held in fall of 2004. The public comment period began in early November of 2004. The public comment period was 44 days and closed on December 14, 2004. In addition to the public, private and public organizations and entities, and state agencies were encouraged to comment on the ND-Plan. If individuals or organizations provided information after that date, it was included as part of the record of comments. A summary of the comments provided by the public and other agencies to the coordinator is provided in Appendix K.

The ND-Plan was reviewed by ANS coordinators from various states, and individuals from federal and state agencies. See Appendix L for additional information on this group. The comments and advice of this group allowed the ND-Plan to be complete in design and scope of need and work. The comments by the public and private sector were limited, but the technical review teams agreed with the intent and form of the ND-Plan. See Appendix M for additional details from the technical review committee.

It is important that the ND-Plan contain sufficient foresight to meet any likely needs to manage against ANS. As part of managing against ANS, the ANS which pose the highest likelihood of impacting North Dakota were used in designing the ND-Plan. The ANS species which are felt most likely to become established and have the greatest impact to North Dakota are listed in Appendix N. Species listed here were taken from a document which outlines ANS potential and problems which North Dakota is likely to experience.

The number of problematic nonindigenous species in North Dakota is small; three fish species – common carp, grass crap, and goldfish – one invertebrate – rusty crayfish – and three plant species – curlyleaf pondweed, Eurasian watermilfoil, and purple loosestrife (a terrestrial plant and is managed as such). It is important that North Dakota keeps the number of ANS, both as species and points of infestation, low to protect the public's natural resources, and provide stability for the economic viability of the state. Appendix O provides a list of nonindigenous species found in North Dakota and lists those species which are to be considered as candidates for listing as ANS in North Dakota.

The guiding principle the ND-Plan focuses on is prevention is better and cheaper than dealing with an infestation. Prevention must include educating the traditional outdoor recreators such as boaters, hunters, anglers, and general water users such as municipalities, rural water lines, power production, cities, and the general public about the impacts of ANS. The ND-Plan's strategies are based on reaching a target audience with effective outreach that ends in ANS prevention protocols being undertaken voluntarily. Monitoring activities and determination of the ANS pathways will define where additional ANS prevention efforts are required. The ND-Plan is an efficient use of available funding to achieve the best outcome; prevention of ANS importation or movement within the state. The ANS regulations, which could be adopted for North Dakota, are simple, enforceable, and effective. The ND-Plan allows for collaboration with other states and federal ANS prevention activities.

The problems and activities needed to eliminate ANS are of importance in preparing the ND-Plan. Appendix P is the North Dakota Rapid Response Plan. This plan outlines how North Dakota will deal with an ANS infestation in the state or a location of primary concern. It is critical the newly detected ANS infestation be dealt with in a timely and effective manner. The planning must be done in advance so those involved with elimination efforts will have their tasks already identified.

The ND-Plan's objectives and strategies outline the major efforts in North Dakota ANS prevention efforts. Those needs are scaled to be accomplishable by the coordinator, AISC, and impacted parties. The ND-Plan is meant to be flexible, as one area is accomplished and goals reached, new items will be placed on the list of projects to be completed. The ND-Plan is meant to move forward with successful completion of projects, but will include some redundant issues to reinforce ANS prevention and updating precautions.

North Dakota agencies are already actively involved in ANS prevention efforts. It is important that these initial ANS prevention efforts are not diminished as any setback will cause future ANS prevention to be more difficult to achieve. The funding for these efforts need to continue and to be increased. The combination of federal and state funds and resources will allow for ANS prevention activities to continue at their current rate.

The ND-Plan is based on the recommendations for developing a statewide management plan that was provided by WRP, ANS-Task Force, and reflects the needs for North Dakota. The ND-Plan is a reasonable approach for ANS prevention and the ANS-Task Force should readily approve this plan. The management plan allows for oversight of activities, evaluation of the effectiveness of those activities, and reporting of findings. Midcourse corrections will be made when and if necessary to allow strategies to be accomplished.

It is understood that the program will need to continue as long as there are threats to North Dakota's aquatic resources. The initial program will have to be modified to address new situations and problems as they are identified.

PROGRAM MONITORING AND EVALUATION

The evaluation of any project is important to understand if the strategies are being accomplished and if the efforts to prevent ANS infestations are providing needed results. A key component in evaluations will be to determine public and private sector awareness of ANS problems. An important point is to understand what precautions these groups are using, where they are acquiring ANS prevention protocols, and what protocols they are using and are willing to use. An additional method of evaluating ANS prevention is to determine the establishment of new ANS in North Dakota and the spread of ANS populations now existing in North Dakota. The comparison of data set

over time will allow for agencies to understand what efforts have provided the best results in preventing ANS movement into or within the state.

GLOSSARY

Accidental introduction: Any introduction of nonindigenous aquatic species that occurs as the result of activities other than the purposeful or intentional introduction of the species involved, such as the transportation of nonindigenous species in ballast water or in water used to transport fish, mollusks, or crustaceans for aquaculture or other purposes.

ANS - aquatic nuisance species: A plant or animal species outside of its native range that threatens the diversity or abundance of native species, the ecological stability of infested waters, or commercial, agricultural, aquacultural, or recreational activities dependent on such waters, and cause negative economic or ecological impacts

Biocontrol: The use of living organisms, such as predators, parasites, and pathogens to control pest insects, weeds, or diseases.

Bio-fouling: The accumulation of living organisms in places where they are not wanted and in sufficient quantities that they cause management problems or unacceptable deleterious impacts.

Commercial venture: Those efforts by individuals to set up and operate a business or industry for profit, i.e., power production, fish rearing, irrigation districts, water diversions, plant nurseries, pet stores, bait dealers, food markets or restaurants dealing in live animals or plants, or similar ventures for gain of individuals or groups.

Control: Eradicating, suppressing, reducing, or managing invasive species populations, preventing the spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species, and to prevent further invasions.

Ecological integrity: The extent to which an ecosystem has been altered by human behavior; an ecosystem with minimal impact from human activity has a high level of integrity; an ecosystem that has been substantially altered by human activity has a low level of integrity.

Eradicate: The act or process of eliminating aquatic nuisance species.

Exotic: Any species or other variable biological material that enters an ecosystem beyond its historic range which is on a continental scale, including such organisms transferred from one ecosystem to another.

Intentional introduction: All or part of the process by which a nonindigenous species is purposefully introduced into a new area.

Invasive: A species that thrives and becomes established in a non-historical location or in a new location where it was not previously found, often to the determent of

species which were there before or to the negative impact of desirable species or native species in the new areas or to the ecosystem and habitats.

Nonindigenous species: Any species or other variable biological material that enters an ecosystem beyond its historic range which is typically the same region, including such organisms transferred to a new location on purpose, but these species may not have an injurious impact on the ecosystem or negative inter species relationships.

Pathogen: Any microbe or other organism that causes disease.

Pioneer infestation: A small ANS colony that has spread to a new area from an established colony.

Priority species: Any ANS that is considered to be a significant threat to North Dakota waters and is recommended for immediate or continued management action to minimize or eliminate their impact.

Watershed: An entire drainage basin including all living and nonliving components.

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Appendix A: **Section 1204 of the National Invasive Species Act of 1996**

SEC. 1204. STATE AQUATIC NUISANCE SPECIES MANAGEMENT PLANS.

(a)STATE OR INTERSTATE INVASIVE SPECIES MANAGEMENT PLANS.—

(1) IN GENERAL -- After providing notice and opportunity for public comment, the Governor of each State may prepare and submit, or the Governors of the States and the governments of Indian Tribes involved in an interstate organization, may jointly prepare and submit—

(A) a comprehensive management plan to the Task Force for approval which identifies those areas or activities within the State or within the interstate region involved, other than those related to public facilities, for which technical, enforcement, or financial assistance (or any combination thereof) is needed to eliminate or reduce the environmental, public health, and safety risk associated with aquatic nuisance species, particularly the zebra mussel; and

(B) a public facility management plan to the Assistant Secretary for approval which is limited solely to identifying those public facilities within the State or within the interstate region involved for which technical and financial assistance is needed to reduce infestations of zebra mussels.

(2) CONTENT -- Each plan shall, to the extent possible, identify the management practices and measures that will be undertaken to reduce infestations of aquatic nuisance species. Each plan shall—

(A) identify and describe State and local programs for environmentally sound prevention and control of the target aquatic nuisance species;

(B) identify Federal activities that may be needed for environmentally sound prevention and control of aquatic nuisance species and a description of the manner in which those activities should be coordinated with State and local government activities;

(C) identify any authority that the State (or any State or Indian Tribe involved in the interstate organization) does not have at the time of the development of the plan that may be necessary for the State (or any State or Indian Tribe involved in the interstate organization) protect public health, property, and the environment from harm by aquatic nuisance species; and

(D) a schedule of implementing the plan, including a schedule of annual objectives, and enabling legislation.

(3) CONSULTATION —

(A)In developing and implementing a management plan, the State or interstate organization should, to the maximum extent practicable, involve local governments

and regional entities, Indian Tribes, and public and private organizations that have expertise in the control of aquatic nuisance species.

(B) Upon the request of a State or the appropriate official of an interstate organization, the Task Force or the Assistant Secretary, as appropriate under paragraph (1), may provide technical assistance in developing and implementing a management plan.

(4) PLAN APPROVAL -- Within 90 days after the submission of a management plan, the Task Force or the Assistant Secretary in consultation with the Task Force, as appropriate under paragraph (1), shall review the proposed plan and approve it if it meets the requirements of this subsection or return the plan to the Governor or the interstate organization with recommended modifications.

(b)GRANT PROGRAM —

(1) STATE GRANTS -- The Director may, at the recommendation of the Task Force, make grants to States with management plans approved under subsection (a) for the implementation of those plans.

(2) APPLICATION -- An application for a grant under this subsection shall include an identification and description of the best management practices and measures which the State proposes to utilize in implementing an approved management plan with any Federal assistance to be provided under the grant.

(3) FEDERAL SHARE —

(A) The Federal share of the cost of each comprehensive management plan implemented with Federal assistance under this section in any fiscal year shall not exceed 75 percent of the cost incurred by the State in implementing such management program and the non–Federal share of such costs shall be provided from non–Federal sources.

(B) The Federal share of the cost of each public facility management plan implemented with Federal assistance under this section in any fiscal year shall not exceed 50 percent of the cost incurred by the State in implementing such management program and the non–Federal share of such costs shall be provided from non–Federal sources.

(4) ADMINISTRATIVE COSTS -- For the purposes of this section, administrative costs for activities and programs carried out with a grant in any fiscal year shall not exceed 5 percent of the amount of the grant in that year.

(5) IN–KIND CONTRIBUTIONS -- In addition to cash outlays and payments, in–kind contributions of property or personnel services by non–Federal interests for

activities under this section may be used for the non–Federal share of the cost of those activities.

(c) ENFORCEMENT ASSISTANCE -- Upon request of a State or Indian Tribe, the Director or Under Secretary, to the extent allowable by law and in a manner consistent with section 141 of title 14, United States Code, may provide assistance to a State or Indian Tribe in enforcing an approved State or interstate invasive species management plan.

Appendix B: **Authorities and Regulations Provided by the State of North Dakota.**

STATE OF NORTH DAKOTA AUTHORITIES AND REGULATIONS

North Dakota has a number of state agencies, which have statutory and regulatory authority over the management of pests and aquatic nuisance species. No single agency has complete authority, but the agencies should work together to resolve problems that will impact the State's resources. This section describes existing authorities related to ANS and the management and control of ANS. The complete set of Century Codes can be found at http://www.state.nd.us/lr/information/statutes/cent-code.html and should be reviewed in addition to the information provided here.

Although none of these agencies listed below have the express power to regulate aquatic nuisance species, the inherent doctrine of "Public Trust" would allow them act in the best interest of the State of North Dakota and for the resident's of the state.

DEPARTMENT OF AGRICULTURE

Key items: powers over the management, control and eradication of pests, noxious weeds, rodent and insect management and the use and application or storage of pesticides; control, maintenance, and eradication of noxious weeds and pests throughout the state, shall compile and keep current a list of noxious weeds and provide local authorities with information and a program with funding for the control or eradication of noxious weeds, enforcement of provisions by Highway Patrol, sheriffs, and other law enforcement officers within the state to prevent the dissemination of noxious weeds on highways, airways or waterways.

GAME AND FISH DEPARTMENT

Key items: authority to regulate the importation, introduction and transplanting of fish, fish eggs and other aquatic animals in to the waters of the state, issue permits for introduce any fish or fish egg into the public waters and the fish or fish eggs must be inspected for disease; the power to remove and dispose of fish deemed undesirable to the best interest of the public; rules for release of fish into the state, and the supervision of live bait wholesalers

STATE DEPARTMENT OF HEALTH

Key items: includes the director of the Game and Fish Department, through the State Department of Health with cooperation of the State Water Commission; protect the present and future use of such waters for, among other reasons, the propagation of fish and aquatic life and wildlife.

STATE WATER COMMISSION AND STATE ENGINEER

Key items: includes authority over projects involving recreational use or wildlife conservation; permit issued by the state engineer, unless the use is for domestic, livestock or for fish, wildlife (including purposes of propagating, sustaining fish and wildlife resources, and for the development and maintenance of water areas) or other recreational need; the authority to control and supervise all water and wildlife

conservation projects and wildlife reservations; the is the Water Resource District Act has express power to order the removal of weeds and pests that hinder waterflows

HIGHWAY PATROL AND OTHER LAW ENFORCEMENT

Key items: enforcement of laws regarding pests, pesticides, noxious weed control, weed control, and game and fish generally require other law enforcement agencies within the state to aide and assist in the enforcement of laws and regulations

DEPARTMENT OF AGRICULTURE

The Commissioner of Agriculture or the commissioner's authorized representative with the assistance of the North Dakota State University extension service has broad powers over the management, control and eradication of pests, noxious weeds, rodent and insect management and the use and application of pesticides.

CHAPTER 4-33 PLANT PESTS

4-33-01. Definitions. In this chapter, unless the context or subject matter otherwise requires:

1. "Certificate" means a document issued or authorized by the commissioner indicating that a regulated article is not contaminated with a pest.

2. "Commissioner" means the commissioner of agriculture or the commissioner's authorized representative.

3. "Host" means any plant or plant product upon which a pest is dependent for completion of any portion of its life cycle.

4. "Infested" means actually infested or infected with a pest or so exposed to infestation that it would be reasonable to believe that an infestation exists.

5. "Move" means to ship, offer for shipment, receive for transportation, carry, or otherwise transport, move, or allow to be moved.

6. "Permit" means a document issued or authorized by the commissioner to provide for the movement of regulated articles to restricted destinations for limited handling, utilization, or processing.

7. "Person" means any individual, corporation, company, society, or association, or other business entity.

8. "Pest" means any invertebrate animal, pathogen, parasitic plant, or similar organism which can cause damage to a plant or part thereof or any processed, manufactured, or other product of plants.

9. "Phytosanitary certificate" means an international document issued or authorized by the commissioner stating that a plant or plant product is considered free from quarantine

pests and practically free from injurious pests and that they are considered to conform with the current phytosanitary regulations of the importing country.

10. “Plant” means agronomic field crops, horticultural crops, and native and tame grasses used for livestock production.

11. “Regulated article” means any article of any character as described in the quarantine carrying or capable of carrying the plant pest against which the quarantine is directed.

Source: S.L. 1969, ch. 89, § 1; 1975, ch. 62, § 1; 1983, ch. 104, § 1; 1987, ch. 90, § 1.

4-33-04. Authority for plant quarantine. The commissioner is authorized to quarantine this state or any portion thereof when he determines that such action is necessary to prevent or retard the spread of a pest within or from this state and to quarantine any other state or portion thereof whenever he determines that a pest exists therein and that such action is necessary to prevent or retard its spread into this state. Before promulgating his determination that a quarantine is necessary, the commissioner shall, after due notice to interested parties, hold a public hearing under such rules as he shall promulgate, at which hearing any interested party may appear and be heard either in person or by attorney, provided, the commissioner may impose a temporary quarantine for a period not to exceed ninety days during which time a public hearing, as provided herein, must be held if it appears that a quarantine for more than the ninety-day period will be necessary to prevent or retard the spread of the pest. The commissioner shall give notice of the establishment of the quarantine in such newspapers in the quarantined area as he may select. The commissioner may limit the application of the quarantine to the infested portion of the quarantined area and appropriate environs, to be known as the regulated area, and may, without further hearing, extend the regulated area to include additional portions of the quarantined area upon publication of a notice to that effect in such newspapers in the quarantined area as he may select or by direct written notice to those concerned.

Following establishment of the quarantine, no person may move any regulated article described in the quarantine or move the pest against which the quarantine is established, within, from, into, or through this state contrary to regulations promulgated by the commissioner. Notice of the regulations must be published in such newspapers in the quarantined area as the commissioner may select.

The regulations may restrict the movement of the pest and any regulated articles from the quarantined or regulated area in this state into or through other parts of this state or other states and from the quarantined or regulated area in other states into or through this state and shall impose such inspection, disinfection, certification, or permit and other requirements as the commissioner deems necessary to effectuate the purposes of this
chapter.

Source: S.L. 1969, ch. 89, § 4.

4-33-05. Authority for abatement and emergency measures. When ever the commissioner finds any article that is infested or reasonably believed to be infested or a host or pest exists on any premise or is in transit in this state, he may, upon giving notice to the owner or his agent in possession thereof, seize, quarantine, treat, or otherwise dispose of such pest, host, or article in such manner as the commissioner deems necessary
to suppress, control, eradicate, or to prevent or retard the spread of a pest, or the commissioner may order such owner or agent to so treat or otherwise dispose of the pest, host, or article. Where large areas or metropolitan areas, involving many people, are to be treated, notice may be by means of newspaper, radio, or other news media. Such notice must prominently appear, at least ten days prior to treatment, in at least three issues of a daily paper having local coverage.

Source: S.L. 1969, ch. 89, § 5.

4-33-06. Authority for inspections — Warrants. To effectuate the purposes of this chapter, the commissioner may with a warrant or the consent of the owner make reasonable inspection of any premises in this state and any property therein or thereon and may without a warrant with the assistance of any law enforcement agency provided for in this code stop and inspect, in a reasonable manner, any means of conveyance moving within this state upon probable cause to believe it contains or carries any pest, host, or other article subject to this chapter, and may make any other reasonable inspection of any premises or means of conveyance for which under the Constitution of the United States and the Constitution of North Dakota, no warrant is required.

The appropriate district courts in this state may issue warrants for such inspections upon a showing by the commissioner that there is probable cause to believe that there exists in or on the property to be inspected a pest, host, or other article subject to this chapter.

Source: S.L. 1969, ch. 89 sec. 6; 1991,
Ch. 326, sec. 2

PESTICIDE ACT

4-35-01. Title. This chapter must be known as the “North Dakota Pesticide Act of 1975”.
Source: S.L. 1975, ch. 63, § 1. Cross-References.
Insecticide, Fungicide, and Rodenticide Act of 1947,
see ch. 19-18.

4-35-02. Creation of pesticide control board. There is hereby created the pesticide control board, hereinafter also called the “board”, consisting of the commissioner of agriculture, the director of the cooperative extension division of the North Dakota state university of agriculture and applied science, and the director of the agricultural experiment station at North Dakota state university of agriculture and applied science. The commissioner of agriculture must be chairman of the board and is responsible for
the enforcement of this chapter. The board shall meet at the call of the chair. The members of the board must be compensated for their expenses in performing their duties under this chapter at the same rate as other state officials and the board’s expenses must be paid from funds provided for the administration of this chapter to the commissioner of agriculture. The board may act through the office of the commissioner of agriculture, and
one person on the commissioner’s staff may be specifically responsible to, or act as the state-level agent of, the board.

Source: S.L. 1975, ch. 63, § 2.

4-35-03. Enforcing agency. This chapter must be administered by the pesticide control board, hereinafter referred to as the “board”.

Source: S.L. 1975, ch. 63, § 3.

4-35-05. Definitions. As used in this chapter:

9. “Environment” includes water, air, land, and all plants and man and other animals living therein, and the interrelationships which exist among these.

17. “Person” means any individual, partnership, association, fiduciary, corporation, or any organized group of persons, whether or not incorporated.

18. “Pest” means:

a. Any insect, snail, slug, rodent, nematode, fungus, weed; or

b. Any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other micro-organism, except viruses, bacteria, or other micro-organisms on or in living man or other living animals which are annoying or otherwise injurious or harmful to agriculture, health, and the environment.

19. “Pesticide” means:

a. Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest; and

b. Any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

27. “Unreasonable adverse effects on the environment” means any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide.

28. “Weed” means any plant which grows where not wanted.

29. “Wildlife” means all living things that are neither human, domesticated, nor, as defined in this chapter, pests, including, but not limited to, mammals, birds, and aquatic life.

Source: S.L. 1975, ch. 63, § 5; 1983, ch. 82, § 7; 1985, ch. 103, § 4

4-35-06. Pesticide control board to administer chapter and adopt regulations.

1. The pesticide control board shall administer the provisions of this chapter and has authority to issue regulations in conformance with provisions of chapter 28-32 to carry out the provisions of this chapter. Such regulations may prescribe methods to be used in the application of pesticides. Where the board finds that such regulations are necessary to carry out the purpose and intent of this chapter, such regulations may relate to the time, place, manner, methods, materials, and amounts and concentrations, in connection with the application of the pesticide, and may restrict or prohibit use of pesticides in designated areas during specified periods of time and shall encompass all reasonable factors which the board deems necessary to prevent damage or injury by drift or misapplication to:

a. Plants, including forage plants, on adjacent or nearby lands.

b. Wildlife in the adjoining or nearby areas.

c. Fish and other aquatic life in waters in proximity to the area to be treated.

d. Persons, animals, or beneficial insects. In issuing such regulations, the board shall give consideration to pertinent research findings and recommendations of other agencies of this state, the federal government, or other reliable sources.

NOXIOUS WEED CONTROL

63-01.1-01. Control and eradication of noxious weeds. It shall be the duty of every person in charge of or in possession of land in this state, whether as landowner, lessee, renter, or tenant, under statutory authority or otherwise, to eradicate or to control the spread of noxious weeds on those lands.

Source: S.L. 1971, ch. 594, § 1; 1981, ch. 638, § 1.

63-01.1-02. Definitions. As used in this chapter:

1. “Board member area” means a geographical area within the county from which a member of the weed board is appointed.

2. “Commissioner” means the agriculture commissioner or the commissioner’s designee.

3. “Control” means to prevent the spread of any noxious weed, designated by the commissioner or other control authority, by seed or any other propagating part or, if authorized, to suppress, eradicate, or prevent or retard the spread of a pest.

4. “Control authority” means the commissioner, the county weed board, and, pursuant to the county weed board’s authorization, the county weed control officer.

5. “County weed board” means members of the board of each county as appointed pursuant to section 63-01.1-04.

6. “County weed control officer” means the person designated by the county weed board to be responsible for the operation and enforcement of this chapter within each county.

7. “Eradicate” or “eradication” means to destroy a plant or, if authorized, a pest so that it is not viable.

8. “Landowner” means any owner of federal, state, municipal, or private land, under statutory authority or otherwise. The term does not include a lessee, renter, tenant, operator, or an owner of any easement or right of way.

9. “Noxious weed” means any plant propagated by either seed or vegetative parts which is determined by the commissioner after consulting with the North Dakota state university extension service, or a county weed board after consulting with the county extension agent, to be injurious to public health, crops, livestock, land, or other property.

10. “Operator” means the person chiefly responsible for the farming or other operations being performed on the land, whether for self benefit, or for the benefit of the landowner or another.

11. “Person” means any individual, partnership, firm, corporation, limited liability company, company, society, association, the state, or any department, agency,

or subdivision thereof, or any other entity which occupies or owns land or which causes noxious weed seeds or propagating parts to be disseminated or transported in this state.

12. “Pest” means any pest defined in section 4-33-01 and includes a prairie dog.

13. “Township road” means a public road that is an improved road, constructed, maintained, graded, and drained by the township, or county in the case of an unorganized township. A township road includes a street in an unincorporated townsite and does not necessarily have to be surfaced. A sodded road is not a township road. In order for a section line to be a township road it must be graded and drained and be an improved maintained road. A township road is a public road that is not designated as part of a county, state, or federal-aid road system and is not located in an incorporated city.

Source: S.L. 1971, ch. 594, § 1; 1979, ch. 651, § 1; 1981, ch. 638, § 2; 1983, ch. 693, § 1; 1993, ch. 54, § 106; 1993, ch. 610, § 1; 1995, ch. 603, § 1.

63-01.1-03. State weed control authority — Agriculture com missioner — Powers and duties.

1. The duty of enforcing this chapter and carrying out its provisions and intent is vested in the commissioner. The commissioner shall cooperate with other weed control authorities.

2. The commissioner shall determine which weeds are noxious for the purposes of a state list of noxious weeds after consulting with the North Dakota state university extension service and shall compile and keep current a list of noxious weeds.

3. The commissioner shall outline procedures, prepare and supply official notices, posters, report forms, and other documents needed in carrying out this chapter. The commissioner shall supply these documents to weed control officers, county, township, and city authorities, and others as needed to carry out an effective weed control program or, if authorized, pest control program. The commissioner shall prepare notices or posters including the noxious weed list, rules, dates for controlling, and other compliance requirements for printing in official newspapers or for posting at least annually.

4. The commissioner shall cooperate with the county weed board, county weed control officers, highway patrol officers, county sheriffs, and others in enforcing this chapter. The commissioner shall also encourage the North Dakota state university extension service to disseminate information and to conduct educational campaigns with

respect to eradication and control of noxious weeds or, if authorized, pests.

5. The commissioner upon receiving a written complaint shall immediately refer the complaint to the proper weed control officer or control authority.

6. The commissioner shall encourage the cooperation of agencies of both the federal and state governments in furtherance of the purposes of this chapter.

7. The commissioner may adopt rules to carry out the intent of this chapter.

8. The commissioner may require operational or program reports from weed control authorities or weed control officers regarding weed control progress and activity in the state and, if authorized, pest control progress and activity in the state.

9. The commissioner shall call an annual meeting of all weed control officers, either statewide or by areas, to review the intent, operation, procedures, and accomplishments under this chapter and may also request the North Dakota state university extension service or others to present educational information on weed control practices or, if authorized, pest control practices. Weed control authority members must be invited to attend meetings called pursuant to this subsection.

Source: S.L. 1971, ch. 594, § 1; 1979, ch. 651, § 2; 1981, ch. 638, § 3; 1993, ch. 610, § 2.

63-01.1-03.1. County weed board — Jurisdiction. All land within the boundaries of North Dakota, including all federal, state, private, and municipally owned lands, is included in the county weed board's jurisdiction within the county in which the land is located.

Source: S.L. 1981, ch. 638, § 4.

63-01.1-12. Preventing dissemination of noxious weeds.

1. To prevent the dissemination of noxious weeds by machinery; trucks, harvesting, or other farm equipment, or during transportation of plants, forage, screenings, dirt, and other articles which may be transported by any means, the commissioner shall, from time to time, publish a list of the possible methods of disseminating the propagating parts of such weeds.

2. All operators of tillage, seeding, and harvesting equipment shall be required to clean such equipment to prevent the spread of noxious weeds by seed or other propagating parts prior to moving such equipment on public highways, airways, waterways, or by any other means of conveyance, public or otherwise. Trucks or trailers transporting grain screenings shall be constructed

and covered so as to prevent weed seed dissemination. Scattering and dumping on land or in water of any material containing noxious weed seeds or propagating parts is prohibited unless such material has been processed or treated or is buried sufficiently deep to destroy seeds and other propagating parts.

Source: S.L. 1971, ch. 594, § 1; 1979, ch. 651, § 7.

63-01.1-12.1. Quarantine period — Materials or farm products and area defined.

1. Whenever the commissioner~ the county weed board, or anyone authorized thereby finds any area of the state to be infested with noxious weeds, and it is established that materials or farm products from that area are liable to spread noxious weeds into other areas to the injury of others, the commissioner shall, without unnecessary delay, declare a quarantine against the area to prevent the transfer of materials or farm products from the quarantined area. When it is ascertained that noxious weeds are likely to be introduced into this state by the importation of materials or farm products, the commissioner shall declare a quarantine against the importation of those materials or farm products.

2. The commissioner shall declare an individual county quarantine when requested by resolution adopted by a two-thirds majority of the county weed board of the county in which the quarantine is to be declared.

3. For the purposes of this section, “area~ means a geographical section of land as identified by the commissioner, which may include cities and counties or any portion of a city or county; “farm products” means all crops, crop products, plants or portions thereof, but shall not mean livestock; and “materials” means gravel or other sub-
stances that can be transported over a state highway.

Source: S.L. 1981, ch. 638, § 18; 1993, ch. 610, § 9.

63-01.1-12.2. Noxious weed certification — Gravel and sand pits and hay land.

1. The commissioner, after consultation with the North Dakota state university extension service, may adopt rules for certifying that gravel, scoria, or sand surface mining operations and land producing hay for sale or for resale are not contaminated with noxious weeds. The rules must identify the extent noxious weeds are allowed with certification.

2. The county weed board, after consultation with the North Dakota state university extension service, may certify gravel, scotia, or sand surface mining operations and land producing hay for sale or for resale as not contaminated with noxious weeds.

NORTH DAKOTA GAME AND FISH DEPARTMENT

The North Dakota Game and Fish Department is to regulate the importation, introduction and transplanting of fish, fish eggs and other aquatic animals in to the waters of the state. The act provides that one must have a permit issued by the director before one can introduce any fish or fish egg into the public waters and the fish or fish eggs must be inspected for disease. In addition, the Game and Fish Department has the power to remove and dispose of fish deemed undesirable to the best interest of the public. The director may adopt rules governing the operation of private fish hatcheries, the introduction and release of fish into the state, and the supervision of live bait wholesalers. Department rules prohibit the dumping of minnow buckets or any other container into the public waters of the state.

GAME AND FISH DEPARTMENT

20.1-02-04. Duties of director. The director shall:

1. Maintain an office in Bismarck.

2. Adopt rules necessary to the conduct of the department.

3. Keep an accurate record of all the transactions and expenditures of the department and submit a biennial report to the governor and the secretary of state in accordance with section 54-06-04.

4. Enforce state laws involving wildlife.

5. Collect and distribute statistics and information germane to this title and publish information and reports, including a monthly bulletin, for the education of the public in conservation matters.

6. Examine all waters of the state and, wherever suitable waters are found, arrange to plant, stock, or deposit available fish, spawn, or fry

7. Cooperate with the United States fish and wildlife service, or any other appropriate federal agency, and make applications for fish, spawn, and fry, to apportion and deposit in waters of the state.

8. Cooperate with and assist clubs and individuals in stocking the waters of this state with fish.

9. Remove or take from any public waters containing a surplus of fish any reasonable quantity of fish for stocking other public waters, hatching or propagating purposes, or exchange with other states and countries.

10. Control, construct, mark, designate, manage, and have charge of all state fish hatcheries, state game farms, game refuges, and game reserves owned, leased, or controlled for the propagation and protection of game birds, game animals, and fish.

11. Supervise the breeding, propagation, capture, distribution, and preservation of game birds, game animals, and fish as the director deems advisable.

12. Adopt rules necessary for carrying out section 20.1-10-01 and these rules have the force of law after one publication in the daily newspapers of this state.

13. Provide the necessary blank forms for making applications for licenses of all kinds and distribute them among those authorized to sell licenses.

14. Keep a record of all permits issued for the purpose of propagation and domestication of game birds or protected animals.

Source: S.L. 1973, ch. 202, § 9; 1973, ch. 403, § 15; 1975, ch. 466, § 16; 1991, ch. 231, § 12; 1991, ch. 232, § 4; 1995, ch. 350, § 15.

20.1-02-05. Powers of director. The director may:

1. Fix the salaries and the necessary travel and other expenses of department personnel subject to law and legislative appropriations.

2. Employ any part-time personnel necessary to run the director's office and remove the employees at will. Salaries and necessary traveling and other expenses of these appointees must be authorized, audited, and paid in the same manner as salaries and expenses of state officers.

3. Accept from any person, or gather, or purchase, fish, spawn, or fry, for distribution in state waters.

4. Take alive at any time, under the director's personal supervision or under the personal supervision of any of the director's bonded appointees, any birds or animals for propagation purposes or for exchange with other states and foreign countries for game birds and animals of other species.

5. Order additional protection for any fish with an open season when, after investigation, the director finds danger of extinction, undue depletion in any waters, or to aid in the propagation and protection of immature fish, by prescribing how, how many, where, and when the fish may be taken. The orders have the force of law.

6. Take or cause to be taken at any time from any state public waters any suckers, carp, or pickerel.

7. With the governor's approval, purchase, lease, or condemn real estate, when it is required to carry out this title, and sell it when it is no longer required, in the name of the state.

8. Lease up to ninety-nine years any department land, for the purpose of development and improvement, to any nonprofit corporation, upon consideration of specified improvements to be made by the corporation and other improvements the department and the corporation may agree upon. The lease must provide that all funds received by the corporation through lease of the property be expended upon the leased premises for development and improvements. The corporation has the authority, subject to approval by the director, to sublease the premises for cabin sites and other recreational purposes. Upon termination of the lease, the leased property, together with all improvements, reverts to the department.

9. With the governor's approval, enter into agreements with the bureau of reclamation for the management of lands in the Heart Butte area acquired by the bureau for the construction of dams on lakes or streams. Revenues derived from the management of these lands or received from any federal agency for expenditure upon these lands may not be commingled with other game and fish funds, but must be deposited by the director in a separate account. These funds are hereby appropriated for expenditure for purposes as may be agreed upon by the bureau of reclamation, the United States fish and wildlife service, the national park service, and the director. The authority herein granted is effective only until the lands are resold to the former landowners by the bureau of reclamation.

10. Secure specimens of game birds, animals, and fish for breeding purposes by purchase or otherwise and by exchange with the game commissions or state game wardens of other states or countries.

11. Issue special permits to shoot wildlife from a stationary motor vehicle upon application from individuals who are physically unable to walk for purposes of hunting or taking wildlife or who have lost the use of an arm at or below the elbow. The application must be accompanied by a physician's statement verifying the person's condition, and if used to hunt on lands controlled by the board of university and school lands, must designate the land on which the individual intends to hunt. The permittee must have permission from the lessee and the commissioner of university and school lands to hunt on lands controlled by the board of university and school lands. A permit issued under this subsection allows the permittee to drive, or to be driven, onto any land for the purposes of hunting wildlife, except that neither any other passenger within the vehicle nor the driver, if someone other than the permittee, may be a hunter, unless the other person is also a permittee. Provided, however, that if the land is privately owned and if the permittee is not going to drive or be driven along an established road or trail, the

permittee must first obtain the consent of the owner or lessee to hunt on the land in the manner provided in this title.

12. Issue to any person, who is a paraplegic or who has lost the use of one or both arms, a special permit to hunt game with a crossbow if that person otherwise complies with and qualifies under the licensing and other provisions of this title.

13. Issue any resident license prescribed by this title to a person who has come to the state with a bona fide intention of becoming a resident, even though that person has not been a resident of this state for the required time period immediately preceding the application for the license, or to any person who is a member of the United States armed
forces and who is within the state on duty or leave, or to any employee of the United States fish and wildlife service or the conservation department of any state or province of Canada in the state to advise or consult with the department. No license may be issued under this subsection unless an affidavit of a bona fide resident, setting forth the actual conditions, accompanies the application. This subsection does not apply to lottery permits, except that the director shall issue a resident deer hunting license to any resident of this state who is a member of the United States armed forces stationed outside this state and who shows proof of North Dakota residence and who pays the appropriate licensing fee. A deer license issued to a member of the United States armed forces under
this subsection must be issued without being subject to the lottery for deer hunting licenses.

14. Adopt rules, and issue permits for the transporting or introducing of fish, fish eggs, small game, big game, or fur-bearers after determining that the fish, fish eggs, birds, or animals have been properly inspected for disease, and that the transplanting or introduction will be in compliance with state laws and rules. No person may trans plant or introduce any fish or fish eggs into any of the public waters of this state, or transplant or introduce any species of small game, big game, or fur-bearers into this state without obtaining a permit from the director.

15. Pursuant to section 4-01-17.1, cooperate with the agriculture commissioner, the United States fish and wildlife service, and other agencies in the destruction of predatory animals, destructive birds, and injurious field rodents. The director is hereby authorized to adopt rules in accordance with organized and systematic plans of the department of the interior for the destruction of these birds and animals. The director may determine the necessity and issue permits and rules and regulations therefor for the operation and use of
private aircraft to assist in the destruction of the above birds and animals and aid in the administration or protection of land, water, wildlife, livestock, domesticated animals, human life, or crops.

16. Exercise authority to establish programs and rules and administer state and federal funds provided to the state for the preservation and management of resident

species determined by the director to be threatened or endangered species of wildlife. The authority exercised must be in compliance with the Endangered Species Act of 1973,
Public Law 93-205. Any person who violates rules established under this subsection is guilty of a class B misdemeanor.

17. Subject to chapter 28-32, adopt rules for the licensing of guides or outfitters and may require records and reports as the director determines necessary. The director may, after due hearing as provided in chapter 28-32, revoke or refuse to renew the license of a person who violates the rules or fails to provide the records and reports.

18. Provide for the funding of a private land habitat and access improvement program with moneys derived from the interest earned on the game and fish fund and habitat restoration stamp fees. The director shall place these funds in a special fund called the “game and fish department private land habitat and access improvement fund”.

19. Carry out a private land habitat and access improvement program by:

a. Entering into cost-sharing, habitat enhancement, and access agreements with landowners or agencies working on private land to help defray all or a portion of their share of local, state, or federally sponsored conservation practices considered beneficial
to fish and wildlife.

20.1-02-15. Police powers of director, deputy director, and bonded appointees of director. The director, deputy director, and any bonded appointees of the director have the power:

1. Of a peace officer for the purpose of enforcing this title and any other state laws or rules relating to wildlife.

2. To make arrests upon view and without warrant for any violation, committed in that person’s presence, of this title and any other state laws or rules relating to wildlife.

3. To regulate dealers in green furs, propagation or possession of live protected wildlife, taxidermists, shooting preserves, guides and outfitters, commercial fishing operations, private fish hatcheries, and commercial bait vendors. In the regulation of these licensed activities, the premises used to conduct the business and records required by law must be open for inspection at reasonable hours by game and fish law enforcement officers.

20.1-02-15.1. Additional powers of director, deputy director, chief game wardens, or district game wardens. The director, deputy director, chief game wardens,

or district game wardens have the power of a peace officer in the following circumstances:

1. To enforce state laws and rules on any game refuge, game manage ment area or other land or water owned, leased, or managed by the department.

2. When responding to requests from other law enforcement agencies or officers for aid and assistance. For the purposes of this subsection, a request from a law enforcement agency or officer means only a request for assistance as to a particular and singular violation or suspicion of violation of law, and does not constitute a continuous request for assistance outside the purview of enforcement of the provisions of this title.

3. The powers and duties conferred are supplemental to other powers and duties conferred upon the director, deputy director, chief game wardens, or district game wardens and do not constitute an obligation beyond the regular course of duty of those officers.

4. To enforce chapter 20.1-15.

5. To enforce chapter 20.1-13.1.

6. To enforce chapter 39-24.1. This section may not be construed to limit the powers or duties of any peace officer within this state.

Source: S.L. 1979, ch. 300, § 1; 1991

FISH, FROG, AND TURTLE REGULATIONS

20.1-06-05. Removing undesirable fish. The director, any person authorized by the director, or anyone contracting with the director, may kill or take fish from waters of this state in any manner prescribed by the director when in the director's judgment it is in the best interest of public fishing. All such fish must be disposed of at the director's discretion. Money derived from the disposal must be deposited in the state treasury and credited to the game and fish fund. All money received and expended must be itemized, and written records thereof must be kept in the director's office. Any person desiring to contract with the director to take such fish, as determined by the director, from the waters of this state, by means of not more than five hoop-nets or traps, not more than five setlines of ten hooks, or not more than one hundred feet [30.48 meters] of seine, must be awarded the contract upon payment of the appropriate fee. These contracts may not specify the disposition of the fish.

Source: S.L. 1973, ch. 202, § 13; 1989, ch. 116, § 3; 1991, ch. 231, § 54.

20.1-06-12. Regulations governing private fish hatcheries. Any person operating a private fish hatchery is not subject to fishing seasons, limits, legal size restrictions, or other methods of taking fish as provided in any governor's proclamation. The director may adopt rules governing the operation of private fish hatcheries. No license is required of any person for taking fish by angling at a licensed private fish hatchery operated in accordance with the rules of the director. The hatchery operator shall furnish to each person taking fish a written certificate in the form the director prescribes, giving the number and description of the fish taken and other information as the director requires, whereupon the fish may be possessed, shipped, or transported within the state in like manner as fish taken by residents under a license. The director shall issue an annual license to operate the hatchery during a calendar year or a portion of a year upon application and payment of the appropriate fee by the owner or operator. The license may be suspended for noncompliance with the director's regulations.

So~Ce: S.L. 1973, ch. 202, § 13; 1991,

20.1-06-13. Property rights — Fish wild by nature. Any person, firm, corporation, or limited liability company raising and owning any lawfully possessed fish, wild by nature, has the same property rights therein as enjoyed by owners of domestic fish. They are, however, subject to all rules adopted by the director regarding the introduction and release into the state of the fish, as provided in subsection 14 of section 20.1-02-05.

Source: S.L. 1973, ch. 202, § 13; 1991, ch. 231, § 58; 1993, ch. 54, § 106.

20.1-06-14. Minnow bait wholesalers and retailers — License. The director shall adopt rules to control and supervise the operations of minnow or other live bait wholesalers. The director shall issue a license to each wholesaler when the wholesaler has complied with the director's rules and has paid the appropriate annual license fee. The director shall also issue a minnow or other live bait retailer's license to any person upon payment of the appropriate license fee. No person may sell minnows or other live bait at wholesale or retail without first obtaining the appropriate license. The director may require each retailer or wholesaler to submit reports as the director may deem necessary.

Source: S.L. 1973, ch. 202, § 13; 1991, ch. 231, § 59.

20.1-06-15. Fishways at dams. Any person owning, erecting, managing, or controlling any dam or other obstruction across any river, creek, or stream within or forming the boundary of this state, at the director's direction, shall construct and keep in

good repair, a durable and efficient fishway in the manner, shape, and size as the director may direct. Upon failure to construct or maintain the fishway, after giving the person ten days' notice, the director may construct or repair the fishway and recover the costs from the person owning, erecting, managing, or controlling the dam or obstruction. No person may construct any fishway without the approval of the director.

Source: S.L. 1973, ch. 202, § 13; 1991

STATE WATER COMMISSION AND STATE ENGINEER

The Water Commission Act has general authority over all surface and sub-service water within the state and includes authority over projects involving recreational use or wildlife conservation. Anyone who wants to divert or appropriate water within the state must get a permit issued by the state engineer, unless the use is for domestic, livestock or for fish, wildlife (including purposes of propagating, sustaining fish and wildlife resources, and for the development and maintenance of water areas) or other recreational need. The state engineer does have the authority to control and supervise all water and wildlife conservation projects and wildlife reservations.

WATER COMMISSION

61-02-01. Water conservation, flood control, management, and development declared a public purpose. It is hereby declared that the general welfare and the protection of the lives, health, property, and the rights of all the people of this state require that the conservation, management, development and control of waters in this state, public or private, navigable or unnavigable, surface or subsurface, the control of floods, and the management of the atmospheric resources, involve and necessitate the exercise of the sovereign powers of this state and are affected with and concern a public purpose. It is declared further that any and all exercise of sovereign powers of this state in investigating, constructing, maintaining, regulating, supervising, and controlling any system of works involving such subject matter embraces and concerns a single object, and that the state water commission in the exercise of its powers, and in the performance of all its official duties, shall be considered and construed to be performing a
governmental function for the benefit, welfare, and prosperity of all the people of this state.

Source: S.L. 1937, ch. 255, § 1; 1939, ch.256,
§ 1; R.C. 1943, § 61-0201; S.L. 1983.

61-02-01.1. Statewide water development program. The legislative assembly finds that there is a critical need to develop a comprehensive statewide water development program. The state water commission shall develop and implement a comprehensive statewide water development program. The commission shall design the program to serve the long-term water resource needs of the state and its people and

to protect the state's current usage of, and the state's claim to, its proper share of Missouri River water.

Source: S.L. 1997, ch. 25, § 9.

61-02-02. Definitions. In this chapter, unless the context or subject matter otherwise requires:

1. "Commission" shall mean the state water commission.

2. "Cost of works" shall include:

a. The cost of construction, the cost of all lands, property rights, water rights, easements, and franchises acquired which are deemed necessary for such construction;

b. The cost of all water rights acquired or exercised by the commission in connection with such works;

c. The cost of all machinery and equipment, financing charges, interest prior to and during construction and for a period not exceeding three years after the completion of construction;

d. The cost of engineering and legal expenses, plans, specifications, surveys, estimates of cost, and other expenses necessary or incident to determining the feasibility or practicability of any project;

e. Administrative expenses;

f. The construction of the works and the placing of the same in operation; and

g. Such other expenses as may be necessary or incident to the financing authorized in this chapter, including, but not limited to, funding of debt service, repair and replacement reserves, capitalized interest, and the payment of bond issuance costs.

3. "Owner" shall include all individuals, associations, corporations, limited liability companies, districts, municipalities, and other political subdivisions of this state having any title or interest in any properties, rights, water rights, easements, or franchises to be acquired.

4. "Project" shall mean any one of the works defined in subsection 5, or any combination of such works, which are physically connected or jointly managed and operated as a single unit.

5. "Works" shall be deemed to include:

a. All property rights, easements, and franchises relating thereto and deemed necessary or convenient for their operation;

b. All water rights acquired and exercised by the commission in connection with such works;

c. All means of conserving and distributing water, including without limiting the generality of the foregoing two subdivisions, reservoirs, dams, diversion canals, distributing canals, channels, lateral ditches, pumping units, mains, pipelines, treatment plants, and waterworks systems; and

d. All works for the conservation, control, development, storage, treatment, distribution, and utilization of water including, without limiting the generality of the foregoing subdivisions, works for the purpose of irrigation, flood control, watering stock, supplying water for public, domestic, industrial, and recreational use, fire protection, and the draining of lands injured or in danger of injury as a result of such water utilization.

61-02-14. Powers and duties of the commission. The commission shall have full and complete power, authority, and general jurisdiction:

1. To investigate, plan, regulate, undertake, construct, establish, maintain, control, operate, and supervise all works, dams, and projects, public and private, which in its judgment may be necessary or advisable:

a. To control the low-water flow of streams in the state.

b. To impound water for the improvement of municipal, industrial, and rural water supplies.

c. To control and regulate floodfiow in the streams of the state to minimize the damage of such floodwaters.

d. To conserve and develop the waters within the natural watershed areas of the state and, subject to vested rights, to divert the waters within a watershed area to another watershed area and the waters of any river, lake, or stream into another river, lake, or
stream.

e. To improve the channels of the streams for more efficient transportation of the available water in the streams.

f. To provide sufficient water flow for the abatement of stream pollution.

g. To develop, restore, and stabilize the waters of the state for domestic, agricultural, and municipal needs, irrigation, flood control, recreation, and wildlife

conservation, by the construction and maintenance of dams, reservoirs, and diversion canals.

Source: S.L. 1937, ch. 255, § 13; 1939, ch. 256, § 13; R.C. 1943, § 61-0226; S.L. 1983, cli. 676, § 12.

61-02-28. Plans, investigations, and surveys concerning use of waters — Special powers of commission. The commission may make plans, investigations, and surveys concerning the use of any and all waters, either within or without this state, for purposes of establishing, maintaining, operating, controlling, and regulating systems of irrigation, municipal, domestic, industrial, recreational, and fish and wildlife works and projects in connection therewith within the state. The commission shall have all necessary powers of purchasing, selling, leasing, and assigning in accordance with chapter 6 1-04, rights and interests in the use or in the appropriation of waters for which it has filed a declaration of intent pursuant to section 61-02-30, or obtained a conditional water permit for projects or works and shall possess full authority and jurisdiction to exercise and assert actual control over the corpus of all of such waters, and to regulate the diversion thereof subject to rules and methods prescribed by the commission. This power and authority shall include full right to contract and agree with any person, association, agency, or entity concerning water rights held by such person, association, agency, or entity through which the commission maybe given full authority and jurisdiction over such water and water rights. In connection therewith the commission may coordinate subordinate, supplement, and act jointly or subordinately with the United States, and any agency or department thereof, covering or concerning any federal project affecting water use, works, or projects in connection therewith.

Source: S.L. 1937, ch. 255, § 15; 1939, ch. 256, § 15; R.C. 1943, § 61-0228; S.L. 1963, ch. 417, § 11; 1983, ch. 676, § 14.

STATE ENGINEER

61-03-01. State engineer — Appointment — Qualifications —Term — Salary — Engaging in private practice. A state engineer shall be appointed by the state water commission. Such engineer shall be a technically qualified and experienced hydraulic engineer and also shall be an experienced irrigation engineer. The state engineer shall serve as secretary and chief engineer of the commission. Such engineer shall hold the office for such term as the commission may determine, and the commission shall fix the state engineer’s salary and shall allow the state engineer’s actual and necessary traveling expenses while away from the office in the discharge of official duties. The state engineer shall not engage in private practice but shall devote all of the state engineer’s time to the duties and requirements of the office.

APPROPRIATION OF WATER

61-04-01.1. Definitions. In this chapter, unless the context or subject matter otherwise requires:

1. “Beneficial use” means a use of water for a purpose consistent with the best interests of the people of the state.

2. “Commission” means the state water commission.

4. “Fish, wildlife, and recreation” means the use of water for the purposes of propagating and sustaining fish and wildlife resources and for the development and maintenance of water areas necessary for outdoor recreation activities.

61-04-02. Permit for beneficial use of water required. Any person, before commencing any construction for the purpose of appropriating waters of the state or before taking waters of the state from any constructed works, shall first secure a water permit from the state engineer unless such construction or taking froni such constructed works is for domestic or livestock purposes or for fish, wildlife, and other recreational uses or unless otherwise provided by law. However, immediately upon completing any constructed works for domestic or livestock purposes or for fish, wildlife, and other recreational uses the water user shall noti~ the state engineer of the location and acre-feet [1233.48 cubic meters] capacity of such constructed works, dams, or dugouts. Regardless of proposed use, however, all water and who filed written comments may file additional written comments with the state engineer or request a hearing on the application, or both. A request for a hearing must be made in writing and must state with particularity how the person would be aggrieved by the decision and the issues and facts to be presented at the hearing. If a request for a hearing is not made, the state engineer shall consider the additional comments, if any are submitted, and issue a final decision. If a request for a hearing is made, or if the state engineer determines a hearing is necessary to obtain additional information to evaluate the application or to receive public input, the state engineer shall designate a time and place for the hearing and serve a copy of the notice of hearing upon the applicant and any person who filed written comments. Service must be made in the manner allowed for service under the North Dakota Rules of Civil Procedure at least twenty days before the hearing. If two or more municipal or public use water facilities request the hearing to be held locally, the state engineer shall hold the hearing in the county seat of the county in which the proposed water appropriation site is located.

Source: Si. 1999, ch. 537, § 2; 2003,

61-04-06. Criteria for issuance of permit. The state engineer shall issue a permit if the state engineer finds all of the following:

1. The rights of a prior appropriator will not be unduly affected.

2. The proposed means of diversion or construction are adequate.

3. The proposed use of water is beneficial.

4. The proposed appropriation is in the public interest. In determining the public interest, the state engineer shall consider all of the following:

a. The benefit to the applicant resulting from the proposed appropriation.

b. The effect of the economic activity resulting from the proposed appropriation.

c. The effect on fish and game resources and public recreational opportunities.

d. The effect of loss of alternate uses of water that might be made within a reasonable time if not precluded or hindered by the proposed appropriation. Harm to other persons resulting from the proposed appropriation.

e. The intent and ability of the applicant to complete the appropriation. Subsection 1 of section 28-32-38 does not apply to water permit application proceedings unless a request for a hearing is made. If an application is approved, the state engineer shall issue a conditional water permit allowing the applicant to appropriate water. Provided, however, the commission may, by resolution, reserve unto itself final approval authority over any specific water permit in excess of five thousand acre-feet [6167409.19 cubic meters]. The state engineer may cause a certified transcript to be prepared for any hearing conducted pursuant to this section. The costs for the original and up to nine copies of the transcript must be paid by the applicant.

Source: S.L. 1905, cli. 34, § 22; R.C. 1905, § 7625; C.L. 1913, § 8256; R.C. 1943, § 61-0406; S.L. 1961, cli. 378, § 3; 1965, ch. 447, § 6; 1977, cli. 569, § 10; 1983, cli. 678, § 2; 1993, ch. 596, § 2; 1999, cli. 537, § 3; 2001, ch. 293, § 34.

61-04-06.1. Preference in granting permits. When there are competing applications for water from the same source, and the source is insufficient to supply all applicants, the state engineer shall adhere to the following order of priority:

1. Domestic use.

2. Municipal use.

3. Livestock use.

4. Irrigation use.

5. Industrial use.

6. Fish, wildlife, and other outdoor recreational uses.

Water Resource Districts

Water Resource Boards have the power to manage water resources with their district and order or initiate legal action to compel a person, user or controller of any bridge, or culvert to remove any weeds, shrubbery or other debris which hinders or decreases the flow of the water.

This is the only agency empowered with the express power to order the removal of weeds and pests form North Dakota's waters.

CREATION OF WATER RESOURCE
DISTRICTS — BOARDS

61-16-06. Order creating water resource district. A certified copy of the order creating a water resource district shall be filed with the county auditor of each county within the district. A like copy of the order shall be filed with the secretary of state. The secretary of state shall issue to the state water commission a certificate, bearing the seal of the state, of the due organization of the district, and shall file a copy of the certificate and the commission's order creating the district. The secretary of state's certificate, or a copy authenticated by the secretary of state, shall be prima facie evidence of the organization of the district. This new district shall be, and is hereby declared to be, a governmental agency, and a body politic and corporate with the authority to exercise the powers specified in this chapter, or which may be reasonably implied to exercise such powers. The commission's order shall specify the name or number by which a district shall be known.

61-16.1-09. Powers of water resource board. Each water resource board shall have the power and authority to:

1. Sue and be sued in the name of the district.

2. Exercise the power of eminent domain in the manner provided by title 32 for the purpose of acquiring and securing any rights, titles, interests, estates, or easements necessary or proper to carry out the duties imposed by this chapter, and particularly to acquire the necessary rights in land for the construction of dams, flood control projects, and other water conservation, distribution, and supply works of any nature and to permit the flooding of lands, and to secure the right of access to such dams and other devices and the right of public access to any waters impounded thereby. Provided, however, that when the interest sought to be acquired is a right of way for any project authorized in this chapter for which federal funds have been appropriated, the district, after making a written offer to purchase the right of way and

depositing the amount of the offer with the clerk of the district court of the county wherein the right of way is located, may thereupon take immediate possession of the right of way, as authorized by section 16 of article I of the Constitution of North Dakota. Within thirty days after notice has been given in writing to the landowner by the clerk of the district court that a deposit has been made for the taking of a right of way as authorized in this subsection, the owner of the property taken may appeal to the district court by serving a notice of appeal upon the acquiring agency, and the matter must be tried at the next regular or special term of court with a jury unless a jury be waived, in the manner prescribed for trials under chapter 32-15.

3. Accept funds and property or other assistance, financial or otherwise, from federal, state, and other public or private sources for the purposes of aiding the construction or maintenance of water conservation, distribution, and flood control projects; and cooperate and contract with the state or federal government, or any department or agency thereof, or any municipality within the district, in furnishing assurances and meeting local cooperation requirements of any project involving control, conservation, distribution, and use of water.

4. Procure the services of engineers and other technical experts, and employ an attorney or attorneys to assist, advise, and act for it in its proceedings.

5. Plan, locate, relocate, construct, reconstruct, modify, maintain, repair, and control all dams and water conservation and management devices of every nature and water channels, and to control and regulate the same and all reservoirs, artificial lakes, and other water storage devices within the district.

6. Maintain and control the water levels and the flow of water in the bodies of water and streams involved in water conservation and flood control projects within the district and regulate streams, channels, or watercourses and the flow of water therein by changing, widening, deepening, or straightening the same, or otherwise improving the use and capacity thereof.

7. Regulate and control water for the prevention of floods and flood damages by deepening, widening, straightening, or diking the channels or floodplains of any stream or watercourse within the district, and construct reservoirs or other structures to impound and regulate such waters.

8. Make rules and regulations concerning the management, control, regulation, and conservation of waters and prevent the pollution, contamination, or other misuse of the water resources, streams, or bodies of water included within the district.

9. Do all things reasonably necessary and proper to preserve the benefits to be derived from the conservation, control, and regulation of the water resources of this state.

10. Construct, operate, and maintain recreational facilities, including beaches, swimming areas, boat docking and landing facilities, toilets, wells, picnic tables, trash receptacles, and parking areas, and to establish and enforce rules and regulations for the use thereof.

14. Authorize and issue warrants to finance construction of water conservation and flood control projects, assess benefited property for part or all of the cost of such projects, and require appropriations and tax levies to maintain sinking funds for construction warrants on a cash basis at all times.

16. Order or initiate appropriate legal action to compel the entity responsible for the maintenance and repair of any bridge or culvert to remove from under, within, and around such bridge or culvert all dirt, rocks, weeds, brush, shrubbery other debris, and any artificial block which hinders or decreases the flow of water through such bridge or culvert.

STATE DEPARTMENT OF HEALTH

The State Water Pollution Control Board, which includes the director of the Game and Fish Department, through the State Department of Health with cooperation of the State Water Commission to maintain and improve the water quality of the state, to formulate and issue standards of water quality and classifications of water and require the proper maintenance and operation of sewage and industrial waste systems to protect the present and future use of such waters for, among other reasons, the propagation of fish and aquatic life and wildlife.

CONTROL, PREVENTION, AND ABATEMENT OF POLLUTION OF SURFACE WATERS

61-28-02. Definitions. As used in this chapter, unless the context otherwise requires:

1. “Board” means the state water pollution control board.

2. “Department” means the state department of health.

3. “Discharge” means the addition of any waste to state waters from any point source.

7. “Pollution” means the manmade or man-induced alteration of the physical, chemical, biological, or radiological integrity of any waters of the state.

10. “Wastes” means all substances which cause or tend to cause pollution of any waters of the state, including dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials,

radiological materials, heat, wrecked or discarded equipment, rock, sand, and cellar dirt and industrial, municipal, and agricultural pollution discharged into any waters of the state.

11. “Waters of the state” means all waters within the jurisdiction of this state including all streams, lakes, ponds, impounding reservoirs, marshes, watercourses, waterways, and all other bodies or accumulations of water on or under the surface of the earth, natural or artificial, public or private, situated wholly or partly within or bordering upon the state, except those private waters that do not combine or effect a junction with natural surface or underground waters just defined.

61-28-04. Powers and duties. The department shall have and may exercise the following powers and duties:

1. To exercise general supervision of the administration and enforcement of this chapter and all rules and regulations and orders promulgated thereunder.

2. To develop comprehensive programs for the prevention, control, and abatement of new or existing pollution of the waters of the state.

3. To advise, consult, and cooperate with other agencies of the state, the federal government, other states and interstate agencies, and with affected groups, political subdivisions, and industries in furtherance of the purposes of this chapter.

4. To accept and administer loans and grants from the federal government and from other sources, public or private, for carrying out any of its functions, which loans and grants shall not be expended for other than the purposes for which provided.

5. To encourage, participate in, or conduct studies, investigations, research, and demonstrations relating to water pollution and causes, prevention, control, and abatement thereof as it may deem advisable and necessary for the discharge of its duties under this chapter.

6. To collect and disseminate information relating to water pollution and the prevention, control, and abatement thereof.

7. To issue, modify or revoke orders:

a. Prohibiting or abating discharges of wastes into the waters of the state.

10. To require proper maintenance and operation of disposal systems:

a. Have the power to require the owner or operator of any point source to:

(1) Establish and maintain records.

(2) Prepare and submit a report.

(3) Install, use, and maintain monitoring equipment or methods, including, where appropriate, biological monitoring methods.

(4) Sample effluents.

(5) Provide such other information as the department may reasonably require.

b. Have the right of entry, upon or through any premises in which an effluent source is located, or in which any records required to be maintained pursuant to subdivision a are located. Such power may be exercised by authorized agents, representatives, and employees of the department.

c. Have the power to have access to and copy any records, inspect any monitoring equipment or method required under subdivision a, or to sample any effluents being discharged into the waters of the state.

11. To exercise all incidental powers necessary to carry out the purposes of this chapter.

14. To establish and modify, jointly with the state water commission, the classification of all waters in accordance with their present and future most beneficial uses.

15. The department, with the cooperation of the state water commission, shall formulate and issue standards of water quality and classification of water according to its most beneficial uses. Such standards of quality shall be such as to protect the public health and welfare and the present and prospective future use of such waters for public water supplies, propagation of fish and aquatic life and wildlife, recreational purposes, and agricultural, industrial, and other legitimate uses.

APPENDIX OF ADMINISTRATIVE CODE

NORTH DAKOTA ADMINISTRATIVE CODE
TITLE 7. AGRICULTURE, COMMISSIONER OF
ARTICLE 7-01. GENERAL ADMINISTRATION
CHAPTER 7-01-01. ORGANIZATION OF DEPARTMENT
Current through Supplement 300 (June 1, 2004)

7-01-01-01. Organization and functions of the department of agriculture.

1. Organization of department.

a. History. The department of agriculture was originally part of the department of agriculture and labor, established by section 12 of article V of the Constitution of North Da..~jt~ approved in 1889. In the years following its creation, the department served primarily as an agency for the collection of statistics related to crop yields, labor forces, and other agricultural statistics. In 1965 a constitutional amendment was approved by the voters which provided for a separate department of labor, making the department of agriculture and labor simply the department of agriculture and creating a new department of labor.

b. Commissioner of agriculture. The office of commissioner of agriculture is an elected position. The commissioner, elected for a four-year term, is responsible for the determination of policies for operation of the department; dissemination of information concerning agricultural issues to the governor, members of the legislative assembly and the public; assumption of a leadership role in formulating policies affecting the direction of the state's agricultural industry; and advocacy for farmers' needs on the state and national levels. The commissioner or the commissioner's designee serves on numerous boards and commissions.

c. Divisions. The department is organized into these divisions with a director in charge of each division:

(1) Apiary.
(2) Dairy/Poultry.
(3) Livestock.
(4) Marketing.
(5) Pesticide.
(6) Plant protection.
(7) Agricultural mediation service.

2. Functions of the divisions.

a. Apiary division. The apiary division is responsible for the annual licensure of beekeepers, as well as the inspection, certification, and regulation of bees and equipment for purposes of disease control. The division also enforces applicable laws and regulations.

b. Dairy/Poultry division.

(1) The dairy division is responsible for the promotion of the state dairy industry. It regulates the production, processing, and handling of milk and milk products, and enforces applicable laws and regulations.

(2) The poultry division supervises the national poultry improvement plan and cooperates with the United States department of agriculture in providing grading services. The division promotes the state poultry industry and enforces licensing and bonding rules.

c. Livestock division. The livestock division is responsible for the licensing of livestock dealers and auction markets, as well as the recording and rerecording once every ten years, of brands and marks identifying livestock. The division also enforces applicable laws and regulations.

d. Marketing division. The marketing division is responsible for providing a variety of marketing services to North Dakota food producers and processors, thereby enhancing the sale of agricultural products. The services include educational seminars,

counseling, market research, secondary crop development, and direct export marketing. The division also works with commodity groups to promote and market North Dakota agricultural products in this country and abroad. Administration of the honey and turkey promotion funds is another responsibility of this division.

e. Pesticide division. The pesticide division enforces laws and regulations regarding the storage, transportation, application, and disposal of pesticides. It also enforces laws and regulations dealing with chemigation, noxious weeds, and anhydrous fertilizer plants.

f. Plant protection division. The plant protection division is responsible for the inspection, certification, and enforcement of laws and regulations pertaining to nurseries. It invokes and maintains quarantines to prevent the introduction and spread of plant pests and it conducts surveys to evaluate established pests and detect new ones. It also initiates control programs for the suppression or eradication of pests. Through inspection and certification, this division ensures that plants and plant products meet domestic and foreign plant quarantine requirements.

g. Agricultural mediation service. This division disseminates information and provides assistance to farmers regarding agricultural credit problems. It provides training for negotiators and mediators, assigns them to individual farmers, and coordinates the efforts of public and private entities dealing with agricultural credit matters and financially distressed farmers.

3. Inquiries. Information about the department of agriculture and its programs and responsibilities may be obtained by contacting:

North Dakota Department of Agriculture

State Capitol

Bismarck, North Dakota 58505

History: Amended effective December 1, 1981; February 1, 1986; May 1, 1990.

General Authority: NDCC 28-32-02.1
Law Implemented: NDCC 28-32-02.1
ND ADC 7-01-01-01

NORTH DAKOTA ADMINISTRATIVE CODE
TITLE 7. AGRICULTURE, COMMISSIONER OF
ARTICLE 7-06. NOXIOUS WEEDS
CHAPTER 7-06-01. GENERAL PROVISIONS
Current through Supplement 300 (June 1, 2004)

7-06-01-01. Weed control officer's certification.

A weed control officer shall be certified upon completion of certification in two categories under the North Dakota Century Code chapter 4-35. The two categories are agricultural pest control and right of way. A temporary certification may be issued for a period of one year to a weed control officer.

History: Amended effective February 1,1982.
General Authority: NDCC 28-32-02, 63-01.1-03.
Law Implemented: NDCC 63-01.1-05.1.

7-06-01 -02. Noxious weeds listed.

Weeds declared noxious shall be confined to weeds that are difficult to control, easily spread, and injurious to public health, crops, livestock, land, or other property. The following weeds have been declared noxious for the purpose of North Dakota Century Code chapter 63-0 1. 1:

I. Absinth wormwood (Artemisia absinthiurn L.)

2. Canada thistle (Cirsium an'ense (L.) Scop.)

3. Dalmatian toadflax (Linaria genistifolia ssp. dalmatica)
4. Diffuse knapweed (Centaurea diffusa Lam.)

5. Field bindweed (Con voh'ulus arvensis L.)

6. Leafy spurge (Euphorbia esula L.)

7. Musk thistle (Carduus nutans L.)

8. Purple loosestrife (Lythrum salicaria L., Lvthrurn virgatum L. and all cultivars)

9. Russian knapweed (Acroptilon repens (L.) DC.

10. Saltcedar (Tamarix ramosissima Ledeb., including T chin ensis and T pari'ef flora DC.)
11. Spotted knapweed (Centaurea niaculosa Lam.)

12. Yellow starthistle (Centaurea solstitialis L.)

History: Amended effective June 1,1985; February 1, 2000; September 1, 2002
General Authority: NDCC28-32-02, 63-01.1-03

Law Implemented: NDCC 63-01.1-03

NORTH DAKOTA ADMINISTRATIVE CODE
TITLE 60. PESTICIDE CONTROL BOARD
ARTICLE 60-03. PESTICIDES
CHAPTER 60-03-01. PESTICIDE SALE, DISTRIBUTION, AND USE
Current through Supplement 300 (June 1, 2004)

60-03-01-02. Definitions.

As used in this chapter, the following words shall have the meaning given to them below, unless otherwise made inappropriate by use and context. Words not defined in this section shall have the meaning given to them in North Dakota Century Code chapter 4-35.

1. “Act’ means the North Dakota Pesticide Act.

2. “Board” means the North Dakota pesticide control board created pursuant to North Dakota Century Code section 4-35-02.

3. “Broadcast” means any intentional application of a pesticide over an area, such as a lawn, field, room, crawl space, or other such surface.

4. “Bulk pesticide” means any volume of pesticide that is intended to be repackaged, can be accurately metered, and can be transported or held in an individual container.

5. “Bulk pesticide facility” means any area, location, tract of land, building, structure, or premises used for the handling or storage of bulk pesticides.

6. “Certification” means certification of dealers, commercial applicators, and private applicators provided for by North Dakota Century Code sections 4-35-09, 4-35-12, and 4-35-14.

7. “Commissioner” means the North Dakota agriculture commissioner.

8. “Compensation” means monetary payment for a specific service.

9. “Custom blend” means any diluted mixture of pesticide prepared by a dealer to the specifications of the end-user and not held in inventory.

10. “End-use labeling” means the written, printed, or graphic matter on, or attached to or accompanying the pesticide or device or any of its containers or wrappers.

11. “End-user” means the person who applies the pesticide.

12. “FIFRA” means Federal Insecticide, Fungicide, and Rodenticide Act of 1947.

13. “General use pesticide” means any pesticide formulation which is not classified for restricted use by the board.

14. “Handling” means the mixing, loading, application, repackaging, storage, transportation, distribution, sale, purchase, or disposal of pesticides.

15. “Mixture” means any diluted combination of pesticide with fertilizer, seed, or other medium.

16. “Mobile container” means a container used to transport pesticides.

17. “Operational area” means a pennanent containment area where pesticides are transferred, loaded, unloaded, mixed, repackaged, or refilled; where pesticides are cleaned or rinsed from containers; or application, handling, storage, or transportation equipment.

18. “Permanent containment area” means:

a. An aboveground pad or dike constructed of impervious material, such as sealed concrete, stainless steel, or other material as approved by the department of agriculture;

b. Bermed, curbed, sloped, or otherwise designed to contain spills, leaks, releases, or other discharges that are generated during the handling of pesticides or pesticide-containing materials;

c. Does not have a drain which exits the containment area; and

d. All seams and cracks must be sealed to prevent leakage.

19. “Pesticide-containing material” means:

a. Any container of a pesticide product that has not been triple-rinsed or the equivalent of triple-rinsed;

b. Any rinsate that is derived from a pesticide container, pesticide application equipment, or equipment washing;

c. Any material that is used to collect or contain excess or spilled pesticide or rinsate;

d. Any mixture of pesticide and diluent such as wash water, rinse water, or rainwater; or

e. Material that is generated as a result of contact with or utilization of a pesticide in an application, containment, recovery, reuse, or treatment system. The term does not include personal protective equipment that contains pesticide residue.

20. “Pesticide-producing establishment” means any site where a pesticide is manufactured, packaged, repackaged, prepared, processed, labeled, relabeled, or held for distribution.

21. “Repackaging” means the transfer of a pesticide in an unaltered state from a container into a designated or dedicated refillable container.

22. “Rinsate” means a dilute mixture of pesticide obtained by rinsing pesticide containers or from rinsing the inside and outside of spray equipment.

23. “Spill kit” means a portable kit or other equipment that is designed to recover, minimize, contain, or absorb spills, leaks, releases, or other discharges of pesticides.

24. “Use of a pesticide” means the loading, mixing, applying, storing, transporting, distribution, and disposing of a pesticide.

25. “Use of a pesticide in a manner inconsistent with its labeling” means to use any pesticide in a manner that is not permitted by the label, except that the term does not apply to any of the following:

a. Applying a pesticide at any dosage, concentration, or frequency that is less than that specified on the label, unless the label specifically prohibits deviation from the specified dosage, concentration, or frequency.

b. Applying a pesticide against any target pest that is not specified on the label if the application is to the crop, animal, or site that is specified on the label.

c. Employing any method of application that is not prohibited by the label unless the label specifically states that the product may be applied only by the methods specified on the labeling.

d. Mixing a pesticide or pesticides with a fertilizer when the label does not prohibit such mixture.

e. Any use of a pesticide that is in compliance with sectionS, 18, or 24 of the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 [Pub. L. 104-170; Stat. 7 U.S.C. 136 et seq.].

History: Amended effective April 15, 1985; October 1, 1990; July 1, 1992; March 1, 2003.

General Authority: NDCC 4-35-06

NORTH DAKOTA ADMINISTRATIVE CODE
TITLE 30. GAME AND FISH DEPARTMENT
ARTICLE 30-0 1. GENERAL ADMINISTRATION
CHAPTER 30-01-01. ORGANIZATION OF DEPARTMENT
Current through Supplement 300 (June 1, 2004)

30-01-01-01. Organization and functions of the game and fish department.

1. Organization of department.

a. History. The first game and fish laws were established in Dakota Territory in 1861 but it was not until 1893 when the superintendent of irrigation and forestry was designated as game commissioner that a game and fish department was formed. In 1909 the game and fish board of control was established. The board continued to function as the agency controlling fish and game until 1929 when legislation was passed providing for a single commissioner charged with certain duties and powers to administer a game and fish department. The title commissioner was changed to director in 1991.

b. Divisions. The department consists of the following five divisions:

(1) Administrative services.

(2) Enforcement.

(3) Fisheries.

(4) Conservation and communications.

(5) Wildlife.

c. Director. The director is appointed by the governor. The director holds office for four years beginning on the first day of July after the governor's election and until a successor is appointed and qualified. The director shall appoint a deputy director who may be removed at the director's pleasure. The director may also appoint a chief game warden, district game wardens, biologists, and technicians to enforce the game laws and to perform duties specified by the director. The director is charged with fourteen statutory duties and has twenty-

seven specific powers relating to the department and the resources it must manage. In addition to these specific duties and powers spelled out in North Dakota Century Code sections 20.1-02-04 and 20.1-02-05, the director has additional authority and power given by various sections of North Dakota Century Code title 20.1.

d. Game and fish advisory board. There is an eight-member game and fish advisory board, each appointed for a four-year term by the governor. The board has the authority to advise the director regarding any policy of hunting, fishing, and trapping regulations, and may make general recommendations regarding the operation of the department and its programs which the director may carry out.

e. Orders and proclamations of the governor. After investigation and recommendations by the director, the governor may open seasons for hunting, fishing, and trapping. The governor may determine in what manner, the numbers, the places, and at what times game, fish, or fur-bearers may be taken.

2. Functions of department divisions.

a. Administrative services division. The division of administration is divided into four programs - accounting and basic operations, data processing, licensing, and planning.

(1) Accounting and basic operations. The program is responsible for accounting and general office and facility management.

(2) Data processing. Coordination and technical support is provided for department personal computers and state mainframe computer activities.

(3) Licensing. All fishing, hunting, and boating licensing is handled as part of this program.

(4) Planning. The planning program is responsible for establishing goals, objectives, and strategies for the department. It is a cooperative effort with the other divisions and is coordinated by a game and fish planner.

b. Enforcement division. The law enforcement program enforces game and fish laws and rules and regulations necessary for proper management of fish and game resources. Enforcement officers called district game wardens have districts averaging approximately two thousand six hundred square miles [673396.92 hectares]. In addition to their enforcement activities, they must carry out education programs, and assist other divisions during busy periods of the year. One of their major non-enforcement activities concerns alleviation of wildlife depredations on farmers’ crops and feed supplies.

c. Fisheries division. The fisheries division is divided into three programs - fish management, sport fisheries research, and lake/stream management.

(1) Fish production. Fish are provided for North Dakota waters through fish hatcheries and by trapping and moving fish from one area to another.

(2) Sport fish research. The program is responsible for all research and survey work connected with sport fishing. It gathers information about the status of lakes and fish populations and carries out management practices on lakes.

(3) Lake/stream management. The lake management program provides public use facilities, lake improvement systems, watershed development, lake and pond construction, and other developments on public fishing waters.

d. Conservation and communications division. This division has three major sections:

(1) Conservation section. Many state and federal agencies have programs that affect fish and wildlife habitat. The efforts of this section are directed toward compensation, alleviation of losses, or possibly enhancement of fish and wildlife by working with these agencies. Staff in this division also operate the department's nongame and endangered species programs.

(2) Communications section. The section is divided into four programs - public information resource specialists, department webmaster, North Dakota Outdoors magazine, and videography – production of department videos.

(3) Outreach section. This section includes hunter education, project wild, aquatic education, becoming an outdoor woman, boating education, and public information outreach staff located statewide.

e. Wildlife division. The wildlife division is divided into three programs - lands and development, game management, private land habitat programs.

(1) Lands and development. The lands and development program is responsible for all habitat development, and management and maintenance on wildlife management areas. The program involves tree plantings, herbaceous cover and food plantings, road construction, weed control, signing, water developments, and any other activity that might enhance these areas for wildlife, the hunter, and the outdoors person who enjoys hiking, photography, and nature study.

(2) Game management. Staff carry out population surveys that are used to determine annual hunting seasons on various species of game. Research is done with the objective of providing optimum hunting opportunities for the people of the state.

(3) Private land habitat program. A private land habitat improvement program is funded from moneys derived from the interest earned on the game and fish fund, habitat stamp sales, and game and fish operating funds. The program involves annual leasing and development of fish and wildlife habitat and hunting access on private land, entering into cost-sharing agreements with

landowners to help defray a portion of their share of conservation practices which benefit fish and wildlife. The program also carries out practices which will alleviate big game and predatory animal depredation.

3. Inquiries. General inquiries regarding the game and fish department may be addressed to the:

North Dakota Game and Fish Department 100 North Bismarck Expressway Bismarck, North Dakota

58501-5095

Specific inquiries about division functions may be addressed to the chief of the division involved.

4. Personnel roster. A roster of personnel with the department may be found in the monthly issue of North Dakota Outdoors or on the department's web page.

History: Amended effective February 1, 1982; September 1, 1983; December 1, 1985; January 1, 1992; March 1, 2002.

General Authority: NDCC 20.1-02-04 2

NORTH DAKOTA ADMINISTRATIVE CODE
TITLE 30. GAME AND FISH DEPARTMENT
ARTICLE 30-04. FISH AND WILDLIFE MANAGEMENT
CHAPTER 30-04-04. TRANSPLANTING OR INTRODUCTION OF FISH, FISH EGGS, GAME
BIRDS, OR GAME ANIMALS INTO NORTH DAKOTA
Current through Supplement 300 (June 1, 2004)

30-04-04-05. Bait transfer.

It shall be unlawful for any person to empty the contents of any minnow bucket or other receptacle containing bait into any of the public waters of the state.

General Authority: NDCC 20.1-02-05

NORTH DAKOTA ADMINISTRATIVE CODE
TITLE 30. GAME AND FISH DEPARTMENT
ARTICLE 30-04. FISH AND WILDLIFE MANAGEMENT
CHAPTER 30-04-04. TRANSPLANTING OR INTRODUCTION OF FISH, FISH EGGS, GAME
BIRDS, OR GAME ANIMALS INTO NORTH DAKOTA

Current through Supplement 300 (June 1, 2004)

30-04-04-04. Fish or fish eggs.

The introduction of fish or fish eggs into any state waters shall be illegal unless done with the written consent of the game and fish commissioner or the commissioner's duly designated bonded employee.

General Authority: NDCC 20.1-02-05

NORTH DAKOTA ADMINISTRATIVE CODE
TITLE 33. STATE DEPARTMENT OF HEALTH
ARTICLE 33-16. CONTROL, PREVENTION, AND ABATEMENT OF POLLUTION OF SURFACE
WATER
CHAPTER 33-16-02.1 STANDARDS OF QUALITY FOR WATERS OF THE STATE
Current through Supplement 295 (January 1, 2004)

33-16-02.1-04. Definitions.

The terms used in this chapter have the same meaning as in North Dakota Century Code chapter 6 1-28, except:

1. "Acute standard" means the one-hour average concentration does not exceed the listed concentration more than once every three years on the average.

2. "Best management practices" are methods, measures, or procedures selected by the department to control nonpoint source pollution. Best management practices include, but are not limited to, structural and nonstructural measures and operation and maintenance procedures.

3. "Chronic standard" means the four-day average concentration does not exceed the listed concentration more than once every three years on the average.

4. "Consecutive thirty-day average" is the average of samples taken during any consecutive thirty-day period. It is not a requirement for thirty consecutive daily samples.

5. "Department" means the North Dakota state department of health.

6. A standard defined as “dissolved” means the total quantity of a given material present in a filtered water sample, regardless of the form or nature of its occurrence.

7. “Pollution” means such contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor. Pollution includes discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state that will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to public health, safety, or welfare; domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or livestock, wild animals, birds, fish, or other aquatic biota.

8. “Site-specific standards” mean water quality criteria developed to reflect local environmental conditions to protect the uses of a specific water body.

9. A standard defined as “total” means the entire quantity of a given material present in an unfiltered water sample regardless of the form or nature of its occurrence. This includes both dissolved and suspended forms of a substance, including the entire amount of the substance present as a constituent of the particulate material. Total recoverable is the quantity of a given material in an unfiltered aqueous sample following digestion by refluxing with hot dilute mineral acid.

10. “Water usage”. The best usage for the waters shall be those uses determined to be the most consistent with present and potential uses in accordance with the economic and social development of the area. Present principal best uses are those defined in subdivisions a, b, c, and d. These are not to be construed to be the only possible usages.

a. Municipal and domestic water. Waters suitable for use as a source of water supply for drinking and culinary purposes after treatment to a level approved by the department.

b. Recreation, fishing, and wildlife. Waters suitable for the propagation or support of fish and other aquatic biota, waters that will not adversely affect wildlife in the area, and waters suitable for boating and swimming. Natural high turbidities in some waters and physical characteristics of banks and streambeds of many streams are factors that limit their value for bathing. Low flows or natural physical and chemical conditions in some waters may limit their value for fish propagation or aquatic biota.

c. Agricultural uses. Waters suitable for irrigation, stock watering, and other agricultural uses, but not suitable for use as a source of domestic supply for the farm unless satisfactory treatment is provided.

d. Industrial water. Waters suitable for industrial purposes, including food processing, after treatment. Treatment may include that necessary for prevention of boiler scale and corrosion.

History: Effective June 1, 2001.

General Authority: NDCC 6 1-28-04, 61-28-05

NORTH DAKOTA ADMINISTRATIVE CODE
TITLE 33. STATE DEPARTMENT OF HEALTH
ARTICLE 33-16. CONTROL, PREVENTION, AND ABATEMENT OF POLLUTION OF SURFACE
WATER
CHAPTER 33-16-02.1 STANDARDS OF QUALITY FOR WATERS OF THE STATE
Current through Supplement 295 (January 1, 2004)

33-16-02.1-09. Surface water classifications, mixing zones, and numeric standards.

1. Classifications. Procedures for the classifications of streams and lakes of the state shall follow this subsection. Classifications of streams and lakes are listed in appendix I and appendix II, respectively.

a. Class I streams. The quality of the waters in this class shall be suitable for the propagation or protection, or both, of resident fish species and other aquatic biota and for swimming, boating, and other water recreation. The quality of the waters shall be suitable for irrigation, stock watering, and wildlife without injurious effects. After treatment consisting of coagulation, settling, filtration, and chlorination, or equivalent treatment processes, the water quality shall meet the bacteriological, physical, and chemical requirements of the department for municipal or domestic use.

b. Class IA streams. The quality of the waters in this class shall be the same as the quality of class I streams, except that treatment for municipal use may also require softening to meet the drinking water requirements of the department.

c. Class II streams. The quality of the waters in this class shall be the same as the quality of class I streams, except that additional treatment may be required to meet the drinking water requirements of the department. Streams in this classification may be intermittent in nature which would make these waters of limited value for beneficial uses such as municipal water, fish life, or irrigation.

d. Class III streams. The quality of the waters in this class shall be suitable for agricultural and industrial uses such as stock watering, irrigation, washing, and cooling. These streams have low average flows and, generally, prolonged periods of no flow. They are of limited seasonal value for immersion recreation, fish life, and aquatic

biota. The quality of these waters must be maintained to protect recreation, fish, and aquatic biota.

e. Wetlands. These water bodies are to be considered waters of the state and will be protected under section 33-16-02-08.

f. Lakes. The type of fishery a lake may be capable of supporting is based on the lake's geophysical characteristics. However, the capability of the lake to support a fishery may be affected by seasonal variations or other natural occurrences which may alter the lake characteristics.

Class Characteristics

1 Cold water fishery. Waters capable of supporting growth of salmonid fishes and associated aquatic biota.

2 Cool water fishery. Waters capable of supporting growth and propagation of nonsalmonid fishes and marginal growth of salmonid fishes and associated aquatic biota.

3 Warm water fishery. Waters capable of supporting growth and propagation of nonsalmonid fishes and associated aquatic biota.

4 Marginal fishery. Waters capable of supporting a fishery on a seasonal basis.

5 Not capable of supporting a fishery due to high salinity.

2. Mixing zones. North Dakota mixing zone and dilution policy is contained in appendix III.

3. Numeric standards.

a. Class I streams. Unless stated otherwise, maximum limits for class I streams are listed in table 1 and table 2.

b. Class IA streams. The physical and chemical criteria shall be those for class I, with the following exceptions:

Substance or Characteristic Maximum Limit

Chlorides (Total)
Sod ium
Sulfate (Total)

175 mg/l
60% of total cations as mEq/l
450 mg/l

c. Class II streams. The physical and chemical criteria shall be those for class IA, with the following exceptions:

Substance or Characteristic	Maximum Limit
Chlorides (Total)	250 mg/l
pH	6.0-9.0

d. Class III streams. The physical and chemical criteria shall be those for class II, with the following exceptions:

Substance or Characteristic	Maximum Limit
Sulfate (Total)	750 mg/l

e. Lakes.

(1) The beneficial uses and parameter limitations designated for class I streams shall apply to all classified lakes.

However, specific background studies and information may require that the department revise a standard for any specific parameter.

(2) In addition, these nutrient parameters are guidelines for use as goals in any lake improvement or maintenance program:

Parameter	Limit
N03 as N	.25 mg/i
P04 as P	.02 mg/i

(3) The temperature standard for class I streams does not apply to Nelson Lake in Oliver County. The temperature of any discharge to Nelson Lake shall not have an adverse effect on fish, aquatic life, and wildlife, or Nelson Lake itself

History: Effective June 1, 200i.

General Authority: NDCC 6 1-28-04

Appendix C. **Federal Laws Addressing Aquatic Nuisance Species Relevant to North Dakota**

Department or Agency	Authority	Provisions	Organisms Addressed	Pathways or Means of Transport Addressed	Web Site
Dept. of Interior/FWS Dept. of Transportation/Coast Guard EPA Dept. of Defense/Army Corps of Engineers Dept. of DOC/NOAA	National Invasive Species Act (1996)	Reauthorized and amended NANPCA to mandate regulations to prevent introduction and spread of aquatic nuisance species into Great Lakes through ballast water. Authorized funding for research on aquatic nuisance species prevention and control (Chesapeake Bay, Gulf of Mexico, Pacific Coast, Atlantic Coast, San Francisco Bay-Delta Estuary) Required ballast water management program to demonstrate technologies and practices to prevent nonindigenous species from being introduced Modified composition of Aquatic Nuisance Species Task Force Required Task Force to develop and implement comprehensive program to control the brown tree snake in Guam	Aquatic nuisance species and brown tree snake	Unintentional introductions: ballast water	http://www.nemw.org/nisa.htm
Dept. of Interior/FWS Dept. of Transportation/Coast Guard EPA Dept. of Defense/Army Corps of Engineers Dept. of DOC/NOAA	Nonindigenous Aquatic Nuisance Prevention and Control Act (1990)	Established Aquatic Nuisance Species Task Force to: identify areas where ballast water does not pose an environmental threat; assess whether aquatic nuisance species threaten the ecological characteristics and economic uses of US waters (other than the Great Lakes); determine the need for controls on vessels entering U.S. waters (other than Great Lakes); identify and evaluate approaches for reducing risk of adverse consequences associated with intentional introduction of aquatic species. Directs Coast Guard to issue regulations to prevent the introduction and spread of aquatic nuisance species into the Great Lakes through ballast water. Directs Corps of Engineers to develop a program of research and technology to control zebra mussels in and around public facilities and make information available about control methods.	Aquatic nuisance species	Unintentional introductions: ballast water	http://www.anstaskforce.gov/toc.htm
	Alien Species Prevention and Enforcement Act (1992)	Makes the shipment of certain categories of plants and animals through U.S. mail illegal.	Plants and animals whose shipment is prohibited under 18 U.S.C. 42;43, or the Lacey Act Plants or plant matter whose shipment is prohibited under the Federal Plant Pest Act or Plant Protection Act	Intentional introductions: U.S. Mail	
Dept. of Agriculture/ APHIS	Plant Protection Act (2000)	Consolidates and modernizes several major statutes (Plant Quarantine Act, Federal Plant Pest Act, Federal Noxious Weed Act, Organic Act of 1944, and others), replacing them with one flexible statutory framework providing the	Plants and plant material Plant pests	Unintentional and intentional introduction	

Department or Agency	Authority	Provisions	Organisms Addressed	Pathways or Means of Transport Addressed	Web Site
		ability to prohibit or restrict imports, exports, and interstate movement; assess higher civil penalties; issue subpoenas; conduct inspections without a warrant; cooperate with industry and others in "quality assurance" programs; recover costs related to disposal of abandoned shipments; and take emergency action. By expanding the definition of "noxious weed" the Act enables APHIS to address a broader range of weed problems.	Noxious weeds Biological control agents		
Federal land management agencies	Federal Noxious Weed Act of 1974	Although the Plant Protection Act superseded and repealed most of the Federal Noxious Weed Act, it left intact Section 15 (management of undesirable plants on Federal lands). Requires Federal land management agencies to develop and establish a management program for control of undesirable plants on Federal lands under the agencies' jurisdiction. Requires those agencies to ANS-Crdinate management where similar programs are being implemented on State and private lands in the same area.	Noxious weeds Undesirable plant species	Control on Federal lands	http://refuges.fws.gov/FICMNEWFiles/FederalNoxiousWeedAct.html
Dept. of Agriculture/ APHIS	International Plant Protection Convention (1952)	Applies primarily to quarantine pests in international trade. Creates an international regime to prevent spread and introduction of plant and plant product pests premised on exchange of phytosanitary certificates between importing and exporting countries' national plant protection offices. Parties have national plant protection organizations established according to the Convention with authority in relation to quarantine control, risk analysis and other measures required to prevent the establishment and spread of all invasive alien species that, directly or indirectly, are pests of plants. Parties agree to cooperate on information exchange and on the development of International Standards for Phytosanitary Measures.	Pests of plants or plant products: "any form of plant or animal life, or any pathogenic agent, injurious or potentially injurious to plants or plant products" Quarantine pests involved with international trade: "pest of potential national economic importance to the country endangered thereby and not yet present there, or present but not widely distributed and being actively controlled"	"Storage places, conveyances, containers and any other object or material capable of harbouring or spreading plant pests, especially where international transportation is involved." Packing material or matter of any kind accompanying plant products Storage places Transportation facilities	http://www.fao.org/legal/treaties/004t-e.htm
Dept. of Interior	Lacey Act (1900; amended in 1998)	Prohibits import of a list of designated species and other vertebrates, mollusks, and crustacea that are "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States" Declares importation or transportation of any live wildlife as injurious and prohibited, except as provided for under the Act	Species injurious to human beings or resources	Intentional introduction and trade	

Department or Agency	Authority	Provisions	Organisms Addressed	Pathways or Means of Transport Addressed	Web Site
		BUT Allows import of almost all species for scientific, medical, education, exhibition, or propagation purposes			
Dept. of Agriculture Dept. of Interior	Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) (1995)	A supplementary agreement to the World Trade Organization Agreement. Provides a uniform interpretation of the measures governing safety and plant and animal health regulations. Applicable to all sanitary and Phytosanitary measures directly or indirectly affecting international trade. Sanitary and Phytosanitary measures are defined as any measure applied a) to protect animal or plant life or health within (a Members' Territory) from entry, establishment or spread of pests, diseases, disease carrying organisms; e) to prevent or limit other damage within the (Members Territory) from the entry, establishment or spread of pests (annex A).	Pests, diseases, disease-carrying organisms, or disease-causing organisms	Importation	http://www.wto.org/goods/spsagr.htm
Dept. of Agriculture/ APHIS	Act of March 2, 1931, often referred to as the Animal Damage Control Act	Gives APHIS authority to control wildlife damage on federal, state, or private land. Protects: field crops, vegetables, fruits, nuts, horticultural crops, commercial forests; freshwater aquaculture ponds and marine species cultivation areas; livestock on public and private range and in feedlots; public and private buildings and facilities; civilian and military aircraft; public health	Damaging species (nutria, blackbirds, European starlings, monk parakeets)	Unintentional introductions	
	North American Agreement on Environmental Cooperation (1994)	Article 10 (2)(h): the Council of the Commission on Environmental Co-operation may develop recommendations regarding exotic species which may be harmful	"Exotic" species: not specified further	Not specified	http://www.cec.org
EPA	Federal Insecticide, Fungicide, and Rodenticide Act	Gives EPA authority to regulate importation and distribution of substances, including organisms, that are intended to function as pesticides	Biological control agents (In terms of biological control agents, EPA currently regulates only eukaryotic and prokaryotic microorganisms under FIFRA. Other biocontrol agents are exempt because they are "adequately regulated" by another agency, I.E. USDA-APHIS)	Intentional introduction	http://www.epa.gov/pesticides/fifra.htm

Department or Agency	Authority	Provisions	Organisms Addressed	Pathways or Means of Transport Addressed	Web Site
Dept. of Agriculture/ APHIS and AMS	Federal Seed Act (1939)	Requires accurate labeling and purity standards for seeds in commerce. Prohibits importation and movement of adulterated or misbranded seeds	Seeds	Intentional introduction through trade	
All	Dept. of Interior	Requires federal government agencies to consider the environmental effects of their actions through preparation of environmental impact statements (or environmental assessments to determine whether a full EIS is required). Effects of non-native species, if harmful to the environment, must be included in the EIS	Non-native species posing harm to the environment	Intentional introductions related to major federal actions	http://es.epa.gov/oeca/ofa/nepa.html
	Convention on International Trade in Endangered Species (CITES) (1975)	Represents alternate model for regulating invasive species not already covered by the IPPC or other agreements. Convention intended to prevent harm in *exporting* country; however, can be applied when species is endangered in exporting country and considered an invasive in importing country.	Species of flora and fauna which are threatened or endangered in exporting countries (Appendices I, II and III- see web site)	Intentional introductions through trade: export, re-export, import and introduction from the sea	http://international.fws.gov/global/citestxt.html (For appendices, see: http://international.fws.gov/global/cites.html)
Dept. of Interior	Wild Bird Conservation Act (1992)	Regulates importation of foreign wild birds	Birds and non-native parasites and diseases transported by foreign birds	Importation	http://international.fws.gov/global/law102.html
Dept. of Interior/FWS Dept. of Commerce/ NMFS	Endangered Species Act	Protects endangered species When non-native invasive species threaten endangered species, this act could be used as basis for their eradication.	Non-native species posing a danger to local endangered species	Not specified	http://endangered.fws.gov/esa.html
All	Executive Order 13112 (Feb. 1999)	Defines invasive species ("any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem") Directs all federal agencies to: -Address invasive species concerns; -Refrain from actions likely to increase invasive species problems. Creates interagency Invasive Species Council Calls for National Invasive Species Management Plan to better ANS-Crdinate federal agency efforts.	All	Unintentional and intentional introductions: escape, release	www. Invasivespecies.gov

Appendix D. **Executive Order 13112**

Executive Order 13112 of February 3, 1999
Invasive Species

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and other pertinent statutes, to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause, it is ordered as follows:

Section 1. Definitions.

(a)"Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions. "

(a) "Ecosystem" means the complex of a community of organisms and its environment.

(b) (d) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104. (e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "Native species" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) "Stakeholders" means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) "United States" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

Sec. 2. Federal Agency Duties. (a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law.

1) identify such actions;

2) subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them; and

3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(b) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

Sec. 3. Invasive Species Council. (a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

Sec. 4. Duties of the Invasive Species Council. The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning

invasive species are ANS-Crdinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species; develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(d) facilitate development of a ANS-Crdinated network among Federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health;

(e) facilitate establishment of a ANS-Crdinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(f) prepare and issue a national Invasive Species Management Plan asset forth in section 5 of this order.

Sec. 5. Invasive Species Management Plan. (a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2

(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk that

introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a ANS-Crdinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of ANS-Crdination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to the Office of Management and Budget on whether the order should be revised.

Sec. 6. Judicial Review and Administration. (a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs.

(d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such requirements is necessary for foreign policy or national security reasons.

WILLIAM J. CLINTON

THE WHITE HOUSE,

February 3, 1999.

Appendix E: **Budget Matrix for North Dakota's Aquatic Nuisance Species Management Plan**

Funding for staffing of ANS education and prevention activities.

			ANS-SP and IASC Funding Needs									
			Year 1		Year 2		Year 3		Year 4		Year 5	
Agency or Entity	Staffing or payment type	Description	Man-yr	Salary	Man-yr	salary	Man-yr	salary	Man-yr	salary	Man-yr	salary
Game and Fish Department	ANS-SP	ANS activities	0.9	$33,750	0.9	$33,750	0.9	$33,750	0.9	$33,750	0.9	$33,750
	Field Staff	monitoring	0.2	$8,000	0.2	$8,000	0.2	$8,000	0.2	$8,000	0.2	$8,000
	Clerical	mailing	0.01	$550	0.01	$550	0.01	$550	0.01	$550	0.01	$550
	Wardens	inspecting boats	0.2	$8,000	0.2	$8,000	0.2	$8,000	0.2	$8,000	0.2	$8,000
State Water Commission	MOU for expenses	meetings, mailings, review permits	0.05	$1,750	0.05	$1,750	0.05	$1,750	0.05	$1,750	0.05	$1,750
Department of Health	MOU for expenses	meetings, mailings, review permits	0.05	$1,750	0.05	$1,750	0.05	$1,750	0.05	$1,750	0.05	$1,750
Department of Agriculture	MOU for expenses	meetings, mailings, review permits	0.075	$2,650	0.075	$2,650	0.075	$2,650	0.075	$2,650	0.075	$2,650
Parks & Recreation Department	MOU for expenses	meetings, mailings, review permits	0.075	$2,650	0.075	$2,650	0.075	$2,650	0.075	$2,650	0.075	$2,650
Department of Tourism	MOU for expenses	meetings, mailings, review permits	0.01	$350	0.01	$350	0.01	$350	0.01	$350	0.01	$350
Department of Transportation	MOU for expenses	meetings, mailings, review permits	0.01	$350	0.01	$350	0.01	$350	0.01	$350	0.01	$350
NRCS and SCDs	MOU for expenses	meetings, mailings, review permits	0.01	$350	0.01	$350	0.01	$350	0.01	$350	0.01	$350
Wildlife Clubs												
Fishing Clubs												
Guides and Outfitters												
League of Cities												
ND Water Users												
Tribal												
		TOTAL	***1.59***	***$60,150***	***1.59***	***$60,150***	***1.59***	***$60,150***	***1.59***	***$60,150***	***1.59***	***$60,150***

Budget for training and education of field staff, law enforcement and volunteers.

			Education of Field staff, law enforcement									
			Year 1		Year 2		Year 3		Year 4		Year 5	
	Agencies and Entities	Description	Man-yr	Salary	Man-yr	Salary	Man-yr	salary	Man-yr	salary	Man-yr	salary
Funded by ANS-SP and ANS program	North Dakota Game and Fish Department	Training of field staff, and wardens	0.01	$2,750	0.01	$1,750	0.01	$1,750	0.01	$1,750	0.01	$1,750
	State Water Commission	Training of staff	>0.01		>0.01		>0.01		>0.01		>0.01	
	Department of Health	Training of staff	>0.01		>0.01		>0.01		>0.01		>0.01	
	Department of Agriculture	Train of law enforcement and field staff	>0.01		>0.01		>0.01		>0.01		>0.01	
	Parks & Recreation Department		>0.01		>0.01		>0.01		>0.01		>0.01	
	Department of Tourism		>0.01		>0.01		>0.01		>0.01		>0.01	
	Department of Transportation		>0.01		>0.01		>0.01		>0.01		>0.01	
	NRSC and SCDs	Training of staff	>0.01		>0.01		>0.01		>0.01		>0.01	
	Wildlife Clubs	Train volunteers	>0.01		>0.01		>0.01		>0.01		>0.01	
	Fishing Clubs	Train volunteers	>0.01		>0.01		>0.01		>0.01		>0.01	
	Guides and Outfitters	Train volunteers	>0.01		>0.01		>0.01		>0.01		>0.01	
	League of Cities	Train volunteers	>0.01		>0.01		>0.01		>0.01		>0.01	
	ND Water Users	Train volunteers	>0.01		>0.01		>0.01		>0.01		>0.01	
	Tribal	Train of law enforcement and field staff	>0.01		>0.01		>0.01		>0.01		>0.01	
		TOTAL		***$2,750***		***$1,750***		***$1,750***		***$1,750***		***$1,750***

Budget for educational materials for field staff and enforcement.

	Educational Materials					
	Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	field guides to ANS; provide to staff and enforcement officers	$2,500	$500		$500	
	brochures which will be provided to agencies, entities, and the public	$2,000				$5,000
	booklet defining ANS problems, state laws, responsibility of agencies and entities	$1,500				

Budget for local and regional educational campaign using mass media.

	Mass Media					
	Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	TV and radio spots, half page articles in newspapers and monthly periodicals	$12,500	$12,500	$12,500	$12,500	$12,500

Budget for promotional items.

	Promotional items					
	Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	Items (beverage wraps, mugs, pens, stickers, etc)	$5,000	$5,000	$1,000	$500	$1,500

Budget to collect information from anglers on effects of educational campaign and attitudes.

	Data Collection					
	Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	Questions in angler interviews	$750	$750	$750	$750	$750

Budget for signs at boat ramps, bait stores, and marine dealers.

	Signs					
	Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	for bait dealers	$250	$250	$250	$250	$250
	signs at marina	$750			$750	$750
	boat dealers	$750			$750	
	Meet Parks and Recreation Department guidelines	$500			$500	

Budget for research as directed by the ANS-SP and IASC.

	Contracts					
	Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	Consultant - boater interviews at waterbodies, research avenues of introduction, determine compliance with ANS prevention protocols, sample for veligar in selected waterbodies; summer staff to conduct field surveys, post signs, and conduct interviews	$7,500	$17,500	$17,500	$20,000	$5,000

Budget for monitoring selected waterbodies for adult zebra mussels.

	Adult Zebra Mussel Sampling					
	Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	ZM traps, other equipment	$500	$1,000	$1,000	$250	$250

Budget for efforts to provide information to the public and private sector by use of outside entities.

	Agency or Entity	Grants					
		Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	Tourism	ANS prevention information in publications	$1,000	$1,000	$1,000	$1,000	$1,000
	Wildlife Clubs	serve as liaison to outdoor interests	$1,000	$1,000	$1,000	$1,000	$1,000
	Fishing Clubs	serve as liaison to outdoor interests	$1,000	$1,000	$1,000	$1,000	$1,000
	Guides and Outfitters	serve as liaison to outdoor interests	$1,000	$1,000	$1,000	$1,000	$1,000
	ND Water Users	serve as liaison to water interest	$1,000	$1,000	$1,000	$1,000	$1,000
	Tribal	serve as liaison to outdoor interests	$1,000	$1,000	$1,000	$1,000	$1,000

Budget for ANS-SP for meeting and conferences on ANS issues and education.

	Attend meetings and conferences					
	Description	Year 1	Year 2	Year 3	Year 4	Year 5
Funded by ANS-SP and ANS program	100th Meridian, WRP, MICRA, WRP, etc	$7,500	$7,500	$7,500	$7,500	$7,500

Appendix F. **Invasive Aquatic Nuisance Species Issues for the North Dakota Legislature**

North Dakota Legislation Issues

The following is a listing of areas that legislation will need to be developed to protect North Dakota's economic and recreational opportunities from ANS:

- Develop North Dakota's list of ANS. The list will be determined by the Aquatic Invasive Species Committee (AISC), and adopted by the North Dakota Game and Fish Department after consultation with other (but consensus is not required to list a species as problem), the list will be regularly reviewed and species added or dropped
- Provide for agencies/entities that have a relationship/responsibility/protection of the State's aquatic resources be tasked with:
    - organize and recognize the AISC as a legislatively authorized advisory board with limited authorities
    - list those aquatic species, plants, animals, and pathogens, that cannot be brought into or moved within North Dakota
    - authorities/powers of agencies and entities responsibility for the best management of North Dakota's resources be expanded to include ANS prevention efforts
    - regulation be provided and expanded where and as needed to prevent ANS movement
    - authority to collect monies or grants to provide for funds for operation of the AISC and conduct ANS education/prevention
    - provide for the partnership of state agencies, state agencies and federal government, private or public organizations to fund ANS prevention efforts
- Provide the agencies authorities/responsibilities/mandated efforts :
    - North Dakota Game and Fish Department to provide for regulations on ANS prevention on the importation in baits, live fish for rearing, stocking, or sale which included the pet trade, transported into or within the state on or in boats, trailers, equipment or vehicles, associated inspections and enforcement of regulations, to apply for those funds held available as grants from state, federal or private sources and to spend such monies on ANS activities
    - Dept of Health to consider including REPPs in permits for water projects of all sorts to prevent the importation or transfer of ANS into or within the state
    - State Water Commission to consider including REPPs in permits for water projects of all sorts to prevent the importation or transfer of ANS into or within the state
    - Dept of Ag to provide for regulations/information on the importation, propagation, and growing of plant in the state or those brought into the state to those engaged in such activities, inspection such plant nurseries, garden centers, or facilities/premises for ANS on a

reasonable bases, enforce such regulations as adopted to prevent ANS
    - USDA or appropriate local government entity involved with food handling and preparation will have responsibility inspection of live animals or plants used in the food industry to assure that they are not ANS or will pose a problem to natural resources if they are allowed to escape
    - Natural Resource Conservation Service/Natural Resource Boards/Water Resource Boards shall participate in ANS prevention as part of their activities, cause those landowners to participate in ANS prevention/control efforts, assist in funding AISC activities, provide for the power to rapidly respond to ANS infestations and take needed/necessary efforts to control or eliminate such problems as are identified to them by the AISC; powers to close waterbodies to use while ANS is being eradicated or control efforts required to use a waterbody
    - Parks and Recreation shall include ANS educational/prevention materials in their published literature and place signs or other devices where and as needed; enforce ANS regulations on the movement of ANS into or within the state
    - Tourism shall include ANS educational/prevention material in literature published
    - mandate that law enforcement professionals and DOT representative include ANS inspection on vehicles as prudent and as suspect to/of need
    - provide for a system of fines/legal forfeitures of such ANS regulations as to make Class B misdemeanor
    - agencies/entities which receive public funds shall include ANS educational/prevention literature

- ANS cannot be imported or transported into or within the state; a civil penalty for violation of such regulations is needed; develop a system of fines/legal actions that are commensurate with the problem – Class B misdemeanor
- provide for the authority to enforce ANS legislation to appropriate agencies with a mandate to enforce such regulations which includes the impounding of vehicles or vessels with ANS, and provide for monies/manpower to do such and mandate that such enforcement be done
- Develop a standing committee to deal with ANS prevention, education, and outreach similar to the Invasive Aquatic Species Committee
- Any boat could be inspected by appropriate authorities before being allowed to be launched into ND waters or transported into or within North Dakota
- Fish, including live baitfish, aquarium pet trade, aquiculture, and similar venues, entering the state would be accompanied by certification of ANS

free from the state they were produced in and brought from, the certification can come from an independent laboratory, a fine compensatory with the problem will be established

- Plants, included those sold in plant nurseries, garden supply centers, home improvement stores, and similar venues, plants would be certified as not being ANS from the supplier, state/county of origin, or by an independent laboratory, a fine compensatory with the problem will be established
- Provide for the Rapid Response Plan's authority to quarantine or require ANS prevention protocols from waterbodies with ANS infestations
- Provide for regulations to prevent the sale of live fish or aquatic creatures in the food market, but allow for the display of live fish or aquatic creatures
- Authority to detain, impound, or hold boats, recreational equipment, industrial equipment, and associated trailers or other equipment that require cleaning and disinfection for ANS and to bill those individuals for agencies time and effort to do that work if not done by owner/operator.

This legislation gives the North Dakota Game and Fish Department and other state agencies the authority to properly prevent the importation and establishment of ANS in North Dakota waters. The AISC will foster cooperation between existing agencies and their programs dealing with aquatic nuisance species, fill the gaps between the programs, and to provide funding for ANS activities.

Appendix G: **Agencies, Public and Private Groups, and Individuals (the representative) on the Aquatic Invasive Species Committee**

Aquatic Invasive Species Committee

Named entities and individuals

North Dakota Department of Health
(Mike Sauer, appointed representative)
600 East Boulevard, 2nd Floor-Judicial Wing
Bismarck ND 58505-0200

North Dakota Department of Parks and Recreation
(Kathy Duttenhefner, appointed representative)
1600 East Century Avenue, Suite 3
Bismarck, ND 58503

North Dakota Game and Fish Department
(Lynn R Schlueter, ANS-Coordinator/designated representative)
100 North Bismarck Expressway
Bismarck, ND 58501

Fishing Clubs and Conservation Groups
(Duane Ash/President, volunteer)
ND Sportfishing Congress
PO Box 365
Devils Lake, ND 58301-0708

North Dakota Tourism and Commerce Department
(Mark Zimmerman, appointed representative)
Outdoors Promotion
North Dakota Tourism
1600 East Century Avenues, Suite 2
Bismarck, ND 58501

North Dakota State Water Commission
(Mike Noone, appointed representative)
900 East Boulevard-State Office Building
Bismarck, ND 58505-0187

North Dakota Department of Agriculture
(Rachel Seifert-Spilde, appointed representative)
600 East Boulevard Avenue
Dept. 602
Bismarck, ND 58505

North Dakota Water Users Organization
(Jason Debouds, appointed)
1605 East Capitol Ave
Halkirk Offices
Bismarck, ND 58505-0187

Wildlife Clubs and Conservation Groups
(John Kopp, President, volunteer)
North Dakota Wildlife Federation
2911 116 R Ave SE
Valley City, ND 58072

Tribal Interests
(Daniel Lonhes, appointed representative)
Marina Director
Spirit Lake Casino and Marina
7889 Highway 57
St Michael, ND 58370

North Dakota Guides and Outfitter Association
(Kyle Blanchfield/Association President, volunteer)
President of
1012 Woodland Drive
Devils Lake ND 58301

Invasive Aquatic Species Committee, standing or associated representatives

Named entities and individuals

United States Department of Agriculture
(Dave Dewald, volunteer)
NRCS, Box 1458
Bismarck, ND 58502

North Dakota League of Cities
(Connie Sprynczynatyk/Director, volunteer)
410 East Front Ave.
Bismarck, ND 58504

North Dakota Department of Commerce
(Lee Peterson)
1600 E. Century Ave, Suite 2
P O Box 2057
Bismarck, ND 58502

North Dakota Water Boards Association
(Ben Varnson, President)
4877 112th Ave NE
Lakota, ND 58344-9481

Garrison Conservative Unit
(Kip Kovar, volunteer)
PO Box 140
Carrington, ND 58421

Eastern Grand Forks County Soil Conservation District
(Nedra Holberg, volunteer)
2397 Demers Avenue
Grand Forks, ND 58201

Contributing agencies or entities, cities, and universities

US Fish and Wildlife Services

US Army Corps of Engineers

Bureau of Reclamation

Cities of
Fargo
Bismarck
Grand Forks
Minot
Dickinson
Devils Lake

Valley City State University

University of North Dakota

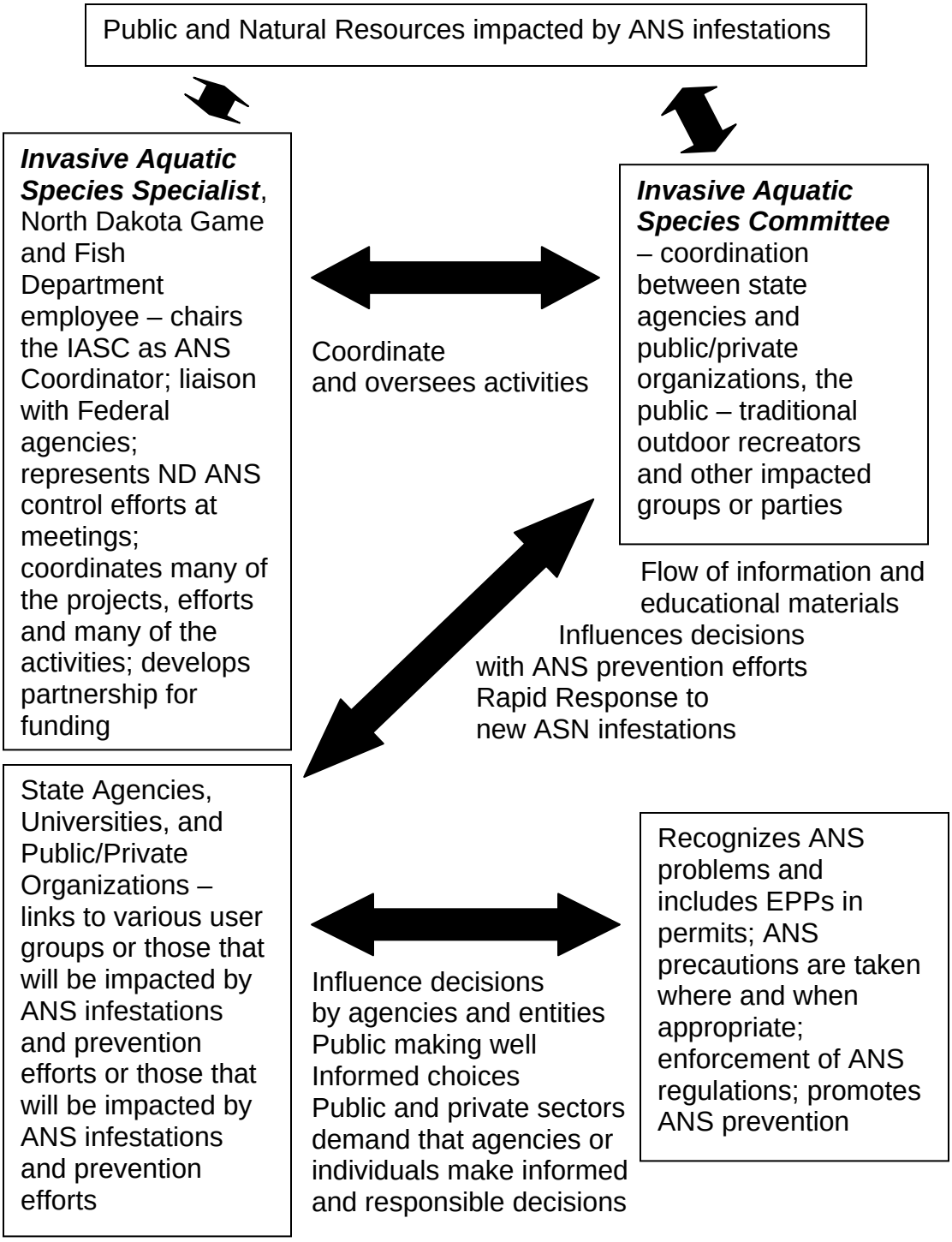
North Dakota State University

Minot State University, Bottineau Campus

Appendix H: **Summary Flow chart for Aquatic Invasive Species Committee and various agencies and entities, public and private.**

North Dakota's Aquatic Invasive Species Committee Flow Diagram for Visualization Purposes

Educated public and private sector, an educated water user will be aware of the need for ANS precautions, North Dakotans will require that ANS precautions be implemented



Appendix I: **Detailed Flow chart for Aquatic Invasive Species Committee and various agencies and entities, public and private.**

North Dakota Statewide Aquatic Nuisance Species Management Plan

North Dakota Game and Fish Department
Lead agency for ND-Plan efforts

Fish and Wildlife Service ANS–Task Force will be providing funds

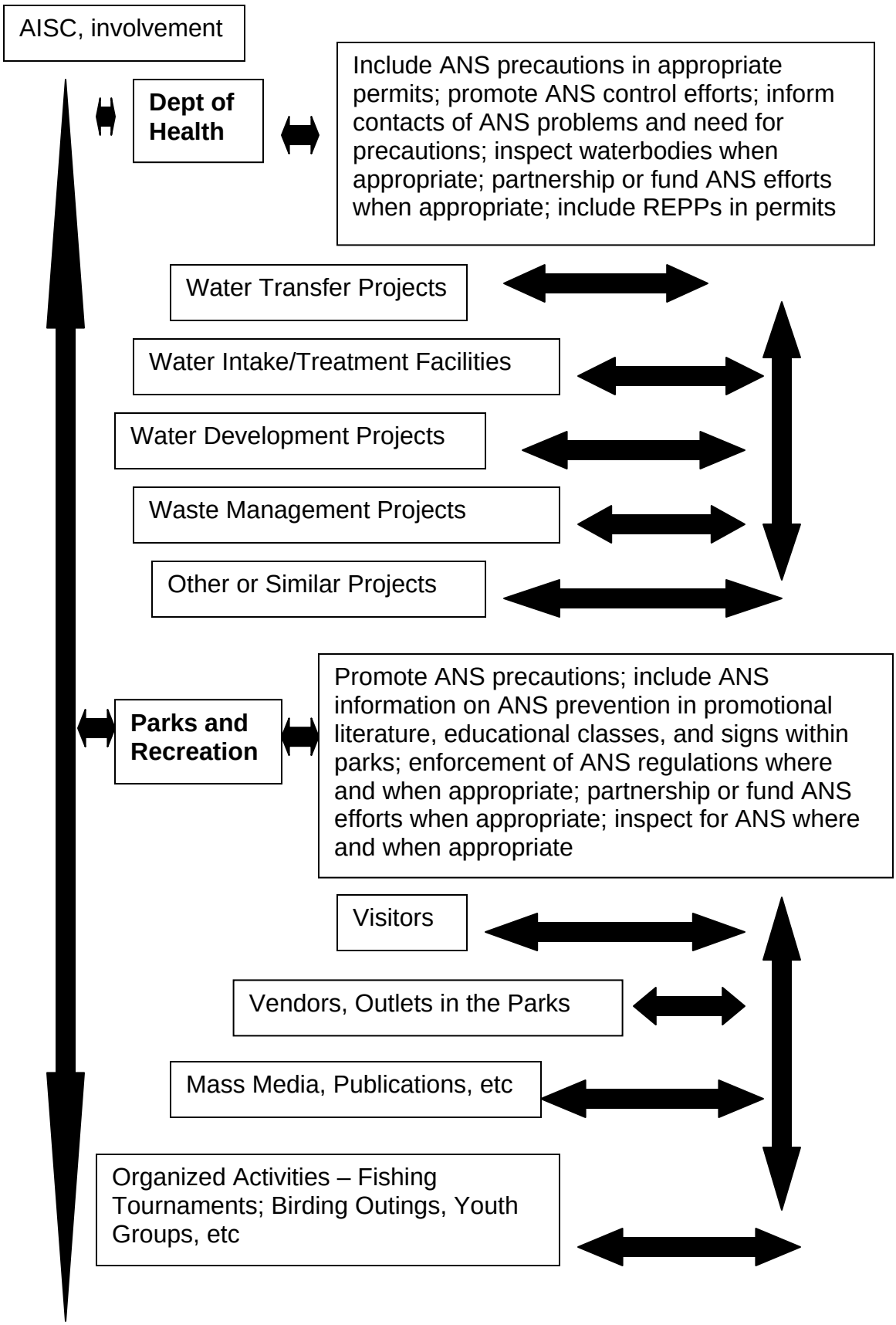
ANS Coordinator, NDGF appointed - the liaison between the various entities (federal entities, state, private, and public) for ANS prevention, education, and control or eradication. Directs the projects and makes recommendation to groups (federal, state, local, private, and private) for ANS education, prevention or eradication. Seek and secure additional funding; alternative sources of funding; use of nontraditional funding sources; partnership between state agencies and federal sources

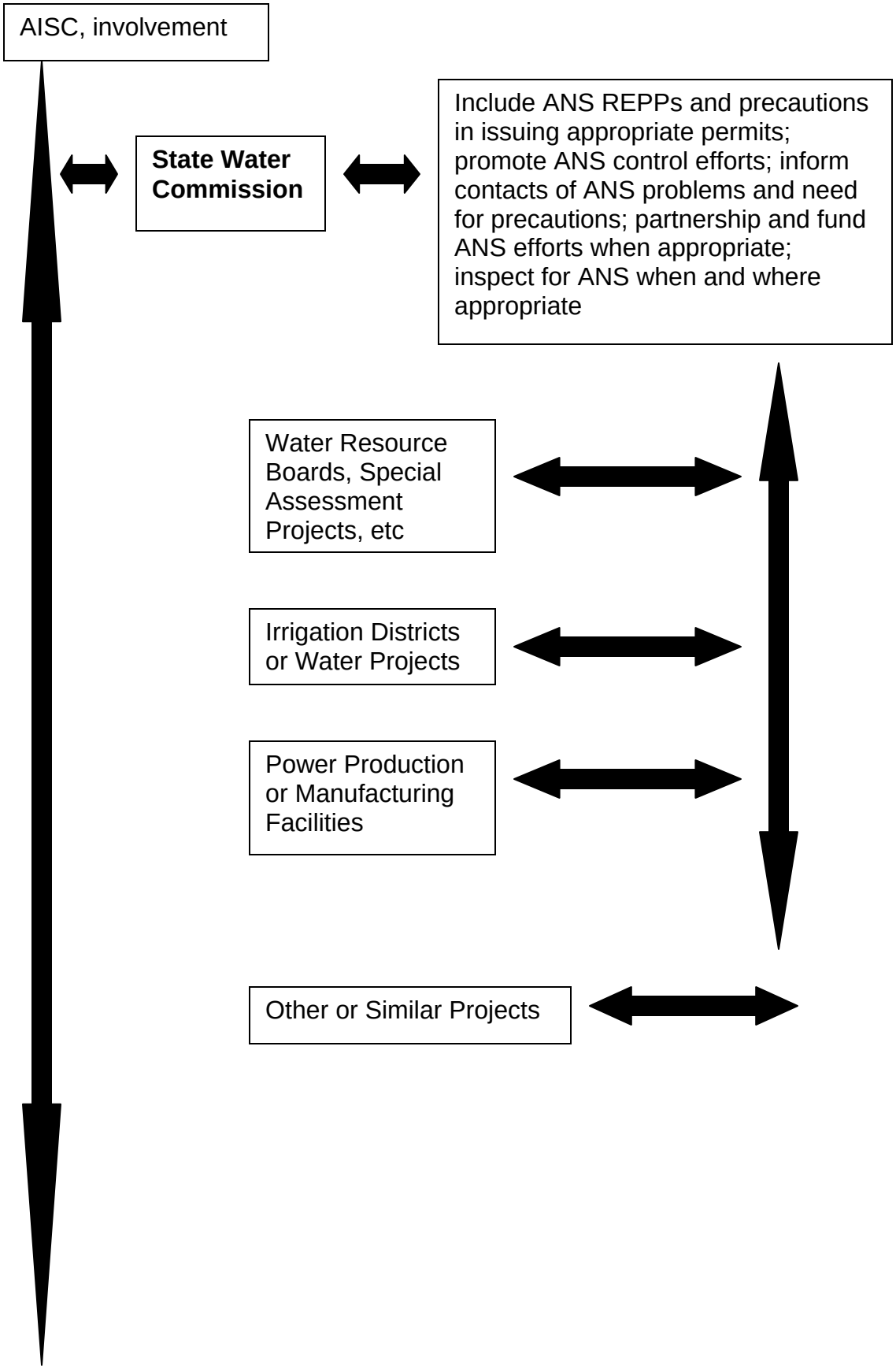
Aquatic Invasive Species Committee (AISC)

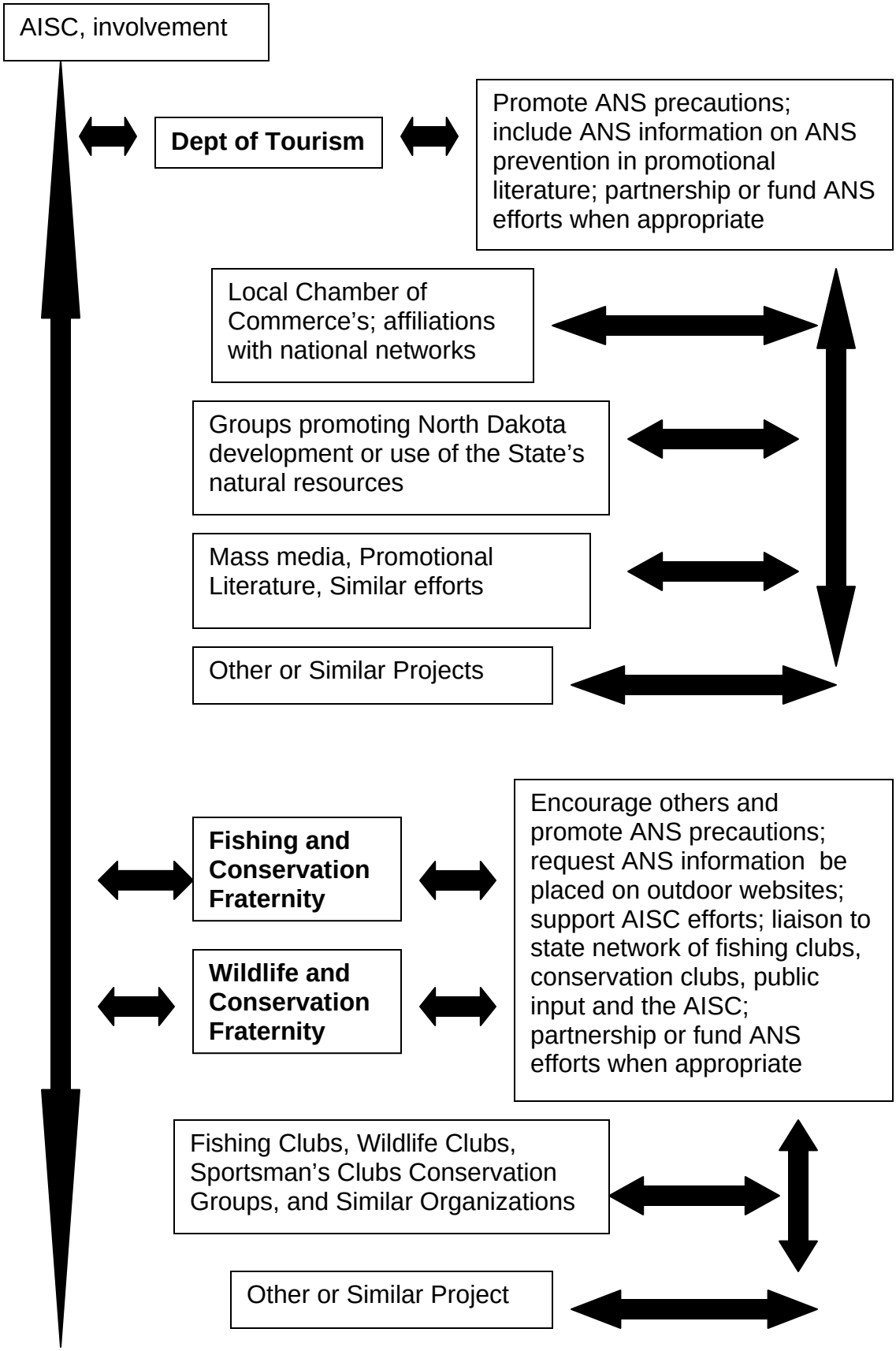
- Development of a North Dakota list of Aquatic Invasive Nuisance Species
- Education and Information, and Public/Private/Commercial Outreach efforts
- Facilitate in monitoring of waterbodies for ANS infestations
- Fund and coordinate monitoring avenues of ANS spread, into or within the state
- Early Detection and Rapid Response to Control or Eradicate Problem Species
- Prevention of Introductions and draft Administrative Code which includes provision for appropriate enforcement of laws and regulations now existing

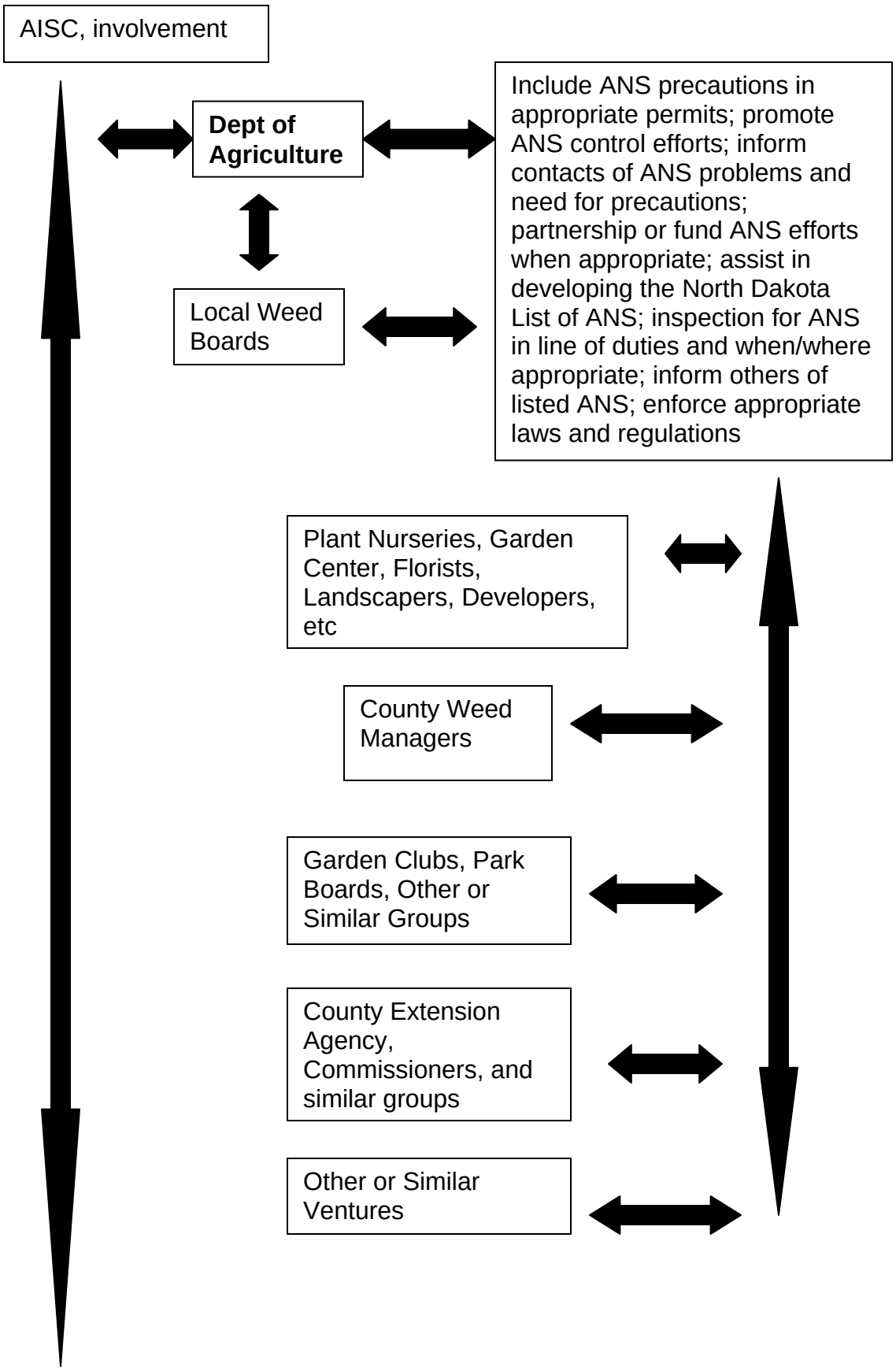
Function as an advisory board for making informed decisions by state, local, public and and private organizations.

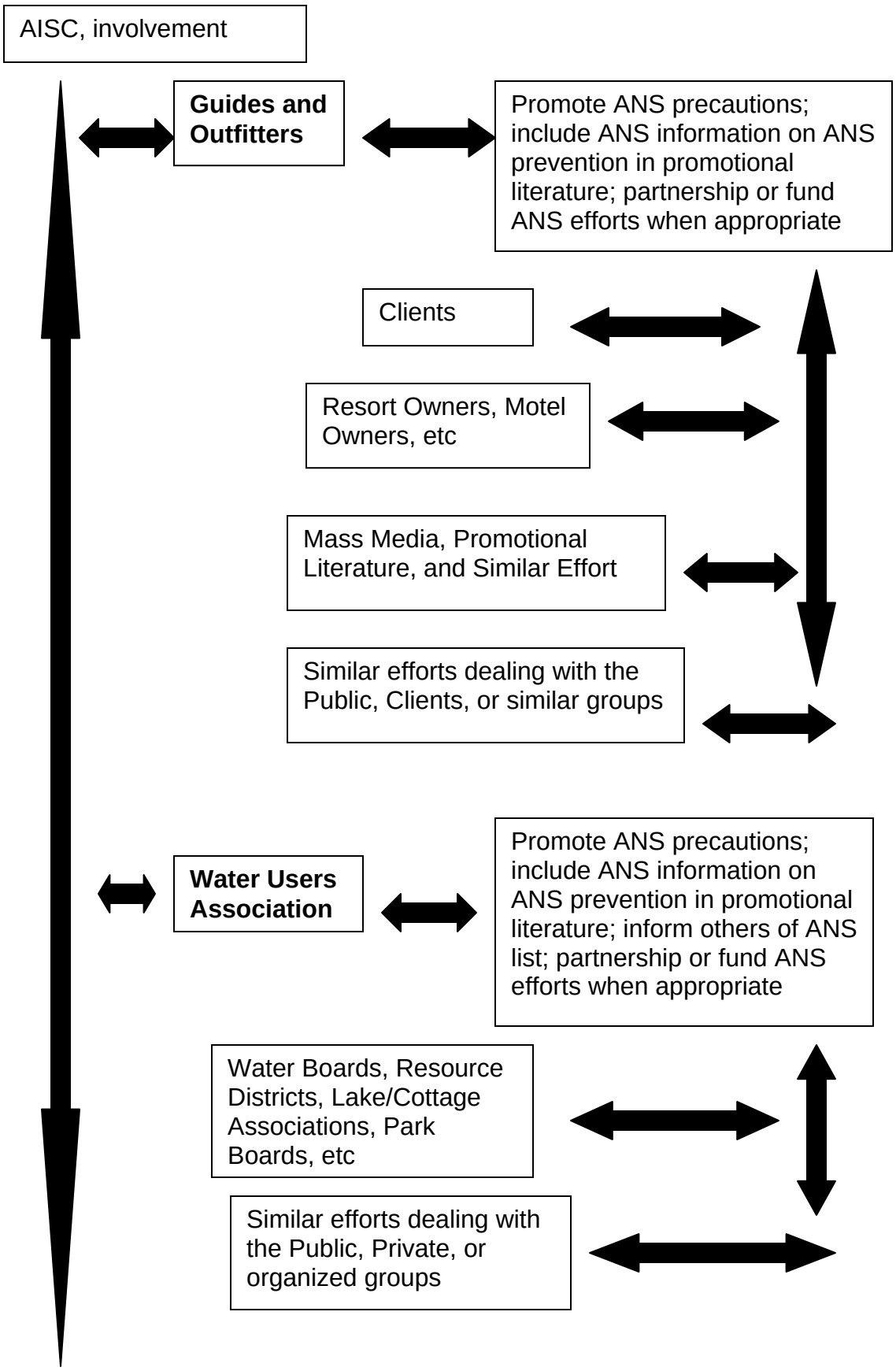
ANS Coordinator is chairperson and facilitates communication between/among agencies, entities, and organizations

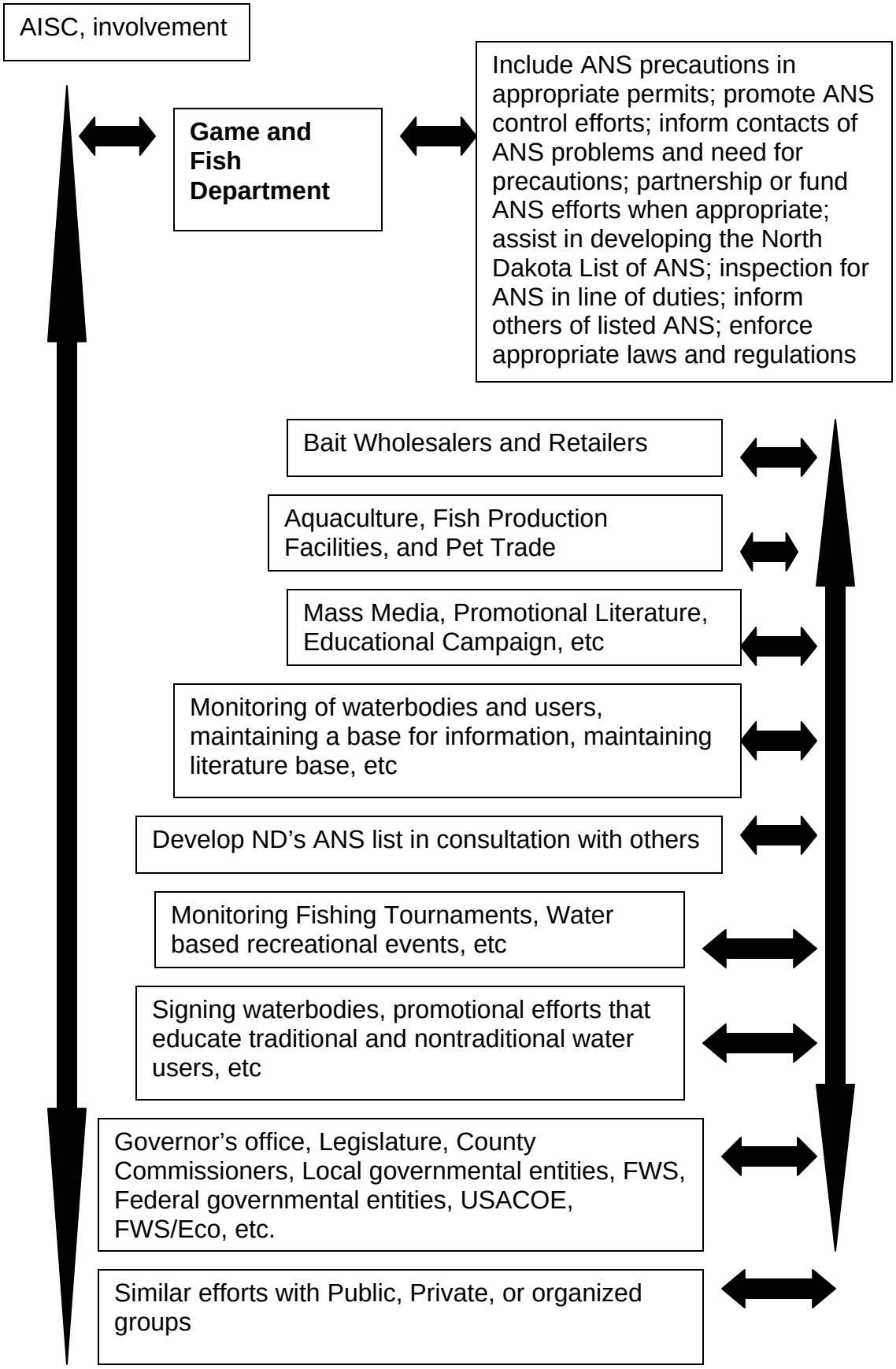

AISC, involvement
Dept of Health
Include ANS precautions in appropriate permits; promote ANS control efforts; inform contacts of ANS problems and need for precautions; inspect waterbodies when appropriate; partnership or fund ANS efforts when appropriate; include REPPs in permits
Water Transfer Projects
Water Intake/Treatment Facilities
Water Development Projects
Waste Management Projects
Other or Similar Projects
Parks and Recreation
Promote ANS precautions; include ANS information on ANS prevention in promotional literature, educational classes, and signs within parks; enforcement of ANS regulations where and when appropriate; partnership or fund ANS efforts when appropriate; inspect for ANS where and when appropriate
Visitors
Vendors, Outlets in the Parks
Mass Media, Publications, etc
Organized Activities – Fishing Tournaments; Birding Outings, Youth Groups, etc

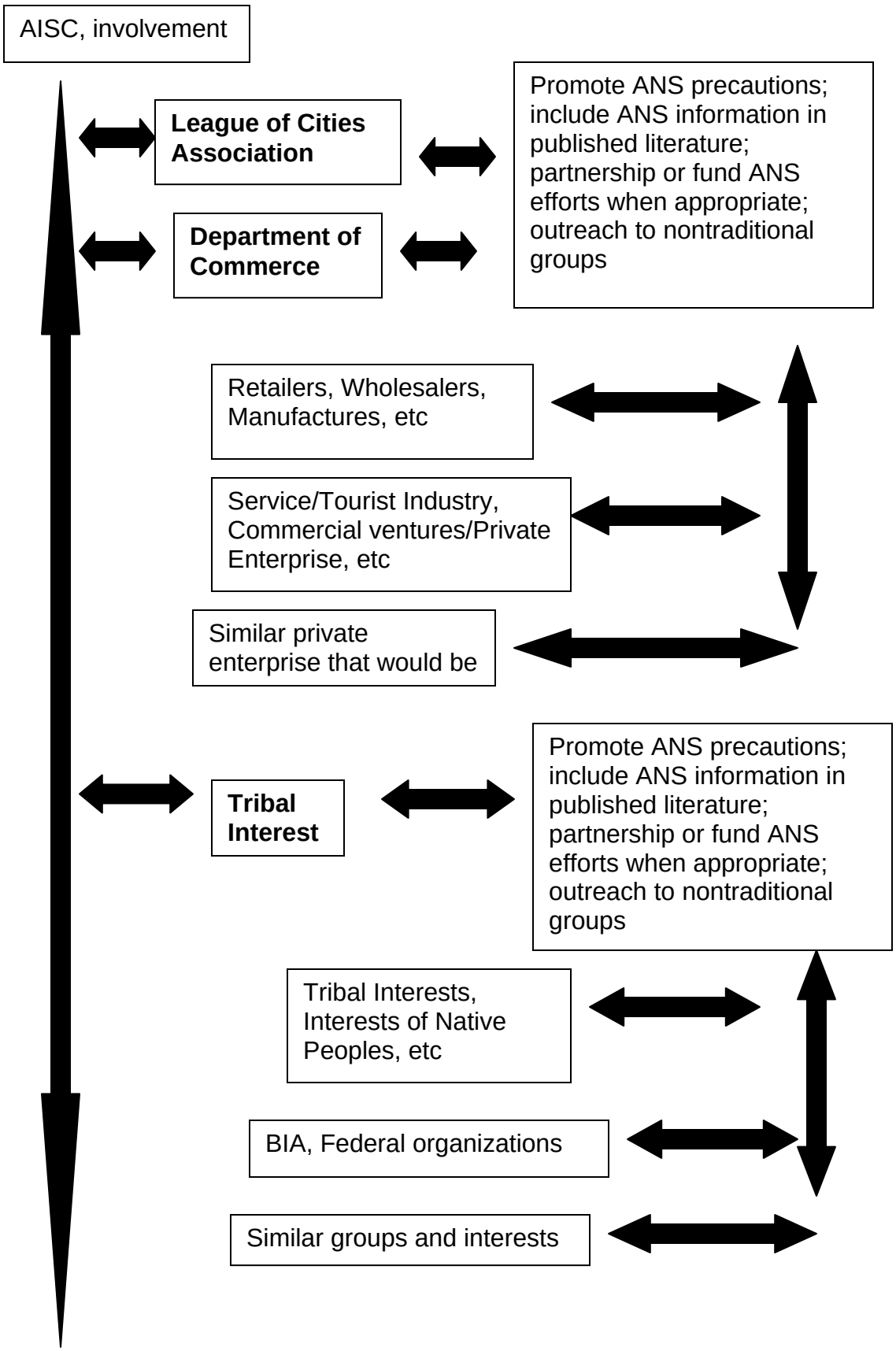

AISC, involvement
State Water Commission
Include ANS REPPs and precautions in issuing appropriate permits; promote ANS control efforts; inform contacts of ANS problems and need for precautions; partnership and fund ANS efforts when appropriate; inspect for ANS when and where appropriate
Water Resource Boards, Special Assessment Projects, etc
Irrigation Districts or Water Projects
Power Production or Manufacturing Facilities
Other or Similar Projects

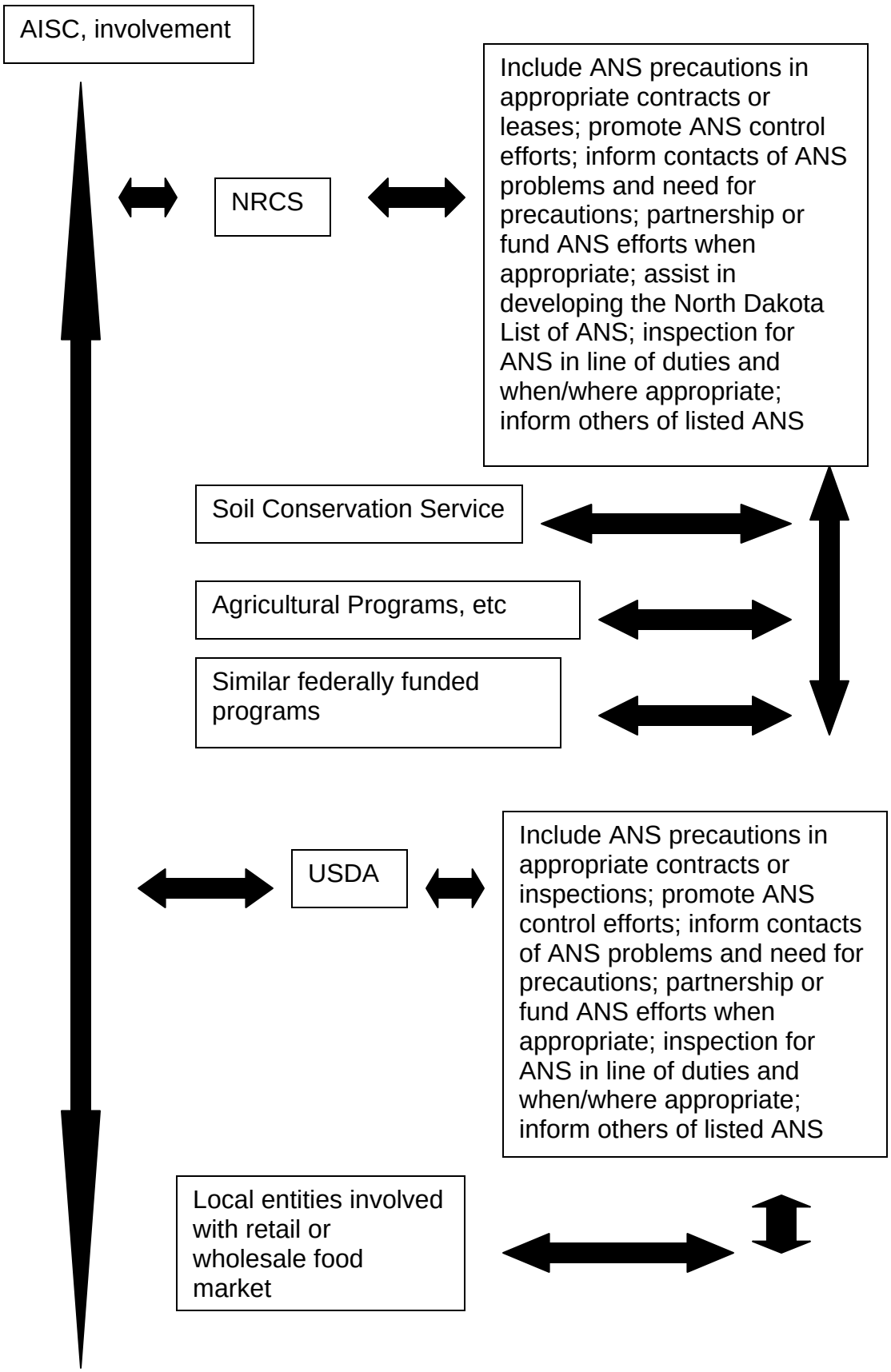

AISC, involvement
Dept of Tourism
Promote ANS precautions; include ANS information on ANS prevention in promotional literature; partnership or fund ANS efforts when appropriate
Local Chamber of Commerce's; affiliations with national networks
Groups promoting North Dakota development or use of the State's natural resources
Mass media, Promotional Literature, Similar efforts
Other or Similar Projects
Fishing and Conservation Fraternity
Wildlife and Conservation Fraternity
Encourage others and promote ANS precautions; request ANS information be placed on outdoor websites; support AISC efforts; liaison to state network of fishing clubs, conservation clubs, public input and the AISC; partnership or fund ANS efforts when appropriate
Fishing Clubs, Wildlife Clubs, Sportsman's Clubs Conservation Groups, and Similar Organizations
Other or Similar Project

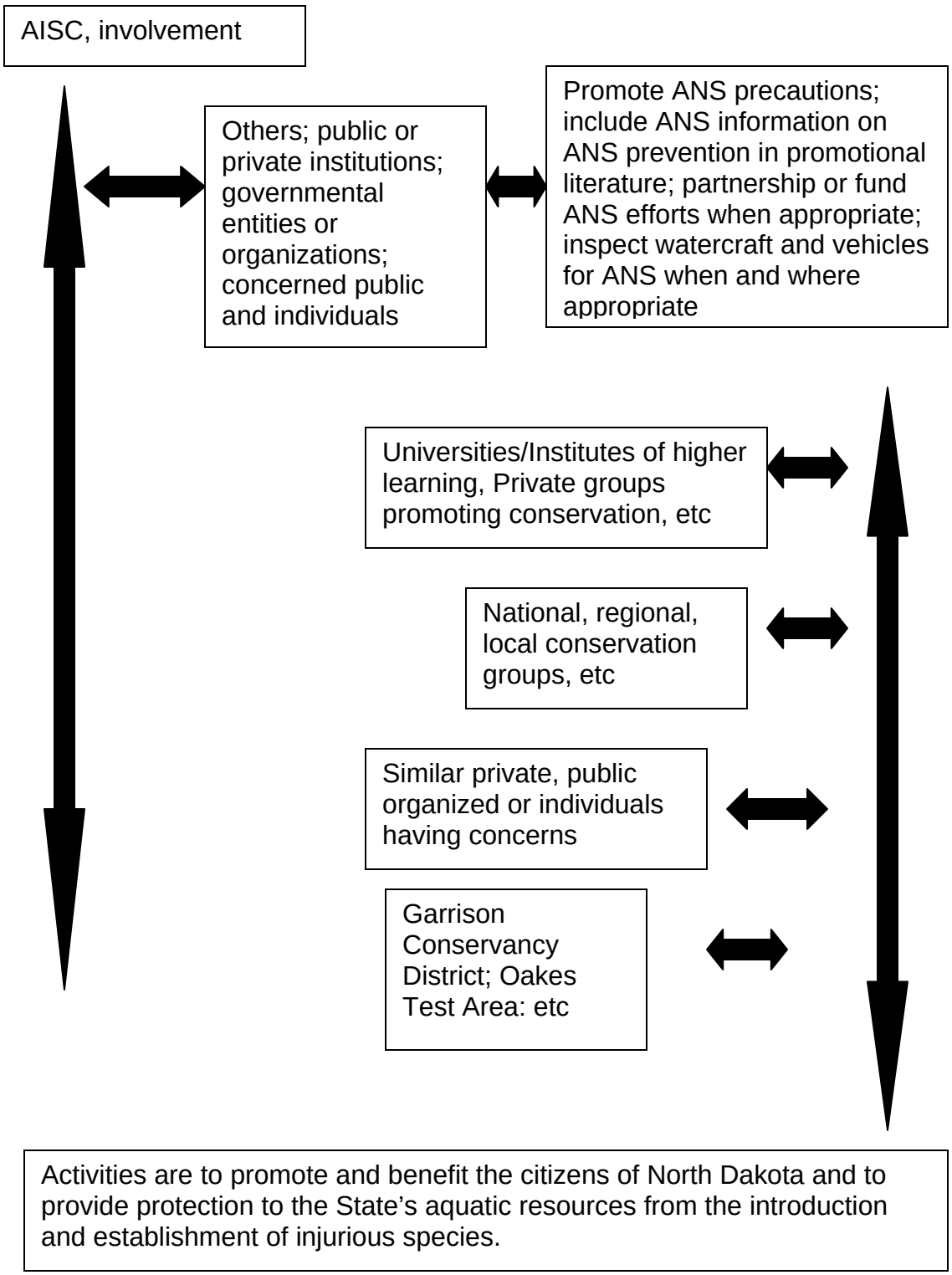

AISC, involvement
Dept of Agriculture
Include ANS precautions in appropriate permits; promote ANS control efforts; inform contacts of ANS problems and need for precautions; partnership or fund ANS efforts when appropriate; assist in developing the North Dakota List of ANS; inspection for ANS in line of duties and when/where appropriate; inform others of listed ANS; enforce appropriate laws and regulations
Local Weed Boards
Plant Nurseries, Garden Center, Florists, Landscapers, Developers, etc
County Weed Managers
Garden Clubs, Park Boards, Other or Similar Groups
County Extension Agency, Commissioners, and similar groups
Other or Similar Ventures


AISC, involvement
Guides and Outfitters
Promote ANS precautions; include ANS information on ANS prevention in promotional literature; partnership or fund ANS efforts when appropriate
Clients
Resort Owners, Motel Owners, etc
Mass Media, Promotional Literature, and Similar Effort
Similar efforts dealing with the Public, Clients, or similar groups
Water Users Association
Promote ANS precautions; include ANS information on ANS prevention in promotional literature; inform others of ANS list; partnership or fund ANS efforts when appropriate
Water Boards, Resource Districts, Lake/Cottage Associations, Park Boards, etc
Similar efforts dealing with the Public, Private, or organized groups


AISC, involvement
Game and Fish Department
Include ANS precautions in appropriate permits; promote ANS control efforts; inform contacts of ANS problems and need for precautions; partnership or fund ANS efforts when appropriate; assist in developing the North Dakota List of ANS; inspection for ANS in line of duties; inform others of listed ANS; enforce appropriate laws and regulations
Bait Wholesalers and Retailers
Aquaculture, Fish Production Facilities, and Pet Trade
Mass Media, Promotional Literature, Educational Campaign, etc
Monitoring of waterbodies and users, maintaining a base for information, maintaining literature base, etc
Develop ND's ANS list in consultation with others
Monitoring Fishing Tournaments, Water based recreational events, etc
Signing waterbodies, promotional efforts that educate traditional and nontraditional water users, etc
Governor's office, Legislature, County Commissioners, Local governmental entities, FWS, Federal governmental entities, USACOE, FWS/Eco, etc.
Similar efforts with Public, Private, or organized groups


AISC, involvement
League of Cities Association
Department of Commerce
Promote ANS precautions; include ANS information in published literature; partnership or fund ANS efforts when appropriate; outreach to nontraditional groups
Retailers, Wholesalers, Manufactures, etc
Service/Tourist Industry, Commercial ventures/Private Enterprise, etc
Similar private enterprise that would be
Tribal Interest
Promote ANS precautions; include ANS information in published literature; partnership or fund ANS efforts when appropriate; outreach to nontraditional groups
Tribal Interests, Interests of Native Peoples, etc
BIA, Federal organizations
Similar groups and interests


AISC, involvement
NRCS
Include ANS precautions in appropriate contracts or leases; promote ANS control efforts; inform contacts of ANS problems and need for precautions; partnership or fund ANS efforts when appropriate; assist in developing the North Dakota List of ANS; inspection for ANS in line of duties and when/where appropriate; inform others of listed ANS
Soil Conservation Service
Agricultural Programs, etc
Similar federally funded programs
USDA
Include ANS precautions in appropriate contracts or inspections; promote ANS control efforts; inform contacts of ANS problems and need for precautions; partnership or fund ANS efforts when appropriate; inspection for ANS in line of duties and when/where appropriate; inform others of listed ANS
Local entities involved with retail or wholesale food market


AISC, involvement
Others; public or private institutions; governmental entities or organizations; concerned public and individuals
Promote ANS precautions; include ANS information on ANS prevention in promotional literature; partnership or fund ANS efforts when appropriate; inspect watercraft and vehicles for ANS when and where appropriate
Universities/Institutes of higher learning, Private groups promoting conservation, etc
National, regional, local conservation groups, etc
Similar private, public organized or individuals having concerns
Garrison Conservancy District; Oakes Test Area: etc
Activities are to promote and benefit the citizens of North Dakota and to provide protection to the State's aquatic resources from the introduction and establishment of injurious species.

Appendix J: **Invasive Aquatic Species Committee Meeting Dates and Summary of that meeting, and How the North Dakota statewide aquatic nuisance species plan was developed.**

Invasive Aquatic Species Committee meeting dates, a summary of that meeting, and of the development of the North Dakota statewide ANS plan.

Date	Activity/Summary
FEB 04	Discussion with in North Dakota Game and Fish Department about problems associated with ANS
20 MAY 04	Initial meeting; various representatives from federal, state, and local shareholders in ANS prevention
02 JUN 04	Letter for Department to selected representatives to join the ANS efforts
10 JUN 04	Initial meeting of Invasive Aquatic Species Committee
22 JUN 04	Meeting to review draft of ND-Plan
06 JUL 04	Meeting to review draft of ND-Plan
20 JUL 04	Meeting to review draft of ND-Plan
17 AUG 04	Meeting to review draft of ND-Plan
21 SEP 04	Meeting to review draft of ND-Plan
25 SEP 04	ND-Plan for internal review within ND Game and Fish Department
26 SEP 04	ND-Plan provided to consultant for review and comment
12 OCT 04	Contacted Consultant about comments that were provided
21 OCT 04	Provided AISC with draft of ND-Plan with consultants comments
03 NOV 04	Final meeting of AISC to review draft plan
05 NOV 04	Final draft of ND-Plan prepared
15 NOV 04	Draft of the ND-Plan provide to the public and other agencies or entities, comments due by 24 DEC 04
24 DEC 04	Final day for comments to be received
06 JAN 05	Review and incorporated comments received into final version of the ND-Plan
14 JAN 05	ND-Plan provided to Director of the North Dakota Game and Fish Department for review and comment
19 JAN 05	ND-Plan provided to North Dakota Governor's Hoeven for review and comment

PROCESS and PLANNING
involved in preparing the
North Dakota statewide aquatic nuisance species plan.

The initial meeting of interested state and federal agencies, public organizations, and interested parties was held on 20 MAY 04 at the Department of Game and Fish headquarters in Bismarck, North Dakota. Following a brief presentation on ANS impacts to North Dakota aquatic resources, an invitation was made to participants to become part of the Aquatic Invasive Species Committee (ASIC) and work to develop the ND-Plan. A letter from the Department was sent out on 02 JUN 04 asking agencies and private groups to participate in the AISC and to name a representative for future contact. On 10 JUN 04, the AISC was formed. With the AISC formed, the Aquatic Invasive Species Coordinator provided this group a working copy of a statewide ANS plan. The AISC reviewed this draft, made suggestions which the Coordinator considered and incorporated where needed. This review was considered to be the first draft of the ND-Plan. A number of AISC meetings were required to prepare a final draft

ND-Plan which was suitable for public review. News releases were provided to all the newspapers in North Dakota via the Department's Conservation and Communication Division.

The final draft of the ND-Plan was provided to the public and interested agencies via the North Dakota Game Fish Department webpage, public meetings, and to all who requested a hard copy or CD. A forty-four day comment period was provided for and comments could be provided to the Bismarck office or to the Devils Lake office.

The draft of the ND-Plan was provided to technical advisors who provided species-specific information and technical review of the document (see Appendix I for a list of those who reviewed the final draft).

Public meetings were held at Grand Forks, Fargo, Riverdale, and Bismarck to provide opportunities for private and agencies or entities to comment on the ND-Plan.

After the public, technical, and other state agency review, a final draft plan was provided to North Dakota's Governor for review and approval. With the signature of the Governor, the ND-Plan was provided to the federal ANS TASK Force for their review and approval.

The development of the ND-Plan was the result of the dedication and coordinated efforts from all of these individuals on the AISC and those that reviewed the draft document.

Appendix K: **Public Comments (reference the North Dakota's statewide aquatic nuisance species management plan.**

Comments on the North Dakota aquatic nuisance species statewide management plan.

Public Comments

Only a few individuals attended the public meetings: Grand Forks – 3 people; Fargo – 3 people; Riverdale – 3 people; and Bismarck – 2 people. There were no negative comments from these individuals and these comments were all verbal. The individuals were encouraged to provided written comments, but they choose not to do such.

Comments from Agencies or Entities

No written comments were received from agencies or entities in opposition to the North Dakota's state management plan for prevention and control of aquatic nuisance species. These groups or representatives from those groups did offer verbal support of the Department's effort to organize the state's efforts to prevent aquatic nuisance species introduction into or within North Dakota.

Appendix L: **Technical Advisors and Individuals that Reviewed North Dakota Aquatic Species Management Plan**

Technical Advisors and Individuals that Reviewed North Dakota Aquatic Species Management Plan

ANS Coordinators

Doug Jensen
Minnesota Sea Grant

Jeff Shearer
South Dakota Game Fish and Parks

Steve Schainhost
Nebraska Game and Parks Department

Eileen Ryce
Montana Game, Fish, and Parks

Kim Bogenschutz
Iowa Department of Natural Resources

Tom Flatt
Illinois Department of Natural Resources Section

Federal

Steve Krentz
Fisheries Assistance Operation
Fish and Wildlife Service

Universities

Steven Kelsch
University of North Dakota
Chair of Biology Department

North Dakota Game and Fish Department

Ron Wilson
Editor of North Dakota Outdoors

Terry Steinwand
Chief of Fisheries

Consultant

Michael E. Fraidenburg
Dynamic Solutions Group, LLC

Appendix M: **Comments from the Technical Advisors that Reviewed the North Dakota ANS Management Plan**

Comments on the North Dakota aquatic nuisance species statewide management plan provided by other states' aquatic nuisance species coordinator or technical representatives

Excerpts from ANS Coordinators' Comments

From
Tom Flatt, Aquatic Habitat Coordinator (AIS and Contaminants)
Div. of Fish and Wildlife, Fisheries Section
402 W. Washington St., Room W273
Indianapolis, IN 46204-2781
Phone: 317-232-4093 FAX: 317-232-8150

Lynn …. I went through it (the ND-Plan) enough to see how it was developed. I see what you mean by the plan being action orientated with development of a comprehensive public input plan coming later. And I can't disagree with your approach. Most of the action items necessary for control and prevention of ANS are universal and do not have to be reinvented in each management plan. I think the main purpose of the public input process is to get stakeholders and partners to have ownership in the plan, but that can happen later as your plan proposes. I think your approach will be as, if not more effective, as the traditionally developed plans.

From
Kim Bogenschutz
Aquatic Nuisance Species Program Coordinator Iowa Department of Natural Resources
1436 255th Street
Boone, Iowa 50036
515-432-2823 (phone)
515-432-2835 (fax)
Kim.Bogenschutz@dnr.state.ia.us

Lyn-

I have a few comments on your ANS plan based on my own experience implementing our plan. I was not involved in writing our plan but can tell you how things have gone over the past four years since we began implementation. Most of my comments are minor, so that must mean you did a great job developing your plan. I loved that you really made it North Dakota's plan, not a Game and Fish plan. I am sure that helps with agency and public buy-in.

From
Eilleen Ryce [ERyce@state.mt.us]

Montana Aquatic Nuisance Species Coordinator
Montana Fish, Wildlife, and Parks
1420 East 6th Avenue
Helena, MT 59620-0701

Hi Lynn,
Your plan looks great. I will get a formal letter sent to you today stating how Montana supports your plan …..

A couple of comments that I have:
1) on pg 2 under the "Outdoor Recreation" section. Whirling disease is a parasite NOT a viral pathogen.
2) in Appendix J, I work for Montana Fish, Wildlife and Parks
3) the only thing I thought a little strange about the way the plan was arranged was that in the plan there was no listing of the priority ANS in North Dakota. I noticed that this information is all in Appendix L in the Risk Assessment. To me it makes sense to have a section in the plan on exactly which species are of highest concern and why they are of concern.

For what they are worth, those are my comments.

Great job, Eileen.

From
Hazel Sletten
Supt. Water Utility
P.O. Box 5200
Grand Forks, ND 58206-5200
(701) 746-2595
Hsletten@grandforksgov.com

Lynn
I apologize for the delay in getting back to you with comments on the INS Report and presentation. I enjoyed the presentation. As a representative of a water utility using surface water I appreciate the opportunity to review the document and the acknowledgement of potential impacts to water utilities from invasive species. I have no comments on the document, it appears to be well thought out and addresses the concerns of the water utility.

Thanks you for the opportunity to comment and review the document.

Hazel

Appendix N: **Outtakes from: RISK ASSESSMENT FOR THE INTRODUCTION AND ESTABLISHMENT OF AQUATIC NUISANCE SPECIES IN NORTH DAKOTA**

Outtakes from:

RISK ASSESSMENT FOR THE INTRODUCTION AND ESTABLISHMENT OF AQUATIC NUISANCE SPECIES IN NORTH DAKOTA

Prepared by
Larry Brooks, Minot State University – Bottineau, 105 Simrall Boulevard,
Bottineau, ND 58318

and

Lynn R Schlueter, Special Project Biologist, North Dakota Game and Fish Department

Submitted on January 2004

Status of Aquatic Nuisance Species in North Dakota - Priority for Action

All nonindigenous species impact native species and habitat in some manner, but not all of them pose a significant threat, and some provide an economic and recreational benefit in certain areas. While it is hard to elucidate the effects that species will have once they are introduced, there are species that have current or potential impacts on native species and habitats and economic and recreational activity in North Dakota are known to be negative and significant are of concern. These ANS are a priority for management actions. At the same time, the ability to manage each species varies greatly, and the resources available are limited. Management efforts must, therefore, be focused on species where actions can produce the greatest benefit. In recognition of the known threats, impacts, and potential problems of certain ANS and the state's current management capabilities, a system to classify species was developed that recommends management activities for each classification. Yet, because impacts either do not occur immediately or may not be apparent until well after establishment, effort must also be devoted to assessing the overall impacts of nonindigenous species, regardless of their classification. The following are examples of species to be addressed by the ND-Plan. This list is not comprehensive, but is provided to illustrate species in each management class. The Plan provides for an on-going assessment of potential priority class species.

PRIORITY CLASS 1

Priority Class 1 species are currently not known to be present in North Dakota, but have a high potential to invade and there are limited or no known management strategies for these species. Appropriate management for this class includes prevention of introductions and eradication of pioneering populations. Examples of species that need to be addressed under this management class are discussed below.

Eurasian Watermilfoil (*Myriopyllum spicatum*)

Eurasian watermilfoil (EWM) was accidentally introduced to North America from Europe. Spread westward into inland lakes primarily by boats and water birds, it reached the Midwestern states between the 1950s and 1980s. A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats and trailers can spread the plant from lake to lake. Once the plant is established it is almost impossible to eradicrate it. Populations of this plant exist in Minnesota and Wisconsin which is the home to many of the non-resident outdoor recreators which come to North Dakota.

While EWM was sampled in the Sheyenne River above Valley City, North Dakota, in the early 1990's, it has not been found in subsequent sampling. The Sheyenne River above Valley City was dewatered in the late fall in the mid 1990's to repair the city's water intake. The temperature dropped to zero or below for a few days and the mudflat on which the ANS was growing froze solid. Eurasian watermillfoil has not been found after that event.

Zebra Mussel (*Dreissena polymorpha*)

In the late-1980s, the zebra mussel was discovered in Lake St. Clair, between Lake Huron and Lake Erie. Zebra mussels were introduced from Eastern Europe via ballast water discharge from European freighters. This species spread rapidly to 20 states in the Mississippi River drainage. Nationwide expenditures to control zebra mussels in water intake pipes, water filtration equipment, and electric generating plants are estimated at $3.1 billion over 10 years (OTA, 1993).

Zebra mussels can easily survive overland transport from the Midwest to North Dakota while attached to boat hulls or in live wells, engine cooling systems, or bait buckets. Live zebra mussels have been found in Minnesota lakes which are less than 100 miles from North Dakota's border. Juvenile zebra mussels have been found in the Missouri River below Gavins Point Dam and Big Bend Dam in South Dakota. These two areas are within a short drive from North Dakota's primary fisheries, i.e., Devils Lake, Lake Sakakawea, and the Missouri River. The zebra mussel is a prolific fouling organism with great potential to disrupt municipal water intake structures and cause ecological and economic damage in upper Midwest. Zebra mussel die-off can occur and large numbers of individuals are left rotting on the shoreline which is a human health concern. In addition, the shells of the zebra mussel can be jagged and be dangerous to walk on with bare feet associated with wading or swimming on beaches.

Asian clam *(Corbicula fluminea)*

Corbicula are freshwater natives of southern and eastern Asia. The sources and pathway of initial introductions are not well documented. This ANS has been in found in the United State beginning in the late 1070's. *Corbicula* will cause the same problems as zebra mussel.

In 2003, *Corbicula* was discovered in the water intake for Yankton, South Dakota and is the closest known population. *Corbicula* have been documented in many of the Midwest states, but no populations are reported this close to North Dakota.

Asian Carp (*Four Species*)

The black carp (*Mylopharyngodon piceus*) has been approved for release for stocking commercial aquaculture ponds to control snails and will surely escape into the wild just as the other three species of Asian carp, the silver (*Hypophthalmichthys molitrix*), bighead (*H. nobilis*) and the grass carp (*Ctenopharyngodon idella*) have. The latter three species were released in the 70s, 80s and early 90s for aquaculture and pond applications and have now developed large wild populations in the Missouri River basin.

Large numbers of bighead carp have been reported "staking in large numbers" below Gavins Point Dam, near Yankton, South Dakota. Gavins Point Dam is the first barrier on the Missouri River. If Asian carp get past the dam, one way or another, they will proceed up the Missouri River and to impact recreation in North Dakota. These carp also have the ability to capitalize on inundated river habitats such as upper Lake Sakakawea and upper Lake Oahe in North Dakota. The bighead carp, a plankton feeder may compete for food with paddlefish and bigmouth buffalo, as well as with forage fishes. All three species compete for food with the larval stages of our native game fish.

Although the extent of their impact and distribution in the Missouri River is largely unknown it would be prudent to keep them out of North Dakota waters.

Round Goby (***Neogobius melanostomus*)**
This fish is a bottom-dwelling fish, native to eastern Europe that entered the eastern Great Lakes in ballast water. They can spawn several times per year, grow to about 10 inches, are aggressive, and compete with native bottom-dwellers including bullheads. The round goby, was introduced, via ballast water, into the St. Clair River and vicinity on the Michigan-Ontario border where several collections were made in 1990. The numbers of native fish species have declined in areas where this goby has become abundant. The round goby has been found to prey on darters, other small fish, and lake trout eggs and fry in laboratory experiments (Marsden, J. E., and D. J. Jude, 1995). The round goby's potential range includes North Dakota and would do well in most of North Dakota's waterbodies.

Ruffe (***Gymnocephalus cernuus*)**
The ruffe (*Gymnocephalus cernuus*) is a small perch-like Eurasian fish. It was apparently introduced to the Great Lakes in the St. Louis River near Duluth, Minnesota from a ballast water discharge. In Europe the ruffe feeds on whitefish eggs and competes with other more desirable fish. The spiny dorsal fins of the ruffe discourage predation by other fish. In Lake Superior, the species of fish that is most affected by the ruffe is the yellow perch. Populations of perch have declined up to 75% in water bodies where the ruffe have become established. If established in North Dakota, there could be serious affects to our lake and reservoir fisheries.

Spiny Water Flea (*Bythotrephes cederstroemi*)
The spiny water flea is not actually an insect, but a tiny (less than half an inch long) crustacean with a long, sharp, barbed tail spine. This creature is native to Great Britain and northern Europe east to the Caspian Sea. The animal was first found in Lake Huron in 1984, probably imported in ballast water of a transoceanic freighter. Since then populations have exploded and the animal can be found throughout the Great Lakes and some inland lakes.

The effects spiny water fleas will have on the ecosystems of the Great Lakes region are unclear. The animals compete directly with young fish for food, such as Daphnia zooplankton. Spiny water flea also reproduces rapidly. During warmer summer conditions, each female can produce up to 10 offspring every two weeks. As temperatures drop in the fall, eggs are produced that can lie dormant all winter.

It is not known if this exotic will have larger impacts on inland lakes. Spiny water fleas eggs and adults spread unseen in bilge water, bait buckets, and livewells. In addition, fishing lines and downriggers will often be coated with both eggs and adults.

Heterosporosis (**Parasite that infects a variety of fish species)**

Heterosporosis is a microscopic parasite, which has the potential to infect several fish species resulting in muscle lesions and can cause serious harm to fish. The parasite was first reported in yellow perch, but may also be found in walleye, northern pike, fathead minnows or other fish species. This parasite has been reported in fish in Minnesota and Wisconsin. It has never been reported in North Dakota, but has the potential to become established in North Dakota fish if infected fish are imported into North Dakota. The parasite causes milky white lesions with a granular texture in fish fillets. Severity of the infection will vary between infected fish populations, but in heavily infected fish as much as 80% of the fillet may be affected.

Infectious Hematopoietic Necrosis (IHN) Virus

IHN virus is an example of a pathogen, which is not currently known to occur in North Dakota, but which has the potential to cause serious mortality if it is introduced. It is a pathogen known to occur in fish in states west of North Dakota. We must constantly be on guard to ensure it is not imported into North Dakota with fish imported from other states. For this reason, IHN virus and other viral pathogens are listed as "pathogens of concern" on North Dakota import and disease laws. Fish may not be imported into North Dakota unless they are certified to be disease free at the request of the Chief of Fisheries.

PRIORITY CLASS 2

Priority Class 2 species are present and established in North Dakota and have the potential to spread in North Dakota and there are limited or no known management strategies for control of these species. These species can be managed through actions that involve mitigation of impact, control of population size, and prevention of dispersal to other waterbodies. Examples of species addressed under this management class are discussed below.

Saltcedar (*Tamaricaceae spp.)*

While this plant is not an aquatic, it has an impact on waterbodies due to its large water volume use during the summer. This invasive small tree or large shrub remains a popular ornamental despite its classification as a "successful" weed. Thousands of tiny pink to white flowers are produced throughout the spring and summer. One mature plant can produce ½ million seeds each year. As well as reproducing by the wind and water borne seed, saltcedar can reproduce vegetatively. Large saltcedar plants can use up to 200 gallons of water a day; reducing and even eliminating water flow. It out-competes native plant communities, degrades wildlife habitat and has resulted in the decline of many species. Tamarisk reduces recreational and agricultural use, and increases wildfire frequency. In North Dakota, counties east of the divide are experiencing a tremendous impact from the rapid spread of the competitive saltcedar. Western North Dakota has an abundance of these ornamentals that pose a threat. A very active group of weed fighters are working together to develop a North Dakota Saltcedar management plan that targets a statewide survey, containment, and eradication program.

Curlyleaf Pondweed (*Potamogeton crispus*).
Curlyleaf pondweed is a perennial, rooted, submerged aquatic vascular plant native to Eurasia, Africa, and Australia. By 1950 most of the U. S. was infested by this species. By late spring it may form dense mats which interfere with recreation and limit the growth of native aquatic plants. By July, this plant senesces and forms vegetative propagules called turions. The turions are dispersed by water movement throughout a water body. Turions may also be transferred to uninfested lakes by the usual means. In some areas it may not be considered a problem but in shallow lakes it can grow dense enough to affect recreational boating and fishing. It can alter the nutrient dynamics of a fertile lake causing heavy summer algae blooms.

PRIORITY CLASS 3

Priority Class 3 species are not known to be established in North Dakota and have a high potential for invasion and appropriate management techniques are available, but effectiveness is of concern. Appropriate management for this class includes prevention of introductions and eradication of pioneering populations. Examples of species that need to be addressed under this management class are discussed below.

Whirling Disease (***Myxobolus cerebralis***)
Whirling disease is caused by a metazoan parasite that infects cartilage tissue of many Salmonid species. The whirling disease parasite was first introduced to the United States from Europe in the 1950s, probably through trout infected in Europe. This parasite has a two-host life cycle which includes both the primary Salmonid host and a common aquatic worm (*Tubifex tubifex*). Infective spores are produced in each host and are capable of spreading the disease in a variety of ways. The disease is now known to occur in over 20 states. Whirling disease has become a major problem in some western states, and has caused major declines in some wild rainbow trout populations and is especially severe in Colorado and Wyoming. Currently whirling disease has not been found in North Dakota waters.

Asian tapeworm (*Bothriocephalus acheilognathi*)
The Asian tapeworm is not known to be present in North Dakota at this time. As with any fish pathogen or parasite, if the Asian tapeworm is introduced and does become established in North Dakota, it will be extremely difficult or impossible to eradicate. For this reason, it is essential that this parasite not be introduced into North Dakota waters. The Asian tapeworm may infect many species of game, forage and bait fish. It has the potential to do serious harm to fish if introduced into North Dakota waters. This parasite was introduced into the United States through shipments of infected grass carp from China. It has spread into several states with infected fish. The tapeworm can result in mortality, but most often is responsible for reduced growth and poor condition of infected fish.

New Zealand Brown Mud Snail (***Potamopyrgus antipodarum***)

Native to New Zealand but long established in Australia and Europe, this species was discovered in North America in 1987 in the Snake River in south-central Idaho. Population levels can exceed 100,000 snails per square meter (NCSE, 1999). New Zealand mud snails (NZMS) have become established in every major river drainage in Yellowstone National Park, in the Madison River Drainage in Montana, at several other locations in the western U.S., and in Lake Ontario, New York. Modes of transportation may include hitchhiking on recreational equipment and other equipment used in water, in the guts of harvested or illegally transported fish, or via transport on waterfowl and other aquatic birds. Effects on native aquatic invertebrates are being documented in the Madison River and in Darlington Ditch, a small stream along the lower Madison River. NZMS degrade habitat due to their high reproductive capacity and the subsequent impacts on invertebrate food sources. Fish receive little, if any, nutritive value from eating the snail. The snail has an operculum that it closes when threatened, which prevents digestive juices from reaching the soft tissue of the snail's body when ingested by fish.

PRIORITY CLASS 4

Priority Class 4 species are present and have the potential to spread in North Dakota but there are management strategies available for these species. These species can be managed through actions that involve mitigation of impact, control of population size, and prevention of dispersal to other waterbodies. Examples of species addressed under this management class are listed below.

Common carp (*Ciprio carpio*)

The carp was introduced into Europe from the Caspian Sea region during the era of the Roman Empire and raised as a food fish. Carp were introduced into the United States in the late 1800's to meet the desires of European immigrants for a food fish. The United States government propagated and stocked carp in many states during this time period. This fish species proved to be adaptable and thrived in its new environment which allowed it to quickly expand its range. By the early 1900's carp were found in all of the states and in a variety of waterbodies.

Carp are omnivorous, feeding on both plant materials and animal food items. They root for food in the mud for plant materials and roots, insects, worms, crayfish, small clams and other small animals. Their feeding activities dislodge plants, break plants into fragments, they stirs up the bottom and its sediments, and will leave the water very turbid. Carp activity makes a lake an unsuitable environment for angler desirable fish. Waterfowl use decreases in waterbodies with a high carp population as there is no aquatic plants in those water bodies.

Carp can be moved from water body to water body by anglers who are using "dirty", i.e., undesirable fish used as bait, live bait and releasing those small fish being used for bait into the water body where the anglers are fishing at. Carp are not a legal baitfish in North Dakota waters. Anglers cannot import this fish species into North Dakota to use as a baitfish. Control methods for carp include eradicating that ANS infestation at a

tremendous cost to the Department. In addition, when a lake is eradicated, the recreational fishery is eliminated for approximately three to five years as stocked fish grow to an angler acceptable size. In many cases, carp are soon found in that waterbody after the eradication due an incomplete fish kill or the reintroduction of that species.

Purple Loosestrife (*Lythrum salicaria*)

Purple loosestrife is a wetland invader that was imported from Europe in the early 1800s for its medicinal value and for the beautiful purple spikes of the blooming plant. Unsupecting visitors to an infested wetland often admire the beauty of the marsh when purple loosestrife is in bloom, unaware that it has displaced native plants and animals. Its vegetative dominance may increase the likelihood of listing additional native species under the ESA. Purple loosestrife is still sold as an ornamental in nurseries in some states, though 24 states, including North Dakota, have listed it as a noxious weed and prohibit its sale. It is found in 42 of the contiguous states, and could invade the remaining six. The plant is extremely difficult to eradicate although recently a suite of biological control agents, i.e., beetles and weevils, have proven effective in suppressing the plant. Estimated losses are $45 million per year in control costs and forage loss (ATTRA, 1997). The North Dakota Purple Loosestrife Task Force has developed a statewide management plan for this species and active eradication programs are currently underway in Lake and Cascade counties in North Dakota.

Yellow Flag Iris (*Iris pseudacorus)*

Yellow iris is a rhizomatous emersed wetland forb. It has very showy yellow iris flowers, and is a tall plant with long, flat, dark green, sword-like leaves. This invasive plant propagates by both seed and underground rhizomes. The drought tolerant rhizomes break off, and spread downstream, as does the seed. Poisonous if ingested, and irritating to the skin, yellow iris is fast growing, fast spreading, and very competitive. It forms almost impenetrable thickets. It was brought into the United States in the early 1900's as an ornamental and has been used for erosion control, as a dye and fiber plant, and in sewage treatment cells. In North Dakota, there are not known populations of yellow flag iris.

Flowering Rush (*Butomus umbellatus*)

Flowering rush was introduced through the North American shipping trade at the turn of the century in ballast as long-lived seed and possibly reproductive bulblets into the ecosystems of Quebec and Michigan. Use as an ornamental provided this invasive plant another route to the Midwest and expedited it's spread westward to the Idaho panhandle which would include North Dakota. Where flowering rush is found it is reported to be out-competing the native willows and cattails. An emergent in shallow areas of lakes, flowering rush has umbellate pink flowers and grows to 3 (three) feet tall on triangular stems. It has a submersed form also, which can grow in water 10 (ten) feet deep.

Nonindigenous fish, invertebrates, and amphibians

These species have been introduced, intentionally and unintentionally, into North Dakota and are well established in some areas. Fish and invertebrates have been implicated in the decline of native fish and amphibians. Impacts of introduced fishes on native fish species include predation, introduction of diseases and parasites, competition for food and space, and hybridization. In some cases non-natives may be controlled for conservation and restoration of native species. Some species, *e.g*. walleye, largemouth bass, lake trout and rainbow trout, are the basis of popular fisheries that provide recreational benefit to many North Dakotans. In addition, recreational angling can provide substantial economic benefits to local economies. While these species have populations in many waters, these lakes did not have fish populations prior to the Department's management efforts. An environmental assessment is required the Department before a fish introduction can occur.

Bacterial fish pathogens

Bacterial fish pathogens, such as *Aeromonas salmonicida* (Furunculosis), are present in some North Dakota watersheds. *Aeromonas salmonicida* is the bacterial pathogen that causes a disease known as furunculosis in fish. This bacterium is known to occur in several North Dakota watersheds. In the wild it generally does not cause serious problems in fish. However, when fish become stressed, the pathogen can result in a disease problem with high potential mortality. Management actions that can reduce elevated water temperatures or other stress factors may have a significant impact on reducing impact of this pathogen on fish. Furunculosis in a hatchery can often be successfully treated with antibiotics. Because of the potential negative impact of this fish pathogen on North Dakota's wild and cultured fisheries, import and transport of fish infected with this pathogen should be closely regulated. North Dakota law prohibits the importation of live fish infected with this bacterial fish pathogen and other known bacterial pathogens.

Appendix O: **List of Non-indigenous Aquatic species in North Dakota**

LIST OF NONINDIGENOUS AQUATIC SPECIES IN NORTH DAKOTA AND THOSE CONSIDERED TO BE AQUATIC NUISANCE SPECIES (ANS)

The following list of nonindigenous fish species reported introduced into public waters in North Dakota is North Dakota Game and Fish Department Fisheries Division's fish stocking records, information published in *Fishes of Dakota* by the Dakota Chapter of American Fisheries Society, and USGS Nonindigenous List, i.e., website - nas.er.usgs.gov/. Other animals or plants listed here are from the nonindigenous list prepared by the USGS and listed on their website, i.e., "nas.er.usgs.gov/". In addition, the list also notes those plants or animals which are considered to be an invasive and injurious species (an ANS species) to North Dakota waterbodies are noted.

Fish

Common name	Species name	ANS
Sacromental perch	*Archoplites interruptus*	
goldfish	*Carassius auratus*	YES
Cisco	*Coregonus artedii*	
lake whitefish	*Coregonus clupeaformis*	YES
common carp	*Cyprinus carpio*	YES
grass carp	*Ctenopharyngoden idella*	
muskellunge	*Esox masquinongy*	
smallmouth bass	*Micropterus dolomieu*	
largemouth bass	*Micropterus salmoides*	
white bass	*Morone chrysops*	
stripped bass	*Morone saxatilis*	
spottail shiner	*Notropis hudsonius*	
cutthroat	*Oncorhynchus clarki*	
coho salmon	*Oncorhynchus kisutch*	
rainbow trout	*Oncorhynchus mykiss*	
Kokanee	*Oncorhynchus nerka*	
chinook salmon	*Oncorhynchus tshawytscha*	
rainbow smelt	*Osmerus mordax*	
Landlocked Atlantic salmon	*Salmo salar Sebago*	
brown trout	*Salmo trutta*	
brook trout	*Salvelinus fontinalis*	
lake trout	*Salvelinus namaycush*	
Saugeye	*Stizostedion canaense x Stizostedion vitreum*	
Zander	*Stizostedion lucioperca*	

Crustaceans

Common name	Species name	ANS
rusty crayfish	*Orconectes rusticus*	YES

Mollusks

NONE

Aquatic Plants

Common name	Species name	ANS
curlyleaf pondweed	*Potamogeton crispus*	YES
eurasian watermilfoil	Myriophyllum spicatum	YES
purple loosestrife	*Lythrum salicaria*	YES
flowering rush	*Butomus umbellatus*	
watercress	*Nasturtium officinale*	

Amphibians

NONE

Appendix P: **North Dakota Rapid Response Plan**

NORTH DAKOTA

RAPID RESPONSE PLAN

TO

AQUATIC NUISANCE SPECIES

PREPARED BY

AQUATIC INVASIVE SPECIES COMMITTEE

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PURPOSE

Rapid response is essential when an injurious organism is discovered in an area free of that infestation. Rapid response includes the successful control or elimination of the problem specie(s) in a timely and efficient manner. This document identifies factors that affect the probability of developing a successful response to a new problem, and it identifies common problems that may preclude success.

Containment and eradication activities require they be done promptly, will be effective, are focused on the actual problem, and the parties involved in the project are committed. In addition, efforts to control aquatic nuisance species (ANS) cannot effectively move forward in an environment of complex demands that are unfounded, based on uncertain requirements for constraints, and control actions being subject to second guessing with no apparent improvement in the outcome. The goal of the model system is to create a consensus driven decision process of those involved, but one where discussions about general strategies occur before the arrival of a new invader and without influences of turf-wars. The group makes the decision as to the general course of action when a nuisance species arrives and proceeds forward with the control efforts. This decision provides the on-the-ground manager clear goals to obtain within reasonable restrictions. Because each situation tends to include unique conditions related to the species and the environment, this plan is general in nature, and it does not attempt to address regional or national processes or the unique circumstance.

BACKGROUND AND RATIONALE

ANS are obligate aquatic species that are invasive and injurious organisms that create problems for ecosystems or for native or desirable species. They may cause direct problems to outdoor recreators as weeds that interfere with boating, fishing, hunting, and water related activities. ANS will cause problems to all North Dakotans, through the costs being passed on to individuals, such as cleaning of municipal water intakes of zebra mussels, removing Asian clams from power plants cooling towers, and reduced values of waterfront properties. ANS will cause a reduced need for the serves industry, i.e., less motel rooms rented, less tourist at convenience stores, less need for sporting goods and similar nonessential goods and services. The numbers of native or desirable fish or aquatic plants in a waterbody can be reduced by direct competition with ANS and habitat modification by ANS. ANS modify habitats which further reduces the carrying capacity for native or desirable species. Traditional management efforts cannot be used to overcome ANS infestations.

The species listed by the Federal government as invasive and injurious species grows each year as more non-native flora and fauna are found in the United States. The Federal list of aquatic nuisance species is provided in Appendix B.

Aquatic nuisance species can cause large and ongoing costs when they invade new locations, but those costs can be avoided if the species can be kept out of those new areas. This approach of avoiding problems is the general concept behind a variety of

programs. It was first applied to public health with the old quarantine laws, and then in agriculture where it was given the name “Pest Prevention.” Now the concept is being adopted to protect some natural resources as well.

LESSONS FROM SUCCESSFUL RESPONSE EFFORTS

There are three requirements for a successful containment and elimination of the problem species are: **A**ccess to the target organism; **P**ersistence of effort; and adequate **T**ools to control the populations. Any response will have a higher chance of success where these requirements are met. Conversely, in responses where these requirements are not adequately met, the chance of failure will be high. Many interdependent factors influence whether the requirements for a rapid response are met. Significant factors include: funding and other resources; legal authority; will to act or indecisive actions; regulatory hurdles; interagency and public cooperation; experienced oversight; biology of the pest; available control methods; and geographic scope of the project.

Rapid response efforts are not new and lessons can be learned about the elements that lead to success or failure, by considering efforts that have proceeded relatively smoothly or not so smoothly.

The initial approach used in these successful responses was very similar. Someone found an infestation because of heightened public awareness and the infestation was confirmed by an expert. Once the problem was confirmed, different agencies and local groups that might be affected or could assist in the response were contacted. Representatives of the interested parties met to consider the situation. Delimitation proceeded quickly while the control options were quickly reviewed with input from expert biologists and managers. At all of these points, the public was informed and educated to the problems that this ANS infestation could cause. The potential control methods were frankly and openly discussed and the likely outcome for action or what would result from inaction. While there was more than one group or entity working on this project, they all understood the gravity of the situation and how not participating would affect them. The efforts were well coordinated, sufficient manpower was made available, and the funds needed to complete the control efforts were provided in a timely manner.

The key to successful operations was that all affected participants worked together with a common goal to reach the needed and desired outcome. The group working on the solution was not side tracked in turf-wars and side bars of second guessing the outcome of the efforts. Examples of successful ANS controls are provided as an attachment to this Appendix.

LESSONS FROM UNSUCCESSFUL RESPONSE EFFORTS

An important lesson can be gained from rapid response efforts that did not succeed for reasons that could have been avoided, quickly rectified when they became obvious, or the process encumbered by entity or personal inability to interact with another entity or turf protection issues. The major reasons for unsuccessful responses was that that agencies were unwilling to deal with the problem, the agencies were indecisive in action and in funding, and the public and other were not made aware of the problem and its impact to them. Examples of unsuccessful ANS controls are provided as an attachment to this Appendix.

FACTORS LEARNED FROM SUCCESSFUL RESPONSE EFFORTS

An important part of learning is to understand what leads to the spread of ANS and what causes projects to fail. Rather than dwell on this point, it is best to state that knowing of a problem and the failure to take control measures in a reasonable time and without adequate control measures will allow for the establishment of ANS in new locations. There needs to be an overall understanding of the decline of the environment and recreational opportunities if ANS becomes established.

Factors to consider when deciding what control measure to use - is an eradication needed or is an unpopular control method justified:

A. Is there knowledge of the risk of reintroduction and is the risk to non target species low enough to justify eradication?

B. Taken overall, can controls be rapidly initiated?

1. Was the invasion detected early? Is the infestation small and only in a few locations?
2. Was the invader rapidly and accurately identified?
3. Is information on species biology and management quickly available?
4. Are treatment methods available?
5. Are there serious environmental issues or regulatory hurdles that will lead to delays or greatly increase the cost of treatment?
6. If permits are needed, can they be obtained in a timely fashion?
7. Has the species been prioritized for response and is there a pre-existing action plan?

C. Taken overall, is there a will to act?

1. Are there decision making procedures in place and entities/agencies with the power to determine whether eradication should proceed, how, and who should fund it?
2. Has there been a clear assessment of technical, field, administrative, funding, and legal resources available for an eradication campaign?
3. Is there acceptance of the need to proceed on the best information available?

4. Is there acceptance of short-term, local impacts in return for long-term, wide-area benefits?
5. Is there acceptance that the “no action” response has serious impacts and is a poor option?
6. Do a preponderance of the agencies (and their staff) feel they have a clear responsibility to act, or does one agency have a clear mandate and authority to act?
7. Is there recognition and acceptance that the eradication effort can be a long term effort, almost always taking years in the case of plants or other organisms with resistant resting stages?

D. Taken overall, is organization adequate and willing to work together?

1. Is there an ability to quarantine the infested area?
2. Is there a capacity to survey, in order to determine whether the pest is restricted to the quarantine area?
3. Will program staff with experience in pest management and eradication be assigned to direct the control efforts and monitor results?
4. Are funding sources adequate and of sufficient duration?
5. Is there effective collaboration among the parties carrying out the effort?
6. Is there regional collaboration where infestations cross jurisdictions?
7. Are there provisions for monitoring in order to modify, expand or end an eradication campaign?

E. Other factors

1. Is there support for the effort by affected parties, including the public?
2. Is there effective outreach and education for both the public and government decision makers?

Clearly, many of these factors are related but they all bear on ready access to the target, availability of adequate tools, and the ability to persist in the effort long enough to achieve eradication.

UNDERTAKING A RAPID RESPONSE

In the current sociopolitical environment in the U.S., the initiation and success of a rapid response can depend strongly on the extent of the infestation, ease of control, public response to the need to take action, and the governmental groups involved in the response working together to effectively respond to the problem. If the general requirements that are needed to initiate an eradication program are anticipated and preparations are made to meet those needs, the initiation of responses can avoid some of the confused and hesitant nature that sometimes characterize them at present.

A rapid response program is a variation of an integrated pest management program. The difference between rapid response and pest management is that the goal of rapid response is to reduce the population to zero (eradication) or no impact to the existing ecosystem or within manageable numbers of individuals. The goal in pest management is to maintain the population below an economic threshold (the point where potential damage outweighs the cost of control). Also, an eradication program is based upon an

intentional trade-off of short-term, localized impacts for long-term, wide-area benefits, so an eradication effort may require accepting higher levels of non-target damage than a pest management program. Eradication programs become less desirable as they require more widespread treatment and cause longer term damage.

The elements of a basic rapid response are relatively straightforward. It is the sociopolitical and environmental issues in a response that can and will complicate the situation. In a basic response to a known threat the usual steps are: rapid confirmation of the identity of a suspicious organism; survey (delimitation) to determine the extent of the infestation; quarantine of the infested area if possible; a very quick review of the available control options to choose the one best suited for the treatment conditions; application of the chosen control options, with at least a visual evaluation of the results on the target and non-target species; and modification of the control strategy as indicated by the results (sometimes called “adaptive management”).

For a less well-known pest, there would be additional steps. Once the pest was identified, a rapid literature survey of the biology and control of the organism might be needed, as well as quick tests of the potential control options to identify the most promising ones. The first applications of the chosen options might be made on a limited basis, with at least a visual evaluation of the results on the target and non-target species, to check that the treatment works as expected. The treatment might be modified as indicated by the results of the early applications or experiments and then general application would begin, with continued evaluation and modification as before. Some of these steps can be progressing at the same time.

In almost all situations involving aquatic nuisance species, the circumstances of the response will probably be complex and involve multiple entities and impacted participants. In a complex situation, the ELEMENTS OF A RESPONSE that need to be considered include:

1. Authority, leadership, and organization (that is, who has the legal ability to act, as well as who has the operational capability, and who is willing to undertake the control measures);
2. Coordination and cooperation among the different parties;
3. Funding and resources (included is manpower and time);
4. Quarantine establishment and enforcement of precautions to the problem’s spread;
5. Environmental regulatory compliance - obtaining permits, developing documentation(s);
6. Public awareness and education - outreach to affected property owners and parties;
7. Delimitation survey (possibly also widespread detection survey) and mapping, evaluation of the risk of spreading;
8. Review of knowledge on biology and controls, convening a science/management/environment advisory panel, research and technology transfer, and identification of potential treatment methods;

9. Informing the public and impacted participants of the problems, its affect on the regional ecosystem, and the needed control measures, and provide a realistic timeline for completion of each phase of the project;
10. Implementation of eradication methods, including persistent surveys and treatment to ensure eradication;
11. Treatment assessment and adaptation. Accountability for progress towards eradication must be recorded for review;
12. Environmental monitoring; and
13. Restoration/mitigation as needed or as legally permissible.

As was shown by successful control of ANS, the response generally begins when a biologist or field staff recognizes something out-of-place, has a specimen identified, and provides that information to appropriate entities. If the potential problem is identified, there must be an effort to determine if it can be controlled and who is responsible for that effort. In a complex situation, a number of agencies and interested parties come together and try to organize a response.

While it sounds simple and prudent to control the initial infestation, it is often a challenge to find an agency with clear authority, or, even better, a mandate and resources to respond to the introduction or an interest in controlling the problem. As a result, the unorganized group tries to identify a lead agency and resources in a non-binding fashion. Either intentionally or not, they will also address some of the response elements listed above, often embodying the results in a consensus-based action plan while each believes that it is the other parties problem(s) and no one is willing to take the lead.

THE MODEL SYSTEM AND RAPID RESPONSE PLANS

The initial rapid response plans for aquatic problems were adapted from agricultural plans. In both terrestrial and aquatic responses to exotic species, the problem(s) begin with detection capabilities, which are extremely important to success in a rapid response. In rapid response itself, the problems center on the lack of clear authority, funding, resolution of environmental issues, and planning to control the problem. These are problems that have been recognized at the national level and they have been identified as issues in the “National Invasive Species Management Plan” released by the National Invasive Species Council in November, 2000. The Council is a Cabinet-level group created by President Clinton’s Executive Order of February 3, 1999.

The model system attempts to address the weaknesses that have been identified in current rapid response efforts. It uses a two-level approach, both organized within the state government. The first level works on a statewide basis to address authority, policy, funding, and priorities. The second level addresses the details of implementing specific projects, particularly the need for experienced supervision. Either embodied in this structure or through a separate fund, adequate resources for responses also need to be available on short notice, because new introductions are unpredictable. The goal of this approach is to create a system, where, for a given introduction, the question of

whether to eradicate is decided at the outset or even prior to introduction, and, if the decision is to eradicate, then all aspects of the eradication are provided for. The system should address the response elements listed above, which currently are typically addressed in an ad hoc action plan developed by a volunteer group as the response unfolds.

North Dakota's Rapid Response Plan will utilize a central working group associated with North Dakota's Aquatic Nuisance Species Management Plan (ND-Plan), the Invasive Aquatic Species Committee (IASC), and chaired by the ANS-Specialist (ANS-SP) from the North Dakota Game and Fish Department. The IASC's purpose is to develop an invasive species management plan and part of that action will be to write a Rapid Response Plan and suggest to North Dakota's Legislature a series of laws which give authority to undertake control of new ANS infestations to the IASC and to provide funds to do such work. The efforts of the IASC could include work that may include providing grants, manpower, expertise, or a variety of efforts to control ANS infestations, and other needed phases of any ANS control effort.

Determine North Dakota's existing authorities and regulations, develop the authorities need to deal with a new aquatic nuisance species

The ability to control and regulate various flora and fauna for different markets such as agriculture purposes, food industry, pet trade, plant nurseries, and for recreational purposes may be covered by existing authorities and their laws and regulations. Determine if there is an authority that has responsibility in the management of ANS infestations. If there is no single authority, work must proceed with North Dakota's legislature to develop the authority for agencies to conduct ANS prevention or control activities.

Authority for an Invasive Aquatic Species Committee (IASC) to function in a Rapid Response role

The authority to eliminate or control ANS needs to be a matter of law and the regulations should lie within one group or with one agency's core mission and responsibility. The current laws shall be reviewed, areas of authority for each state agency will be delineated and compared to the needs facing the state's natural resources, and the ability and willingness to use those authorities to provide the efforts for control of ANS.

The IASC will be given the authority to act in the best interests of the state, and country in order to provide for long term protection from ANS infestations and with management authorities to take appropriate responses to the those infestations.

NATIONAL INITIATIVES

In addition to setting up a statewide system for addressing rapid response, relatively modest efforts at the national level could help tremendously. The most cost-effective

efforts would be through development of reviews of biology and control methods for various high priority species or higher taxonomic groups to be used as the basis for control projects. It makes little sense for each state to have to develop this information for itself and to keep track of the data or provide a data base for others. Many authorities have repeatedly noted the importance of ready access to technical information in the success of an eradication effort.

SUMMARY

A rapid response can occur in a complicated social and environmental setting, but in most instances a response must be initiated quickly without turf-wars and second guessing to have a successful eradication. Although debate and consensus-building are desirable means to construct public policy, if they are slow, the initiation of a response is likely to be counterproductive to the goal of eradication. Once a new ANS infestation is noticed, there must be a forum that will quickly rapidly address the issues and then make a sound decision. That decision can range for do nothing to a complete eradication. If the decision is made to eradicate, the ultimate goal of this plan is to put competent pest management personnel on the ground and give them the freedom to focus on the infestation with the persistence that is required to achieve eradication.

The approach to these goals employs a two-level organization. The first level, the state's Aquatic Invasive Species Committee (AISC), would focus on the problem of that ANS infestation and on preparing for a vigorous response effort(s). This level agreement must occur at a high level of state management and with participation of affected federal and local interests. The AISC's decisions on a course of action should provide the state a management plan to achieve the goals of control or eradication of the problem(s). The second level of organization focuses on the operations on the ground. It also identifies the various issues and options surrounding invasive species and informs the first level about them and further uses that information to prepare for introductions. Once the first level outlines a course of action, the second level focuses its knowledge and experience on the field operations needed to achieve the goals.

A successful response to an invasive species requires access to adequate tools, access to the target species, and, often, dogged persistence. Sometimes these requirements are inconvenient or too expensive for society, and extra costs fall on the people and habitats caught up in the area of the infestation. The decision to eradicate or otherwise respond to an invasive species can be difficult, and it needs to have a forum that reflects the importance of the issues involved. Once the decision is made to eradicate or suppress an introduced population, the managers on the ground then need to put their full energies on finding and removing the target species. This plan attempts to address these dual needs and maximizes success against invasive aquatic nuisance species.

THE FRAMEWORK PROVIDING FOR NORTH DAKOTA'S RAPID RESPONSE ACTIONS

The steps that follow provide the framework of the actions that North Dakota will take in the event that a new ANS is discovered within the state.

Discovery of new infestation

The Department will develop a website for reporting the occurrence of ANS, provide for the reporting methodology for the discovery of new ANS, for tracking the presence or absence of ANS species and their locations, and a protocol to verify specimen suspected of being a new ANS.

Confirmation of a new ANS or an ANS in a new location is done by the Lead Agency (the North Dakota Game and Fish Department). The North Dakota Game and Fish Department may defer to another agency if it is in the best interest of controlling the problem to be the LEAD AGENCY.

The information flow on the new ANS will be from the Lead Agency via the coordinator to prevent problems with conflicting comments, tracking information dissemination, and how information is provided. This step is critical to prevent false and misleading information being provided to the public as direct reports or via mass media.

leads to

Report/Notice to Lead Agency

The Lead Agency will have the responsibility of communicating with other involved agencies that have jurisdiction or regulatory authorities, local experts, stakeholders, directly with the public, and with the mass media. The Department's Director or the Chief of Fisheries will head the committee with assistance of the ANS coordinator (coordinator), a Department position, to facilitate the efforts to eliminate or control the aquatic nuisance species. The Department will contact the AISC and inform them of the new discovery.

The Lead Agency and ANS-SP will notify others (agencies with jurisdiction or regulatory authority, stakeholders, local experts, etc.) when a new ANS is located within the State or is on the state's borders. As a matter of operating procedures, when a new species is found, but not yet confirmed, the ANS-SP and associated response team will be notified when a new ANS has been reported or reported/confirmed in North Dakota.

The Risk Assessment Matrix (RAMx) will be filled out for existing species and for any

new species identified. See attachment for a copy of the RAMx. The value of the RAMx will be in a quick determination of the new species likelihood of become a significant problem to North Dakota waterbodies.

leads to

IASC Convenes a Science Panel to discuss the problem and develop a statement of facts and anticipated direction

The AISC convenes a Science Panel (SP) after an ANS infestation has been confirmed. The SP will be made up of five to eleven experts in their respective field(s) and from various federal, state, and local agencies, or from institutions of higher learning. It shall be the SP's responsibility to make a time review of information on the specie or genera, make a recommendation on the need for control(s), method(s) of control, and likely outcome(s) if no control is done. Included in the "likely outcome" will be an analysis of environmental and economical impacts of the new ANS. A portion of this report will contain the likely scenario of no action being taken and the likely effects on natural resources. This report shall be completed in a reasonable time frame and be of reliable estimations which would include a peer review of regional authorities.

The above effort will need to be done in a timely manner and with a professional product being produced. A concern is if the process drags on for an extended period of time, the ANS can and will spread, which negates the effectiveness of the SP. Any recommendation by the SP could be for remedial action(s) that are only effective in the initial stages of an infestation. When decisions are delayed, the controls may now be inadequate for a widespread infestation that cannot be controlled.

The SP can be called prior to any new ANS infestation, review the available information on controlling species or genera of concern, provide likely problems if a specific ANS becomes established, provide for a likely listing of control options or eradication measures (the tool box approach), and document this information for use at a later date. The exercise on control measures should periodically be updated to reduce the time needed to respond in the event of an actual new ANS infestation.

leads to

Lead Agency actions

The information provided by the SP will be reviewed by the AISC, coordinator, and the Department to determine the next sequence of steps. The Lead Agency's action could range from a news release in that area of the state to a complete closure of the waterbody to all users. Within this range there could be any item of control listed in the tool box of control and elimination measures.

In any course of action, an informed public is vital to allowing for control and to eradicate the problem ANS. When the public is provided the information and that information is correct, the likely outcome from the ANS infestation, ramifications to the them, i.e., environment, water supplies, economics, reduced recreation, increased costs of living, and other appropriate information, it is firmly believed that the general public will select the best alternative for them and the environment.

leads to

Outreach efforts about the ANS problem, the Science Panel recommendation and concurrence of Lead Agency, and take public input/comment

The AISC, via the coordinator, will provide the public with information about the ANS infestation, the potential impacts of the ANS, the formation of the SP, the objectives of the SP, and alternative(s) to control the problem species. The coordinator will work closely with mass media outlets to provide current and factual information, which will be delivered in a timely manner. It shall be the responsibility of the AISC, via the coordinator, rather than the individuals of the committee or individual entities to provide information to the public or other entities about ANS infestations or potential problems**.**

Public information available to the coordinator and ANS-SP can be provide in many different avenues: mass media presentations, conducting public meetings, give interviews or conduct open houses to provide the information, reporting the data the SP has found, and answer appropriate questions. This effort will be used in selecting the preferred control methodology within the bounds of obtaining reasonable results.

Again, this process should not become involved and time consuming. When the time from discovery of the ANS infestation to control is prolonged, the effectiveness of control or confinement is greatly reduced. To promote local residents being aware of the ANS problem, appropriate field staff of the Lead Agency will be making some of the contacts to various local entities or groups to provide information on the problem.

leads to

AISC shall select the action plan or appropriate solution and inform the public within a reasonable time

The AISC shall review the documentation provided by the coordinator and select the appropriate action plan or control methodology. The ANS-SP shall inform the public of the preferred control methodology and review their comments and concerns. Legitimate concerns will be addressed and appropriate information will be provided to those groups involved in the management of the resource and use of the natural resources.

The ANS-SP shall acquire the needed permits to conduct the action plan or control method that will be used.

The AISC shall have the authority to collect funds or provide billing for reimbursement from the various agencies that make up the working group.

An integral part of this phase of the project will be selecting an appropriate method for the recording of the before and after conditions so a baseline can be established, and results can be determined allowing for an evaluation of the IASC actions.

The process can select from a variety of control methods or a combination of those methods. In general, the control from the tool box of actions could include: 1) a campaign to inform the public of the problem(s) and request their help in not spreading the problem; 2) posting signs at the area informing the public of the problem(s); 3) posting information on the preferred procedures on how to clean and disinfect a boat/PWC/trailer and recreational gear; 3) requiring that recreators take proper cleaning methods when leaving that waterbody; 4) limiting recreation on that waterbody to a time period when the problem(s) is not likely to be moved to a new location; 5) closing of that waterbody to recreational efforts until the problem is eliminated or brought under control; 6) complete eradication of the waterbody which includes elimination of closely associated species and a short term modification of that waterbody's ecosystem; and 7) do nothing as the problem is widespread and cannot be controlled or eliminated by current methodology.

All of the above information and options, along with the preferred method, are to be provided to the Lead Agency for their decision on the method of control and for informing the public. As part of this work, a timeline must be developed which lists the major needs of the control plan, whom (both as an entity or an individual within that entity) will accomplish that section of the control plan, when these sections of the control plan will be accomplished, how the efforts and the status of the control will be reported to the public and involved or impacted participants, and the expected outcome with a

plan for evaluation(s) that includes the methodology to be used and when the evaluation(s) will be accomplished.

leads to

Implementation of the preferred control method

The preferred method of control must be put into place in a timely manner and at the levels decided on by the Lead Agency. To achieve the desired effects, there should not be infighting or disagreements voiced outside of the IASC or SP to the general public. The Lead Agency will designate appropriate staff to complete the activities selected by the AISC.

Implementation will occur as or when all permits are acquired, the public is informed, the public's consent or grudging acceptance or agreement by education has been done, and other agencies concerns addressed with those being satisfied or acknowledged.

The control method will be undertaken within a reasonable timeline to be the most effective. A reasonable timeline must be constructed and followed.

leads to

Evaluation of the outcome

As this is the final portion of the AISC activities, it is important that the process be used to reach the defined objective and be recorded, that the objective was clearly stated, that the objective was one that could be quantified and measured, and the control method used be described and recorded. The monitoring of the infested site is to continue for a reasonable time and the expectation is that the infestation be eliminated, controlled, or its spread curtailed. The latter will be compared to the objective and a determination of success can be made by the members of the AISC. This will also allow for modification of the control measures for future infestation by other species or the same species at another site.

The public will be informed of the evaluation procedures, the status of information being collected, and the outcome of the control methods. This information will be provided in a reasonable time frame and in understandable context for the public.

Attachment to Appendix K

Snakehead in Maryland

A species of snakehead (Family Channidae) that could survive in temperate to cold climates was collected from a small abandoned, rock quarry in Maryland. This specie's diet includes a variety of food items, i.e., bottom dwelling invertebrates, small fish, and animals on the waters surface which they capture with strong, toothed jaws. It can grow to a large size, produce large numbers of young, and are long lived. The source of these fish was likely to have been from the pet trade or from Oriental food markets.

Maryland has had a history of working with ANS infestations and understood the potential for additional problems if this infestation spread beyond this pond. A Scientific Advisory Panel was convened to make recommendations on controlling this fish species. The group reviewed many possible control methods. The working group focused on determining the practical solution to the infestation and this task was completed in less than 24 hours. The solution to the temperate snakehead infestation was to eradicate the pond in a timely manner.

Many state and federal agencies worked closely on this project which allowed for information to be quickly exchanged, problems identified, and compromises to problem areas could be found with little loss of time. The inter agency cooperation was good, the various groups focused on eradicating the abandoned rock quarry in an expedient manner, and the desired outcome was reached.

In all phases of this project, the public was provided with current and honest information which greatly decreased pubic concerns about the project and associated delays. The need to eradicate the quarry was conveyed to the public and little or no objections from the public or environmental groups was voiced.

The eradication was successful as temperate snakeheads have not been found in that pond. Due to the public concern about this species, snakeheads are now included in the Federal list of prohibited animals for importation or for sale.

Caulerpa in Coastal Southern California

Caulerpa taxifolia is a saltwater alga -- a seaweed -- that is native to tropical waters, where it typically grows to a small size and in limited patches. In the late 1970's the species became popular in the aquarium trade because it is a fast growing and decorative plant. A clone of this specie escaped from an aquarium into the Mediterranean and it rapidly spread from a patch of about one square yard to over two acres by 1989. By 1997 it blanketed more than 11,000 acres of the northern Mediterranean coastline.

On June 12, 2000, Caulerpa was noticed in the Aqua Hedionda Lagoon, in
Attachment to Appendix K

Carlsbad, California. Once the plant was identified, the firm contacted a variety of agencies that address invasive species, water, and wildlife issues, and discussions began about possible responses. Several different groups began researching control possibilities by June 22nd. By the end of June the group outlined an action plan that they released on July 12th as the Southern California Caulerpa Action Team (SCCAT) Rapid Response Program. By then, the infested area had been cordoned off and the local police and game wardens were helping enforce the closures. In addition, intensive public outreach efforts had been initiated.

In the ensuing weeks and months, SCCAT continued to focus on eradicating the population and reaching out to other interested groups. By September 18th, all the known patches in the Aqua Hedionda Lagoon had been treated. In early August, another small infestation was found in Huntington Harbor, near Los Angeles. Again decisive steps were taken and the problem was quickly and effectively treated.

The description of the response might give the impression that there was a strong central authority, with a clear strategy and unquestioned lines of command from the outset, but the original records show otherwise. The group had a diversity of opinions and agendas and it developed its strategies through a consensus approach. A different set of people spearheaded the different components of the response and they volunteered according to their abilities as much as being appointed by the group.

Salvinia in the Lower Colorado River

Salvinia molesta is an attractive plant in small quantities and has been used in the aquarium trade and with the current interest in water gardens, offered for sale in the nursery trade. Unfortunately, *Salvinia*'s growth rate, ease of spread, tendency to clump or form large mats, and the creation of critical dissolved oxygen problems when these mats decompose make up for its small size.

On August 4, 1999, a biologist for the U.S. Fish and Wildlife Service (USFWS) noticed thousands of free-floating *Salvinia* plants on the Colorado River as it passes through the Imperial National Wildlife Refuge, about 25 miles north of the Mexican border. On August 20th, over fifty agency representatives and other interested people attended a meeting to consider the situation and plan a course of action. The USFWS was identified as the lead agency for the project. The group decided to quickly and cooperatively expand the search for the plant. They completed the delimitation survey by September 15th, when a second planning meeting occurred. The infested area included two federal wildlife refuges and the habitat of two endangered fish and two endangered birds.

Attachment to Appendix K

At the second meeting, the Task force formed a Science/Management Advisory Panel of five experts in aquatic plants and their control from across the US. This group

established a Task Force and encouraged all land managers in the infested area to undertake "...whatever actions they could to control *Salvinia* within existing and pertinent regulatory constraints". A Task Force began development of an Action Plan and was completed by October 13th. The group's recommendations were for "...a comprehensive, integrated and aggressive control program whose objectives are…to **eliminate** (their emphasis) populations in the River and all waters of the Western states". Yet the all-out eradication program failed to materialize.

The primary problems with completing the eradication were typical for interjurisdictional endeavors. Some of the specific areas of concern were:

1) Serious environmental concerns created a difficult situation, because two wildlife refuges, four endangered species, and a major water supply all required special consideration; 2) Within the authorities working on the problem, no consensus about an overall approach to treatment throughout the infestation could be reached; 3) The involved institutions had difficulty finding funds to provide a dedicated project manager or other staff and necessary support; 4) Everyone involved tried to participate in the response in addition to all their normal duties; 5) Federal agencies could use their funds for herbicide treatments but that would likely trigger the need for an Environmental Impact Statement, and this would cause likely delays; and 6) The biological control method which holds out the best hope was a Brazilian weevil specializing in feeding on *Salvinia,* which was not certified for release in this area.

Momentum for an all-out eradication program did not materialize. Although the U.S. Fish and Wildlife Service took on the role of lead agency for the response, a variety of agencies have jurisdictions along the River, and there was no consensus about an overall approach to treatment throughout the infestation. Part of the difficulty was to use pesticides which would likely trigger an Environmental Impact Statement, with the attended delays. Another factor was that biological control holds out hope for a less painful option. For some unclear reason, but probably related to water chemistry, *Salvinia* has not thrived in the Colorado River itself, although it does well in the ditch. These latter two factors made the situation appear less threatening, reducing the incentive to eradicate.

<u>Eurasian watermilfoil in Minnesota</u>

Eurasian watermilfoil arrived in the northeastern United States in the 1880's. This plant was used in the aquarium trade during the 1950's. Aquarium owners who dumped their aquariums into local lakes or ponds could have started new infestations. Recreational boats or trailers moved plant fragments to new

waterbodies. By 1985, Eurasian watermilfoil was reported in 33 states and three Canadian provinces. Minnesota's first infestation of Eurasian watermilfoil was reported in Lake Minnetonka, located near the twin cities of Minneapolis and St. Paul, in 1987. This lake has been highly popular with numerous private estates and property holdings

by influential private parties along the shoreline. While the effects of Eurasian watermilfoil is known, there was no interest by the lake's property owners in taking actions which would have included localized application of an aquatic herbicide.

By 2001, 133 waterbodies have been found to have Eurasian watermilfoil infestations. A pattern of infestation was observed where new infestations radiated from Lake Minnetonka and these infestations were along the major travel routes used by recreators. Eight infested lakes are found along U.S. Highway 169 and 65, which lead from the Twin Cities to the lake country of northern Minnesota. There are seven infected lakes along Interstate 94, the
route leading to North Dakota. One of these lakes is about 45 miles east of Fargo, North Dakota. The rate of new infestations of Eurasian watermilfoil has increased in recent years. While the majority of these early infestations were near the Twin Cities, more outlying infestations are being found. Many of these new infestations are located at a considerable distance from the original site near the Twin Cities. One of the new infestations is about 60 miles from the Twin Cities, but is not on a major travel route. The rate of new infestations has been increasing in the past few years. These new infestations can be the source of plants that are being transported to new waterbodies and these then create an infestation at that site or sites.

Efforts to control Eurasian watermilfoil have included a public education campaign, regulations prohibiting the transportation of aquatic vegetation on boats, trailers or vehicles, and chemical eradications. The first two reactions have helped make the public aware of the problems and methods to prevent the movement of the problem species. The latter example, application of a herbicide, is a dramatic step to eliminate the problem from an area and the likelihood of it being spread from that site. The two lakes in Itasca County were treated with a fluridone herbicide, Sonar, in a whole-lake treatment in 1999. Inspections for Eurasian watermilfoil were done in 2001 and these did not find Eurasian watermilfoil to have reestablished an infestation.

The use of a herbicide was an effort to quickly eliminate the problem and prevent its spread. This tactic would have been effective in the initial infestations, but it was not done without public concerns about localized recreational opportunities. As an outcome, the Minnesota Department of Natural Resources is spending approximately $1 million dollars annually to treat ANS. Not all of the monies are used to control Eurasian watermilfoil, but has prevented the problem from

spreading. Nor have these efforts of monies and manpower eliminated the problem.

Attachment 1

Risk Assessment Matrix

	Species
Factors Influence the Establishment of ANS in North Dakota	
North Dakota's climate and habitat conditions are similar to those in the specie's native range: very similar - 5; at the end of its range - 3; outside of its range – 1	
This specie is: not on a state or other local lists - 5, is a state or local listed species - 3; on a Federal 1	
The specie already has: statewide distribution - 5, is in isolated areas in the state - 3, or is not present at this time - 1	
The species is: self controlled due to location, time of year, i.e., fall, movement is unlikely for the short term – 1; there is a likelihood that the ANS will be moved – 3; the species is readily moved and is likely to be moved to new areas in a relatively short time – 1.	
Introduction will cause the loss of native or desirable specie(s) or habitats - 5, expanding its range is of ecological concern - 3, and no concerns from the establishment – 1	
This specie causes environmental or economic problem(s) - 5, this specie has the potential to cause problem(s) - 3, has caused no known problems -1	
Control method(s) are: proven - 1, experimental - 3, unknown – 5	
Control efforts are focused on preventing the introduction - 1, eradicate the isolated populations -3, prevent the spread or slow the introduction of the species – 5	
Introduction pathways are: many or unknown - 5, few -3, single – 1	
Agencies have the authority/responsibility to deal with the problem(s): multiple - 1, few - 3, and single – 5	
Agencies that are wiling to deal with the problem(s): multiple - 1, few - 3, and single – 5	
Information available on the specie: extensive on the specific specie - 1, general - 3, little or none – 5	
Public concern about this species: no concern – 5; aware with some concern and might do something – 3; concerned about the problem and willing to do something – 1	
Total Score	

Attachment: **2004 PROGRESS REPORT NORTH DAKOTA AQUATIC NUISANCE SPECIES MANAGEMENT PROGRAM by LR Schlueter, Special Project Biologist, North Dakota Game and Fish Department, Devils Lake, ND.**

2004 PROGRESS REPORT
NORTH DAKOTA AQUATIC NUISANCE SPECIES (ANS)
MANAGEMENT PROGRAM

January 2005

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The following summarizes completed activities or activities in-progress identified in North Dakota Statewide ANS Plan's Strategy and Objectives. It is understood that many of these activities need to continue at the current level or more effort will be required to make sure that ANS prevention is effective. The initial contacts and involvement has been made with target audiences, it is important to continue to work with them in ANS education and prevention as it will be very difficult to keep the momentum if the efforts wane or falter.

Objective 1: Coordination of aquatic nuisance species activities and preparing/implementing a comprehensive management plan

Strategy 1A: Coordination of ANS activities for all ANS management programs and activities within North Dakota through development of the Aquatic Invasive Species Committee.

Strategy 1A1. The Game and Fish Department will designate an Aquatic Nuisance Species Coordinator and support this position with federal ANS Task Force funds and matching state funds. The Coordinator will encourage communication between governmental entities, the public, and private sector; provide information, archive appropriate ANS information, and provide the public with needed information for them to make responsible decisions.

> **Action Taken:** ANS prevention is a priority of the Game and Fish Department. The Department assigned the Special Project Biologist to work on ANS issues and be the coordinator for the state's ANS management. The Department, through the Special Project Biologist, will support the efforts of the Aquatic

Invasive Species Committee (AISC) in developing and implementing North Dakota's Aquatic Nuisance Specie Management Plan (ND-Plan).

Strategy 1A2. The coordinator will identify key personnel in governmental, tribal, private, and the public sector with ANS responsibilities. These individuals will be invited to form the Aquatic Invasive Species Committee to oversee ANS activities within North Dakota. The Coordinator will be the chairperson of this advisory committee. The AISC will work to ensure that the ANS strategy is coherent and consistent throughout North Dakota. AISC will develop ANS assessment guidelines as needed for local governments or cooperating entities.

Action Taken: An *ad hoc* AISC was formed to produce a draft of the ND-Plan. The AISC will become recognized through the approval and acceptance of coordinated, pro ANS management efforts in North Dakota. The Seated Committee, e.g., voting privileges, will provide information and recommendations to the various government agencies, public entities, and the private sector. Using representatives from a variety of agencies, public entities, and private organizations the AISC (see Appendix H for a listing of Seated Committee and Standing Representatives on the AISC) will strive to ensure communication between government and private sectors on ANS issues, resolve issues before they become road blocks to the prevention of ANS, and to make recommendations for continuous improvement of the state's ANS management (see Appendix I for flow chart and communication description). The AISC is open to all interested parties as Standing Representative, e.g., no voting authority, to participate in ANS management in North Dakota. Initial committee representation was a cross-section of North Dakotans. The AISC reviewed a draft of a state management plan adapted from other state's efforts. The ND-Plan and sent it out for technical review (see Appendix J for a listing of the Technical Review panel). The plan received considerable internal review by the AISC (see Appendix K for a review of the plan development process).

Strategy 1A3. The state plan will allow for coordinating North Dakota ANS prevention efforts with those being done on a regional and national scale.

Action Taken: The coordinator is working with the US Fish and Wildlife Service's ANS-Task Force, the Western Regional Panel, other states, and local government agencies to improve and to collaborate on ANS issues. These efforts requires that funding be available to travel to meetings and actively participate in dialog to reach mutually achievable goals and objectives.

Strategy 1B: Prepare and implement a comprehensive management plan.

Strategy 1B1. AISC will prepare a plan to begin comprehensive, statewide ANS management plan for North Dakota.

> **Action Taken:** A draft North Dakota AQUATIC NUISANCE SPECIES (ANS) MANAGEMENT PLAN will have been completed and submitted to the FWS ANS-Task Force for approval and funding by March 2005.

Strategy 1B3. The state plan will allow for coordinating North Dakota ANS prevention efforts with those being done on a local level, in the region such as the efforts outlined in Montana's and Iowa's state plan and Minnesota's Sea Grant work, and on a national scale.

> **Action Taken:** A draft North Dakota AQUATIC NUISANCE SPECIES (ANS) MANAGEMENT PLAN is contingent on state agencies, entities, the private sector, and the public work together to achieve the solutions to ANS problems and the spread of such problems.

Strategy 1C: Participate in and support regional, federal, and international efforts to control ANS.

Strategy 1C1. The coordinator is to participate in the FWS ANS-Task Force's Western Regional Panel, support the Pacific States Marine Fisheries Commission's 100th Meridian Project, and coordinate with Canadian provinces and neighboring states on ANS issues.

> **Action Taken:** The Coordinator is participating with groups that are actively working to prevent the spread of ANS. Those groups include: Western Regional Panel, 100th Meridian Project, Missouri Interstate Cooperative Resource Association ANS-Panel, and initiated coordination activities with neighboring Canadian provinces and states. These activities will continue as funding permits.
>
> **I**nteraction during the meeting and seminars is critical to ANS prevention and networking which provides for better ANS prevention efforts. These efforts are frequently dropped when funding is low, but they need to continue at current or higher levels.

Strategy 1D: Develop partnerships and funding sources to leverage state and federal funds with nonfederal funds to increase ANS prevention efforts that will be undertaken.

Strategy 1D1. Create stable funding sources for ANS management in North Dakota by seeking federal funding from the Nonindigenous Aquatic Nuisance Prevention and Control Act-1990 (NANPCA Act), seek other potential funding sources from state agencies, alternative funding sources, or grants for ANS prevention or control efforts.

> **Action Taken:** The Game and Fish Department requested funding from

the North Dakota Legislature for the 2005 to 2007 biennium. The Coordinator will leverage these funds with federal funds, grant monies, and other funding sources to accomplish the prioritized needs of the ND-Plan.

In preceding years, 1998 through 2004, the North Dakota spent approximately $125,000 on ANS prevention efforts. The funding sources were both federal and state. To accomplish ANS efforts, the Game and Fish was able to shift allocated funds and manpower from other fish management projects. Initial federal funding was part of the impetus for North Dakota concerted ANS prevention effort. Other state agencies were conducting ANS prevention, but the amount that they have spent has not been qualified as the effort was not closely tracked.

The ND-Plan and ANS efforts to date are concrete efforts that the state legislature will recognize. Funding the ND-Plan by North Dakota Legislature should be increased because previous ANS efforts have been successful and is concrete evidence that education is effective in prevention.

The ability to combine state funds with anticipated funds from the FWS ANS-Task Force makes the ND-Plan more likely to be funded at an appropriate level. Federal dollars are needed to make the ND-Plan a more credible program and more effective.

Strategy 1D2. Develop partnerships with state and federal agencies, private enterprise, and the public to leverage existing funding sources to undertake additional ANS prevention and eradication efforts. Partnerships to fund ANS prevention information with local entities will create a buy-in for ANS prevention with those groups and an ownership in preventing ANS importation.

Action Taken: The AISC was developed based on the concept of having partners to accomplish the ND-Plan's prioritized needs. The coordinator has developed partnerships with private groups such as fishbait retailers, fishing and hunting guides, motels and other lodging accommodations, convenience stores, commercial ventures, and local chambers of commerce. Partnerships have been formed with a variety of state and federal agencies or entities such as the US Army Corps of Engineers, US Fish and Wildlife Service, Bureau of Reclamation, Coast Guard, and others that are concerned with ANS prevention. The partnerships have included ANS prevention efforts as funds for educational information and manpower to do monitoring.

The coordinator has worked with Department of Tourism to include ANS information in publication they provide on local and regional bases. This effort has been extended to fishing clubs, local chamber of commences, fishing and hunting guides, and other groups which has resulted in local agreement and buy-in for ANS prevention efforts. The use of partnerships on local ANS information is a ownership of prevention efforts by the local outdoor recreational community.

Strategy 1E: Review and evaluate state efforts in addressing ANS.

Strategy1E1. Update the state ANS plan as needed, with annual progress reports and a five-year program report

> **Action Taken:** The 2004 PROGRESS REPORT-NORTH DAKOTA ANS AQUATIC NUISANCE SPECIES MANAGEMENT PROGRAM is the initial document that addresses ND-Plan's accomplishments. This document will be updated in following years, but dependent on funding for the ND-Plan.

OBJECTIVE 2: PREVENT THE INTRODUCTION OF AQUATIC NUISANCE SPECIES INTO NORTH DAKOTA.

Strategy 2A: Research and address pathways of introduction.

Strategy 2A1. Describe the potential pathways through which ANS can enter North Dakota via recreational, commercial, esthetic, and illegal pathways, and include judgments of the risks of introduction from specific pathways.

> **Action Taken:** The Coordinator reviewed literature on biota introduction into North Dakota, identifying 19 separate pathways. There is a risk associated with each pathway, but the most likely ANS introduction will be from recreational vessels and equipment.

Strategy 2A2. Estimate the potential for ANS introduction for each pathway; conduct a risk analysis.

> **Action Taken:** Conducted comprehensive boater surveys that determined: 1 – boat owners' residence, 2 – water the boat was last in, 3 - intended destination for boaters, 4 – awareness of ANS issues, and 5 – ANS precautions taken prior to this trip. Interviews will be a combination of questions asked during angler creel interviews, statewide questionnaires, and by contract with outside entities to conduct specific boater interviews. Interviews provide a baseline for comparing changes in boater attitudes and evaluating the risk for ANS import to North Dakota's waters. Continue this effort as angler interviews are conducted at North Dakota's major waters, e. g., Devils Lake, Missouri River, and Lake Sakakawea, ever three years and on other waters in association with fisheries management projects.
>
> Pet retailers were contacted to determine origin of goldfish, Koi or other carp. The concerns was the these fish could be a source of Spring Viremia of Carp Virus which can be infectious to cyprinids and related species. Additional efforts are needed to define actual sources of fish or aquatic plants and animals being offered for sale in North Dakota's markets.
>
> The pathways that ANS could enter North Dakota should be continued to be researched and monitored. For each pathway, a risk assessment and likelihood of infections from a pathway or a combination of pathways should be

conducted. These efforts would be best undertaken by contracting with a university to complete a study on non recreational boating ANS pathways.

Strategy 2B: Prevention of ANS along determined pathways of introduction.

Strategy 2B1. Continue to educate public and private groups that are shown to be the likely sources of ANS importation and the results of accidental introduction of ANS.

Action Taken: The coordinator contacted representatives from power production plants, industry and manufacturing, and municipal water plants about impacts of ANS to those systems. These groups were provided with information on the financial impact to their businesses from ANS infestations. North Dakota groups were unaware of the potential ANS financial impact on their ventures. These groups were provided website information on the problem, given contact within umbrella groups to develop their prevention program, and invited to AISC meetings.

Educational efforts must be on-going as to keep the target audiences' awareness at appropriate levels, these efforts need to continue and be increases where and when possible.

Strategy 2B3. Implement the HACCP (Hazard Analysis and Critical Control Point) training program for appropriate fish hatchery, field, and survey personnel of the North Dakota Game and Fish Department.

Action Taken: ANS transport on vessels and prevention protocols were reviewed with the North Dakota Game and Fish Department's Fisheries Division during their staff meeting. To prevent ANS transport on nets or in boats, prevention would include equipment washing and nets, disinfection as required, and air drying when practical. North Dakota fish for stocking sources, e.g., federal fish hatcheries in North Dakota and fish hatcheries outside of North Dakota, were contacted to determine ANS prevention protocols used. These efforts were made to assure that the Fisheries Division and FWS hatcheries were not unintentionally moving ANS with loads of fish.

These efforts need to be ongoing to prevent complacency which could allow for the unintentional introduction on ANS.

Strategy 2B4. Work with fishing tournament officials to ensure boats and equipment under went ANS prevention protocols.

Action Taken: The coordinator worked with fishing tournament officials to provide participants information on ANS impacts, ANS prevention protocols, and encouragement of ANS protocols to be mandatory for the tournament. This effort has been as a presentation at numerous fishing tournaments during 2003 and 2004. Participants' ANS awareness, prevention protocols are determined by questions they are asked at the time they register to participate in a tournament.

Fishing tournament officials ANS inspections were monitored by the coordinator. Information was summarized in unpublished Fisheries Division reports.

Annual efforts were made by the coordinator to reinforce the need to take ANS prevention as tournament anglers travel between lakes. The tournament anglers were requested to include ANS prevention information in seminars they present in the off season.

Strategy 2D: Prohibit, control, or permit the importation of nonindigenous aquatic species based upon their invasive potential.

Strategy 2D1. The develop a non-indigenous species list in North Dakota.

Action Item: The coordinator compiled a North Dakota non-indigenous fish species list from information on file from the Dakota Chapter of American Fisheries Society (see Appendix M for a listing and those species considered to be an ANS) and from the USGS web site on nonindigenous species on record for each state.

Strategy 2D2. Develop a list of defined ANS and those that are of high concern to North Dakota and develop preferred management strategies for dealing with these as listed by priority class.

Action Item: The North Dakota Game and Fish Department contracted with Minot State University, Bottineau Campus for a life history review of selected ANS, comparing that information with abotic condition, e.g., temperature, water chemistry parameters, turbidity, and bottom types, etc., found in North Dakota waters, and determine which ANS species could survive if introduced into them. The information became the "Status of Aquatic Nuisance Species in North Dakota - Priority for Action" report (see Appendix K for the North Dakota ANS Status Report and species of concern). A summary of that information is given below:

Outtake from - *Status of Aquatic Nuisance Species in North Dakota*
Priority Class 1:

Presence in ND:	Currently not in North Dakota
Risk for importation:	High potential to be brought into North Dakota.
Significance of impact to economies or ecosystems:	Significant negative impact to ecosystems and to regional economies.
Cost and/or effectiveness of control options:	Control prohibitively expensive.
Availability of management strategies:	Limited effectiveness, or no known management strategies for these species.
Appropriate management stance:	Prevent introduction and eradication of pioneering populations.

continued: *Status of Aquatic Nuisance Species in North Dakota*

Species in this Priority Class:
1. Eurasian Watermilfoil (*Myriopyllum spicatum*)
2. Zebra Mussel (*Dreissena polymorpha*)
3. Asian Clam (*Corbicula fluminea*)
4. Asian Carp (Bighead *Hypophthalmichthys nobilis)*
   (Grass *Ctenopharyngodon idella)*
   (Silver *Hypophthalmichthys molitrix)*
   (Black *Mylopharyngodon piceus*)
5. Round Goby (*Neogobius melanostomus*)
6. Ruffe (*Gymnocephalus cernuus*)
7. Spiny Water Flea (*Bythotrephes cederstroemi*)
8. Heterosporosis (Micsporidia that infects a variety of fish species)
9. Infectious Hematopoietic Necrosis (IHN) Virus

Priority Class 2:

Presence in ND:	Present and established in North Dakota.
Risk for importation:	High potential to spread within North Dakota.
Significance of impact to economies or ecosystems:	Localized ecosystem and economical impacts.
Cost and/or effectiveness of control options:	Control prohibitively expensive.
Availability of management strategies:	Limited in nature, or no known management strategies.
Appropriate management stance:	Prevent introduction or spread or if the species becomes established mitigate impacts, control of population size, and prevent dispersal.

Species in this Priority Class:
1. Saltcedar (*Tamarix spp*.) – this is a terrestrial plant species, managed as a terrestrial problem, and is listed as an ANS because of its impact on watersheds and water bodies
2. Curlyleaf Pondweed (*Potamogeton crispus*).

Priority Class 3:

Presence in ND:	Not established in North Dakota.
Risk for importation:	Potential for introduction into specific North Dakota waters.
Significance of impact to economies or ecosystems:	Impact to specific ecosystems, watersheds, or economies.
Cost and/or effectiveness of control options:	High costs due the constraints associated with the species life histories.
Availability of management strategies:	No management techniques available for wide spread application.
Appropriate management stance:	Prevention of introductions and eradication of pioneering populations.

continued: *Status of Aquatic Nuisance Species in North Dakota*

Species in this Priority Class:
1. Whirling Disease (*Myxobolus cerebralis*)
2. Asian tapeworm (*Bothriocephalus acheilognathi*)
3. New Zealand Mud Snail (*Potamopyrgus antipodarum*)

Priority Class 4:

Presence in ND:	Present in North Dakota.
Risk for importation:	Potential to easily spread in the state.
Significance of impact to economies or ecosystems:	Wide ranging impact to specific ecosystems or economies.
Cost and/or effectiveness of control options:	Expensive to treat on an extensive level.
Availability of management strategies:	Management strategies are limited.
Appropriate management stance:	Prevention of dispersal to other water bodies and control of species where practical and appropriate.

Species in this Priority Class:

1. Common Carp (*Cyprinus carpio*)
2. Purple Loosestrife (*Lythrum salicaria*) - this is a terrestrial plant species, managed as a terrestrial problem, and is listed as an ANS because of its impact on watersheds and water bodies
3. Yellow Flag Iris (*Iris pseudacorus*)
4. Flowering Rush (*Butomus umbellatus*)
5. Bacterial fish pathogens (various species)

The Priority List must be periodically reviewed and updated as new ANS are found in the United States, the spread of known ANS is found to have occurred, and additional information on life histories becomes available.

2D3. Develop a North Dakota list of ANS that cannot be imported, moved, possessed or sold within North Dakota. Provide that information to the North Dakota Legislature for review and concurrence.

Action Taken: The information for 2D2 and existing regulations were reviewed, and regulations from other states were reviewed. The listingof ANS was developed and can be provided to the North Dakota Legislature when requested.

Strategy 2E: Promote legislation and regulatory rules that establishes or increases the state's authority to control the introduction of new species.

Strategy 2E5. Require that fish imported for hatchery use or bait is disease free or collected from areas free of ANS. Periodically review the status of ANS in areas the fish or bait originate in and new ANS to keep North Dakota's moratorium on importation current.

Action Taken: The North Dakota Game and Fish Department requires that live fish brought into the state are free from known diseases, and that fish for stocking and baitfish are collected from ANS free areas. The prohibited list of diseases and ANS for the importation of fish into North Dakota is updated when relevant information comes available. The location of bait fish collection is required on import permits and reviewed against the current ANS location maps.

The import of fish must continue to be monitored as ANS infestation spread to new locations in bordering states. The moratorium on baitfish or importation of fish from areas that are known to have ANS must continue.

OBJECTIVE 3: DETECT A PIONEERING AQUATIC NUISANCE SPECIES AND MONITOR EXISTING POPULATIONS OF AQUATIC NUISANCE SPECIES.

Strategy 3A: Implement a monitoring and early detection program.

Strategy 3A2. Conduct an annual monitoring of high-risk water bodies and monitor other water bodies with regularity.

Action Taken: The coordinator developed a monitoring program that is conducted on waters where the Fisheries Division is conducting fisheries inventories. Data sets track waters initially surveyed, lakes inspected a last time, and ANS found. ArcView provides layered maps to track the initial infestations and spread of ANS. The efforts to collect data and provide ArcView mapping is contingent on funding of the ND-Plan. These efforts will be important to track any ANS infestation and know in which areas the ANS has not been found.

Strategy 3A3. Place zebra mussel colonization substrates (traps) in areas of high probability of infestation or provide traps to other agencies or individuals. In addition, inspect boat docks or buoy lines that have been recently removed from the water bodies for zebra mussels.

Action Taken: The coordinator developed partnerships with the US Army Corp of Engineers to place and retrieve artificial substrates (traps) for zebra mussel colonization for Lake Sakakawea and Lake Ashtabula. North Dakota Game and Fish, Fisheries Division staff placed and retrieved traps in Lake Sakakawea and Bowman-Haley Reservoir. Fisheries staff and personnel for US Army Corps of Engineers inspected boat dock, marker buoy anchor lines, and other equipment that had been in the water for the summer. Information from these efforts is summarized and provided to the Pacific State Marine Fisheries Commission for their records. North Dakota's zebra trap information is made available as ArchView layers in ANS tracking maps.

Strategy 3B: Develop an early response mechanism to deal with detected and potential invasive species.

Strategy 3B1. Implement a Rapid Response Plan.

> **Action Taken:** The coordinator and the AISC prepared a Rapid Response Plan (see Appendix N for details on North Dakota's Rapid Response Plan). The ND-Rapid Response is proactive in order to quickly eliminate an ANS infestation. This document is a proactive approach towards developing solutions to ANS as they are discovered. This approach differs from the traditional views of "wait to see" or "manage around the problem" and "react after the problem" has caused economic damage. A fundamental reality of the ANS issue in that all agencies must begin to communicate and agree on actions in a timely and effective manner.
>
> The Rapid Response Plan should be periodically reviewed and updated to make sure that it is a useable and functional document.

OBJECTIVE 4: EDUCATIONAL CAMPAIGN TO PREVENT THE SPREAD OF AQUATIC NUISANCE SPECIES.

Strategy 4A: Educate resident anglers and hunters about ANS prevention protocols by providing focused information in the best avenues of dissemination.

Strategy 4A1. Identify what is the key message, the best format to deliver the information, and where to best deliver the message to this group.

Strategy 4A2. Provide information and education (e.g., signs, posters, kiosks, banners, newspaper articles, articles in periodicals, on radio and television spots, and similar venues) on ANS risks and prevention protocols as found in 4A1.

> **Action Taken for 4A1 and 4A2:** The North Dakota Game and Fish Department and the coordinator have developed the following: a 15 minute video on ANS problems; methodology of introduction; prevention protocols; brochures provided with each boat renewal; posters provide to major sporting good outlets, e.g., Cabelas, Gander Mountain, Wal-Mart, K-Mart, and Scheelds,; posters in baits shops, boat dealerships, and marinas; posted signs at boat ramps; produced numerous articles in local and regional news papers, articles in regional periodicals; public appearances; and individual contacts. The North Dakota Game and Fish Department assisted the 100th Meridian with the design and the posting of ANS informational signs at Lewis and Clark Bicentennial destination sites. The coordinator worked with the FWS ANS-Task Force to design and distribute promotional items which were supplied by the FWS.

Increase in marketing to target audience will require additional funds to be in the correct market to reach the intended audience and achieve the desired response.

Strategy 4A3. Determine the levels of ANS awareness and precautions used.

Action Taken: Through interviews and statewide questionnaires, anglers are asked questions to determine their level of ANS awareness and ANS prevention protocols. These interviews are repeated at heavily used waters every three years which will give comparisons over time. Statewide angler questionnaires are done annually. Comparing recent results with those of the prior five-years, North Dakota anglers have had a significant increased in both ANS awareness and of their taking ANS precautions between fishing and boating trip.

Conducting interviews requires funds that need to be made available to complete this section of the ANS prevention efforts.

Strategy 4B: Educate non-resident anglers and hunters about ANS prevention protocols by providing focused information through the best avenues of dissemination.

Strategy 4B1. Identify what is the key message, the best format to deliver the information, and where to best deliver the message to this group.

Strategy 4B2. Provide information and education (e.g., newspaper articles, articles in periodicals, in tourism publications, on radio and television spots, and similar venues) on ANS risks and prevention protocols as found in 4B1.

Action Taken for 4B1 and 4B2: The coordinator is working with State and local tourism officials to determine those regions where North Dakota travel information is most requested and is the most likely source of ANS introductions. Include ANS information in packets being mailed out and list web links of ANS prevention sites. Determine if mass media efforts will provide the ANS prevention message to the market-audience. These mailings require additional postage that is an increased expense to small cities' Chamber of Commerce.

Strategy 4B3. Determine the level of ANS awareness and precautions used.

Action Taken: The coordinator compared the response from nonresidents from recent and previous angler interviews at North Dakota's major waters. Determine if there have been any changes in the level of ANS awareness and of ANS prevention used. Focus on ANS prevention protocols listed to be taken before making the trip to that water.

Determine where the nonresident and resident are receiving the ANS information and if there would be a better source for information dissemination. A secondary effort would be to determine if the style of information dissemination should be adjusted to reach this targeted audience.

Strategy 4C: Educate non-consumptive outdoor recreators about ANS, the need to prevent it, and disseminate information in the best form and venue.

Strategy 4C1. Identify what is the key message, the best format to deliver the information, and where to best deliver the message to this group.

> **Action Taken:** The coordinator worked with established groups, e.g., birding groups and eco-tourism, to determine attitude of non-consumptive recreators toward ANS prevention. Provide eco-tourism information on ANS impacts and prevention protocols.
>
> Determine where the non-consumptive recreators are receiving the ANS information and if there would be a better source for information dissemination. A secondary effort would be to determine if the style of information dissemination should be adjusted to reach this targeted audience.

Strategy 4D: Educate water users about ANS problems for them, the need to prevent the introduction or spread of the problem, and how to best provide that message.

Strategy 4D1. Determine where the different types of water users can be contacted and in what form will the ANS message be best received and understood by them.

> **Action Taken:** The coordinator contacted local water resource boards, and provided them presentations on the ANS impacts. The water resource boards were encouraged to consider ANS impacts and to include REPPs in their projects, and realize their projects impacts extend beyond the traditional take line.
>
> Education will need to continue and this will require additional funds be made available to reach this target audience that was typically over looked in ANS prevention efforts.

Strategy 4E: Provide tourism promotion groups, including state and local efforts which include guides and outfitters, fishing tournament promoters, etc., with information about the impacts of ANS, how ANS are moved into or within the State, and how critical prevention is.

Strategy 4E2. Determine these groups willingness to provide additional information on ANS prevention methods.

> **Action taken:** The coordinator has contacted these groups and determined which will provide ANS information to their contacts or clients.

Strategy 4F: Develop communication with public and private entities, such as the Garrison Conservancy District, water pipeline cooperatives, etc., about potential

ANS impacts to their operation, the need for a cooperative approach to prevention, and the need to heighten staff awareness.

Strategy 4F1. Determine the level of awareness that these groups have regarding potential ANS problems and what ANS prevention and monitoring is currently being done.

> **Action taken:** The coordinator will contact these groups and determined which are receptive to learning about ANS impacts for their particular ventures.

OBJECTIVE 5: INSPECTIONS OF RECREATIONAL BOATS, COMMERCAL VESSELS, AND EQUIPMENT USED IN AQUATIC SITUATIONS.

Strategy 5A: Implement an inspection program for boats used for fishing, hunting, or pleasure.

Strategy 5A1: Develop and implement boat inspections at boat ramps to determine if ASN is present, where the boat has been, where the boat will be used, and owner/operators awareness of ANS problems and preventions.

> **Action taken:** Boaters were contacted at boat ramps in 1999, their boats inspected, and they were interviewed to determine ANS awareness. These interviews should continue as specific projects conducted by contracts to universities or to conservation groups. This should be an ongoing project and be done via contract to outside sources rather than done by Department staff.

Strategy 5B: Implement an inspection program for vessels used during construction in aquatic situations.

Strategy 5B1. Develop and implement requirements as provided in permits that vessels such as barges, tugs, work boats, tenders, or similar vessels be required to be ANS free prior to their being launched or used on or in North Dakota's waters.

> **Action taken:** The Department has preparing verbiage to be provided to Corps of Engineers to be included in permitting. Inspection of vessels has occurred where and when the location of the vessel was made availably to the Coordinator and the vessel could be inspected.

Strategy 5C: Implement an inspection program for equipment used in construction in aquatic situations.

Strategy 5C1. Develop and implement requirements as provided in permits that equipment used in aquatic situations be required to be ANS free prior to their being launched or used on or in North Dakota's waters.

Action taken: The Department has preparing verbiage to be provided to Corps of Engineers to be included in permitting. Inspection of construction equipment has occurred where and when the location of such equipment was made availably to the Coordinator and the vessel could be inspected.

OBJECTIVE 6: WHERE FEASIBLE, CONTROL AND ERADICATE PIONEERING OR ESTABLISHED AQUATIC NUISANCE SPECIES THAT HAVE SIGNIFICANT IMPACTS ON NATIVE OR DESIRABLE SPECIES.

Strategy 6A: Control known nuisance populations where economically and technically feasible.

Strategy 6A3. Provide technical assistance to watershed councils, conservation districts, irrigation districts, lake associations, and other groups for development of management plans.

Action Taken: The coordinator and State Water Commission are working with local Water Resource Boards to prevent common carp from being introduced into waters not infested with carp. Details on fish barriers were provided along with recommendations on which design was the most effective.

The value of local Water Resource Boards including ANS prevention efforts should become part of their planning proposes and not an after the fact thought when it is brought to their attention. Early incorporation of ANS prevention is cost effective and allows designing REPPs.

OBJECTIVE 7: INFORM THE POLICY MAKERS ABOUT THE RISKS AND IMPACTS OF AQUATIC NUISANCE SPECIES.

Strategy 7A: Educate public officials about the problems of ANS and how ANS are spread.

Strategy 7A1. Create med presentation and accompanying information on ANS concerns, impacts, and need for proactive prevention efforts

Action Taken: The coordinator has developed a presentation highlighting the potential ANS impacts to North Dakota's resources.

Strategy 7A2. Provide interested law makers the pertinent points to be considered when crafting legislation to prevent the introduction or spread of ANS.

Action Taken: The coordinator and AISC have prepared a list of items to be considered in promulgating legislation on ANS. (see Appendix K for additional information on ANS concerns provided to North Dakota Legislators)

OBJECTIVE 8: INCREASE THE AQUATIC NUISANCE SPECIES KNOWLEDGE BASE AND DISSEMINATE THAT KNOWLEDGE IN NORTH DAKOTA THROUGH COMPILING DATA, CONDUCTING RESEARCH AND INFORMATIONAL PUBLICATIONS.

Strategy 8C: Facilitate the collection and dispersal of information, research, and data on ANS in North Dakota.

Strategy 8C1. Create a central repository for reference materials and a central data base on ANS infestations.

> **Action Taken:** The coordinator has begun to compile information on ANS species, infestation sites, and life history.

Appendix C

Noxious Weed Inventory Location Figures

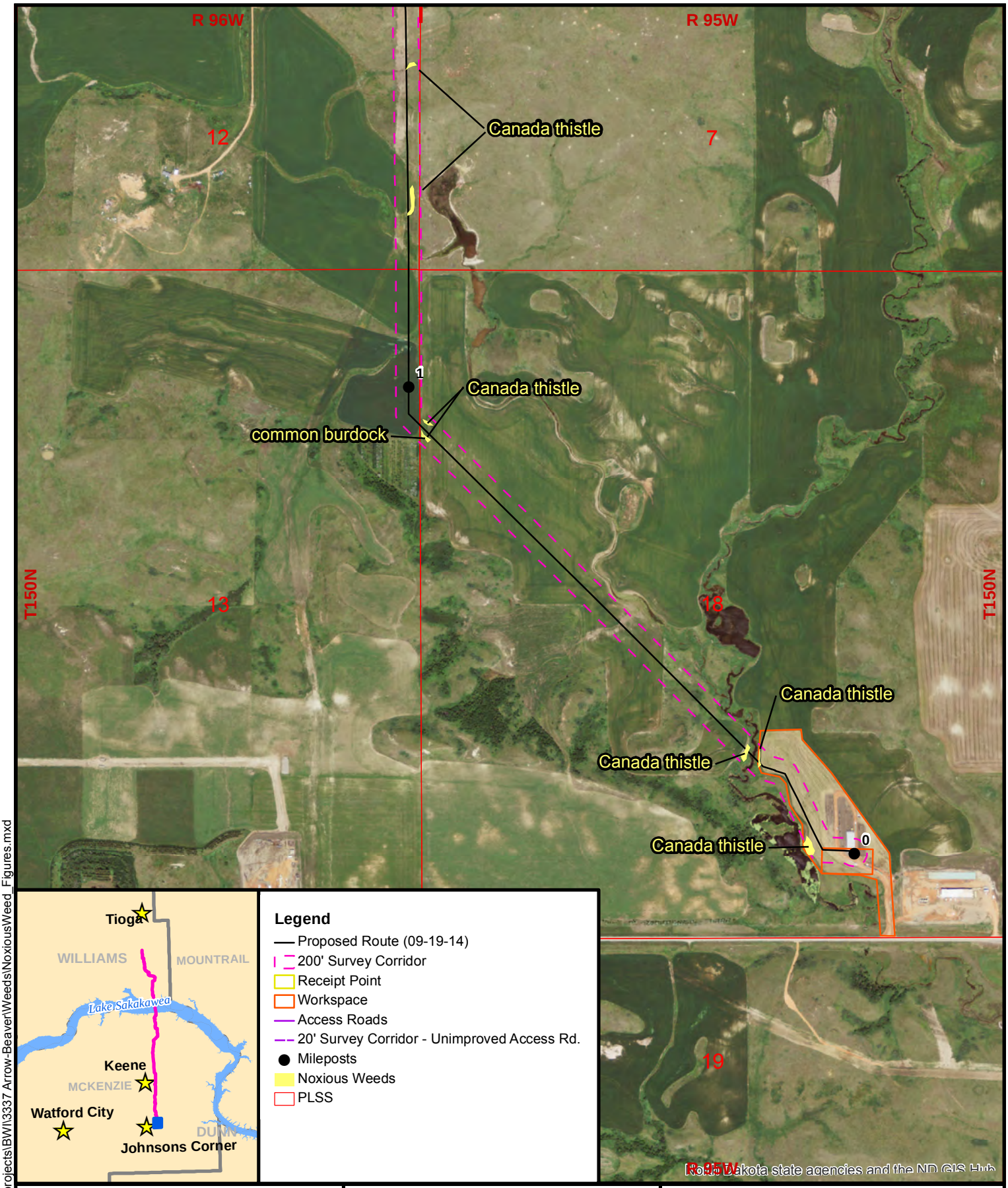

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Figure 1

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

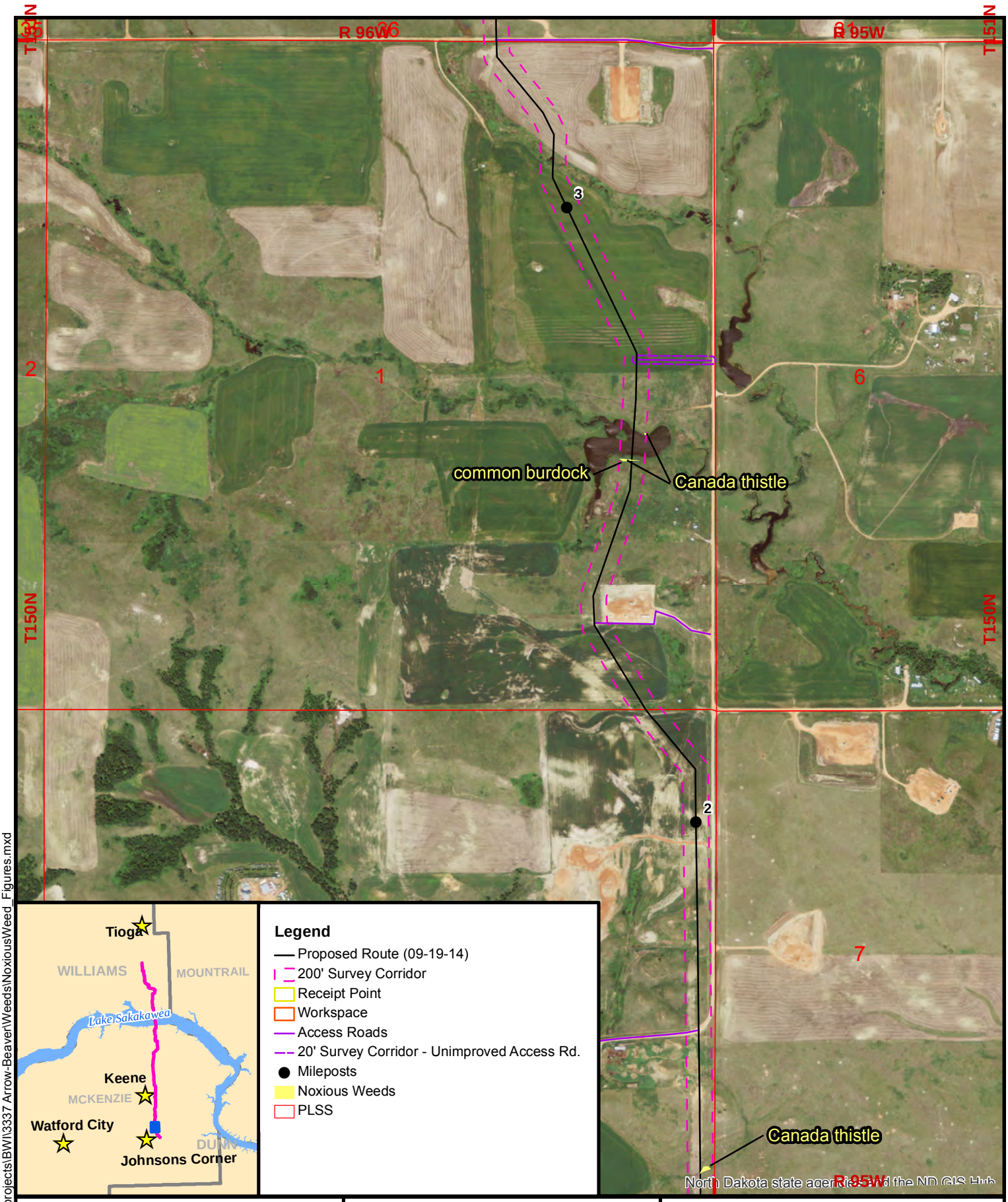

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Figure 2

Noxious Weed Locations
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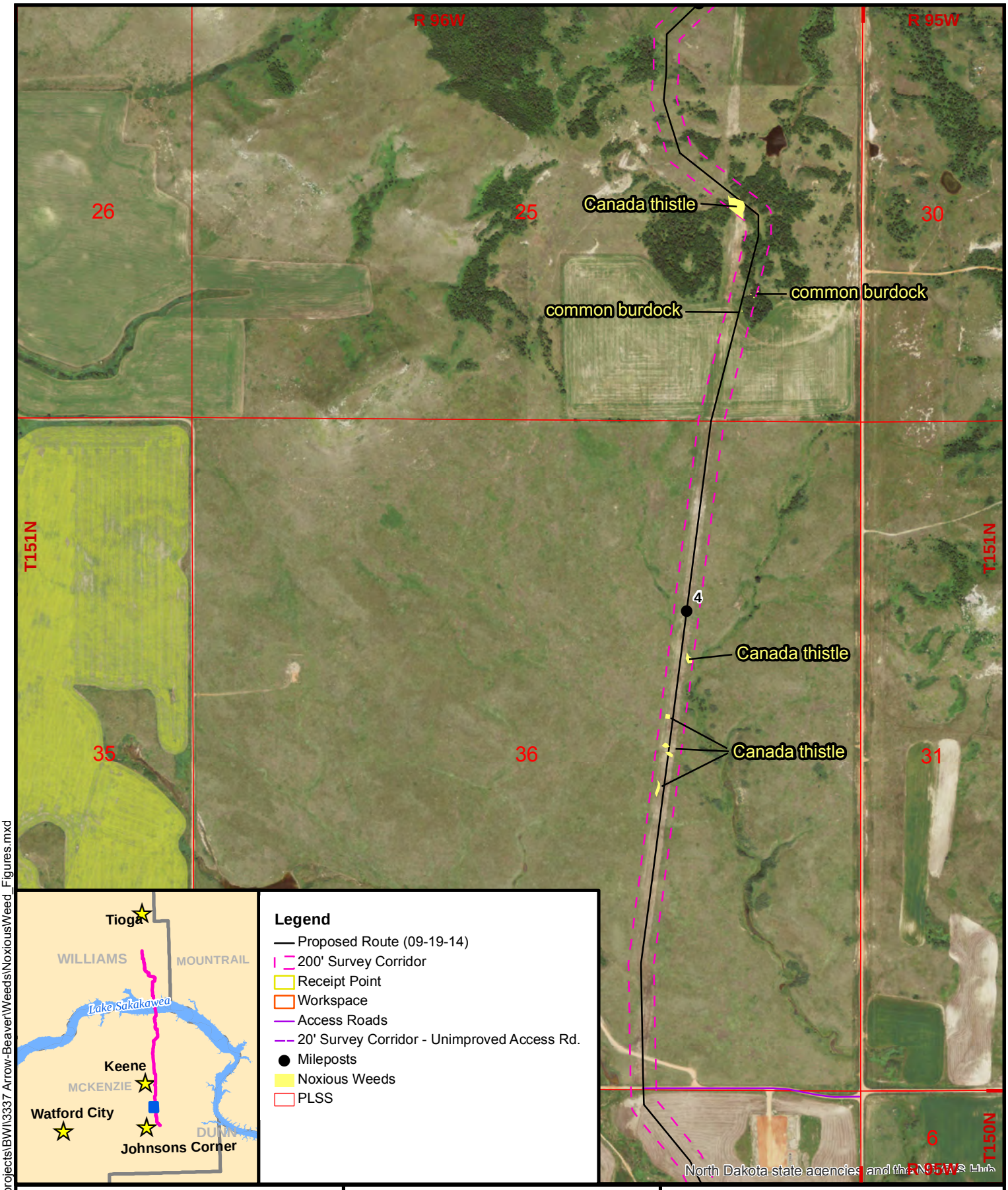

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Figure 3

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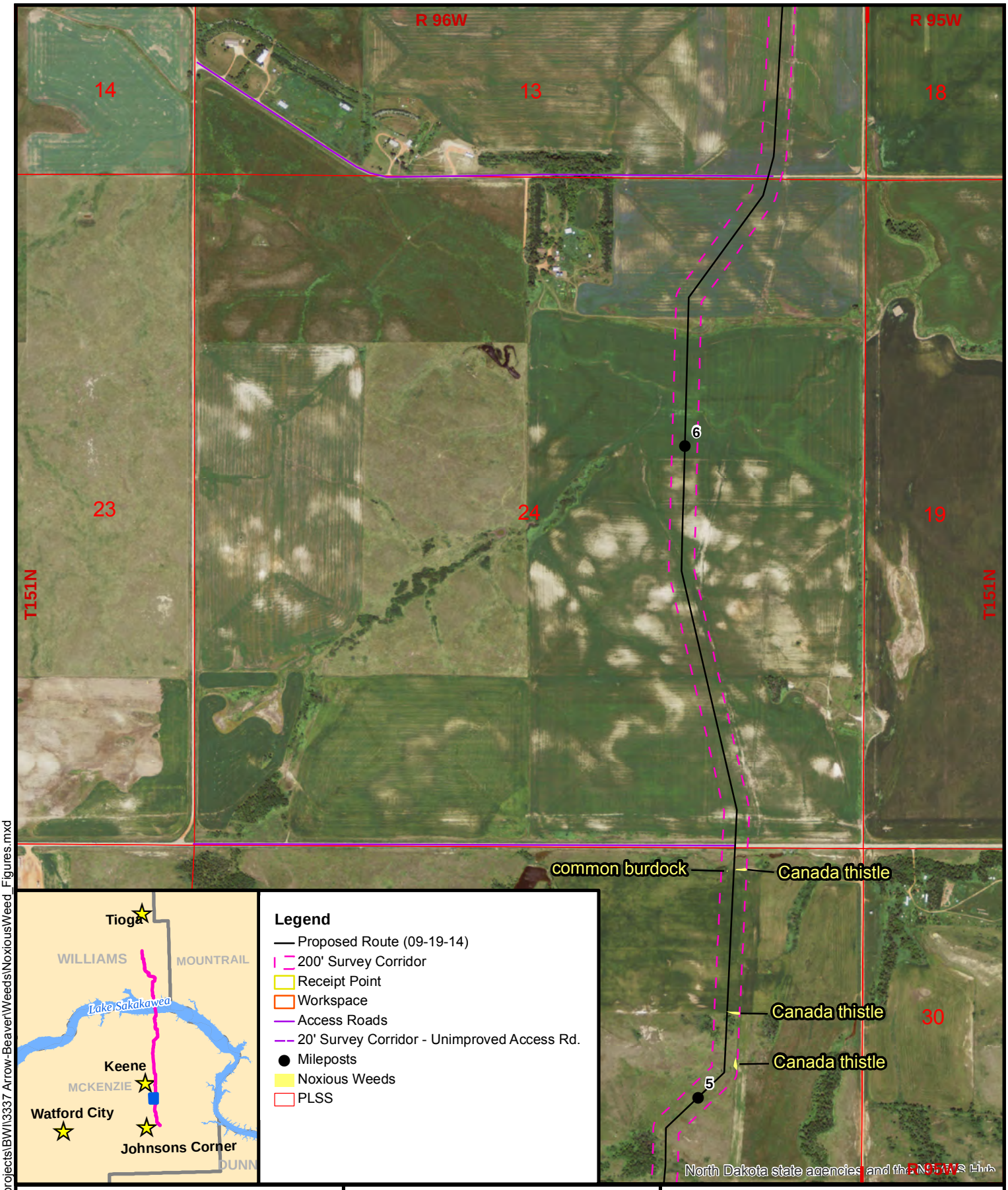

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Figure 4

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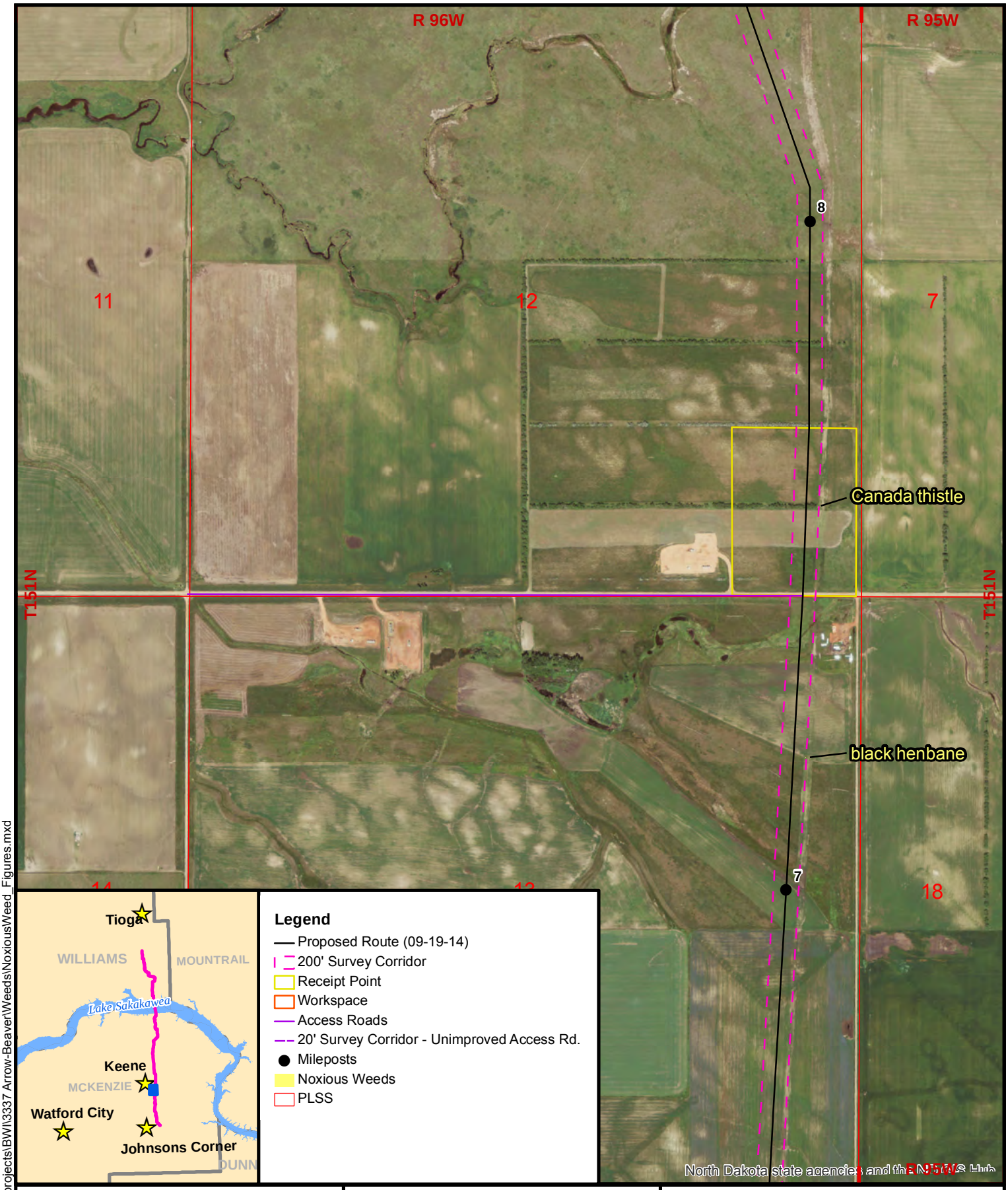

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Figure 5

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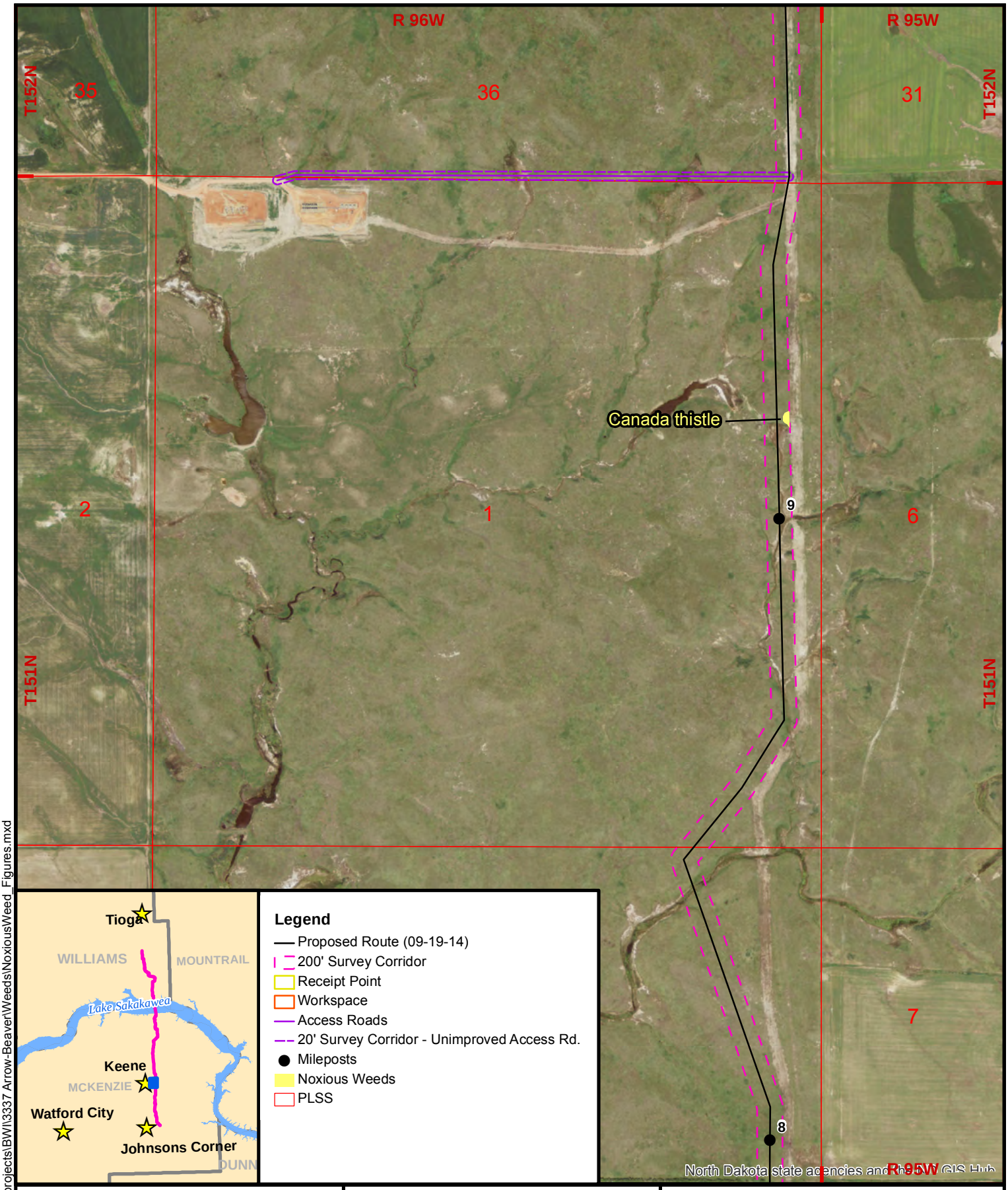

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Figure 6

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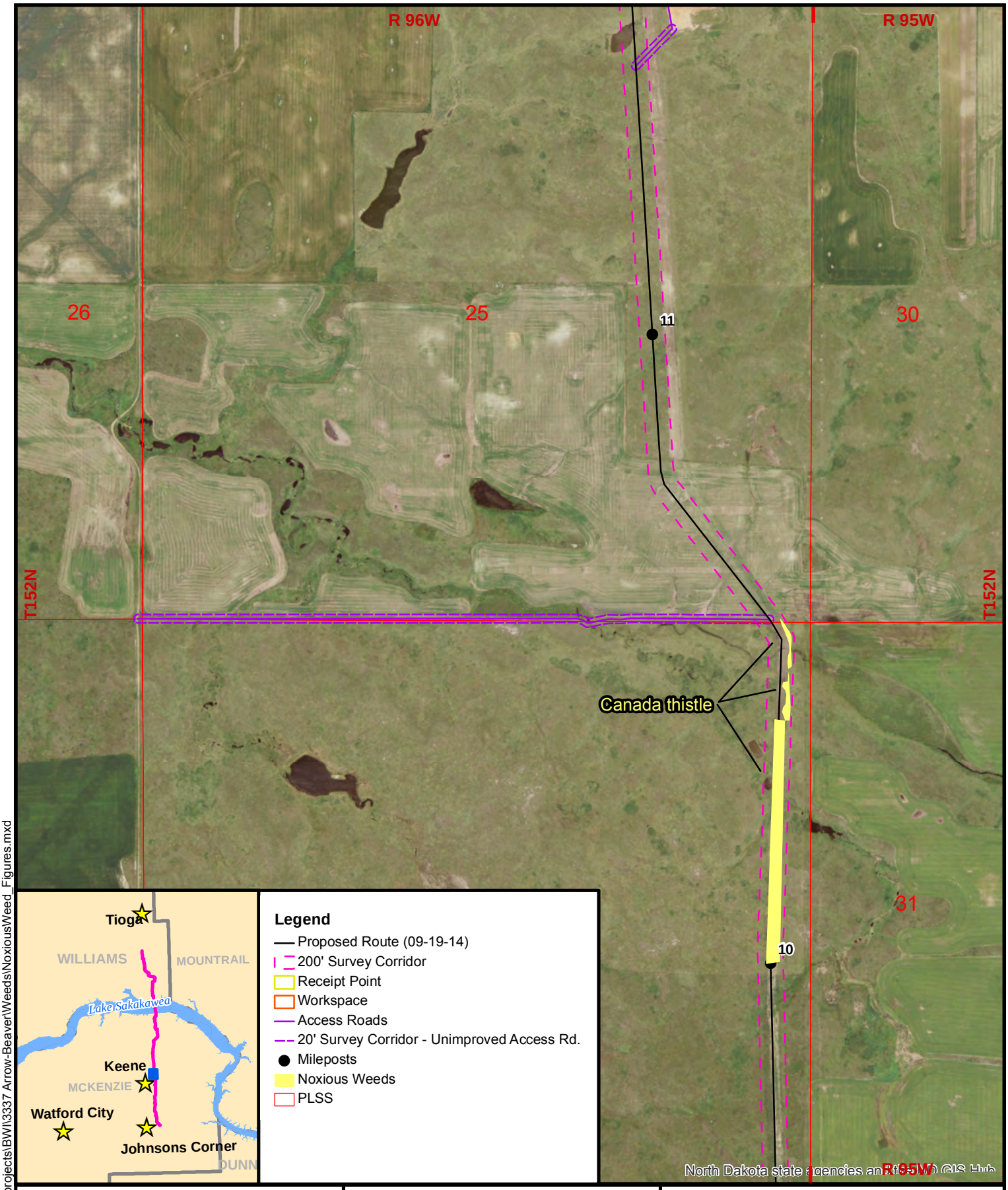

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Figure 7

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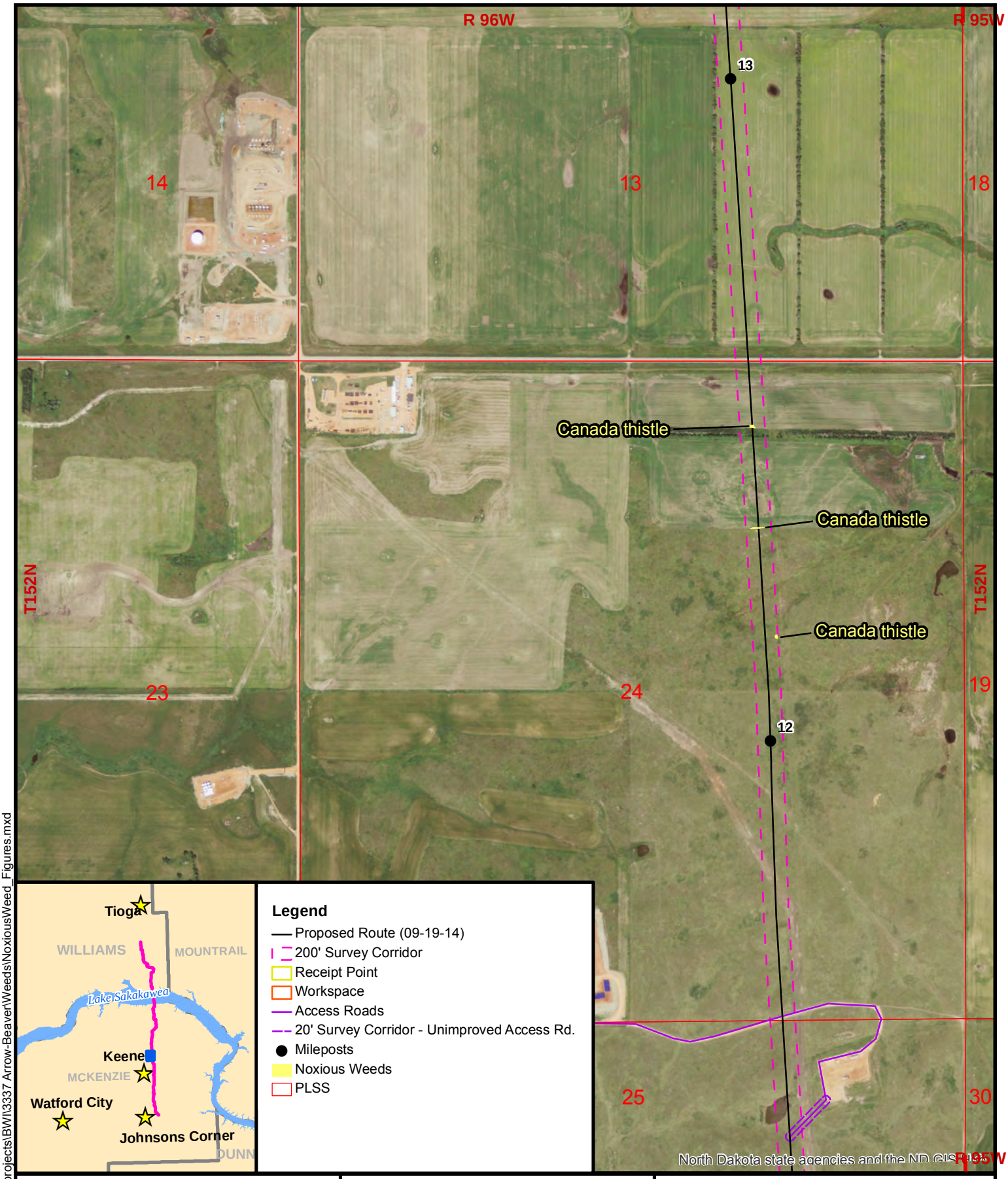

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Figure 8

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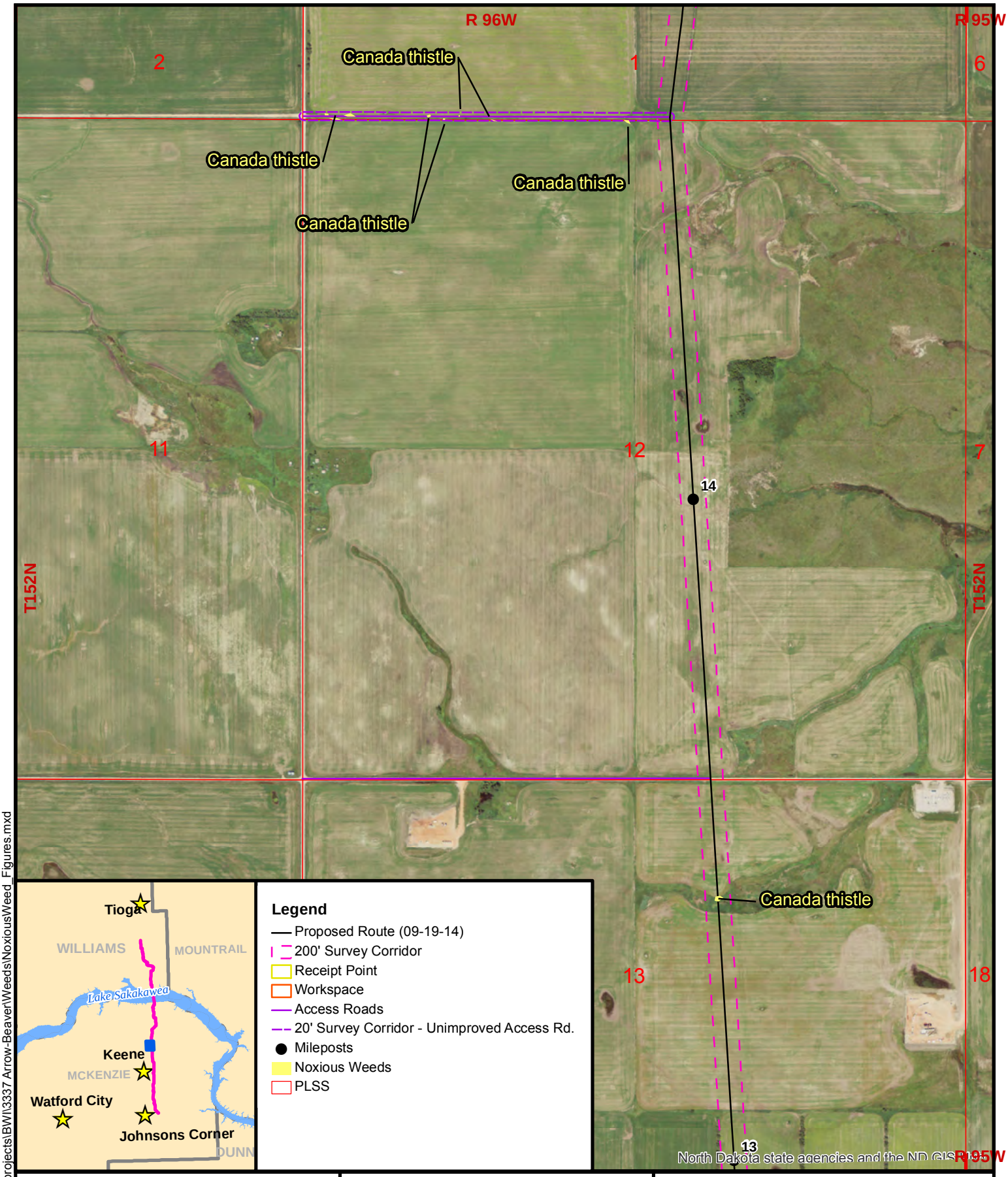

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Figure 9

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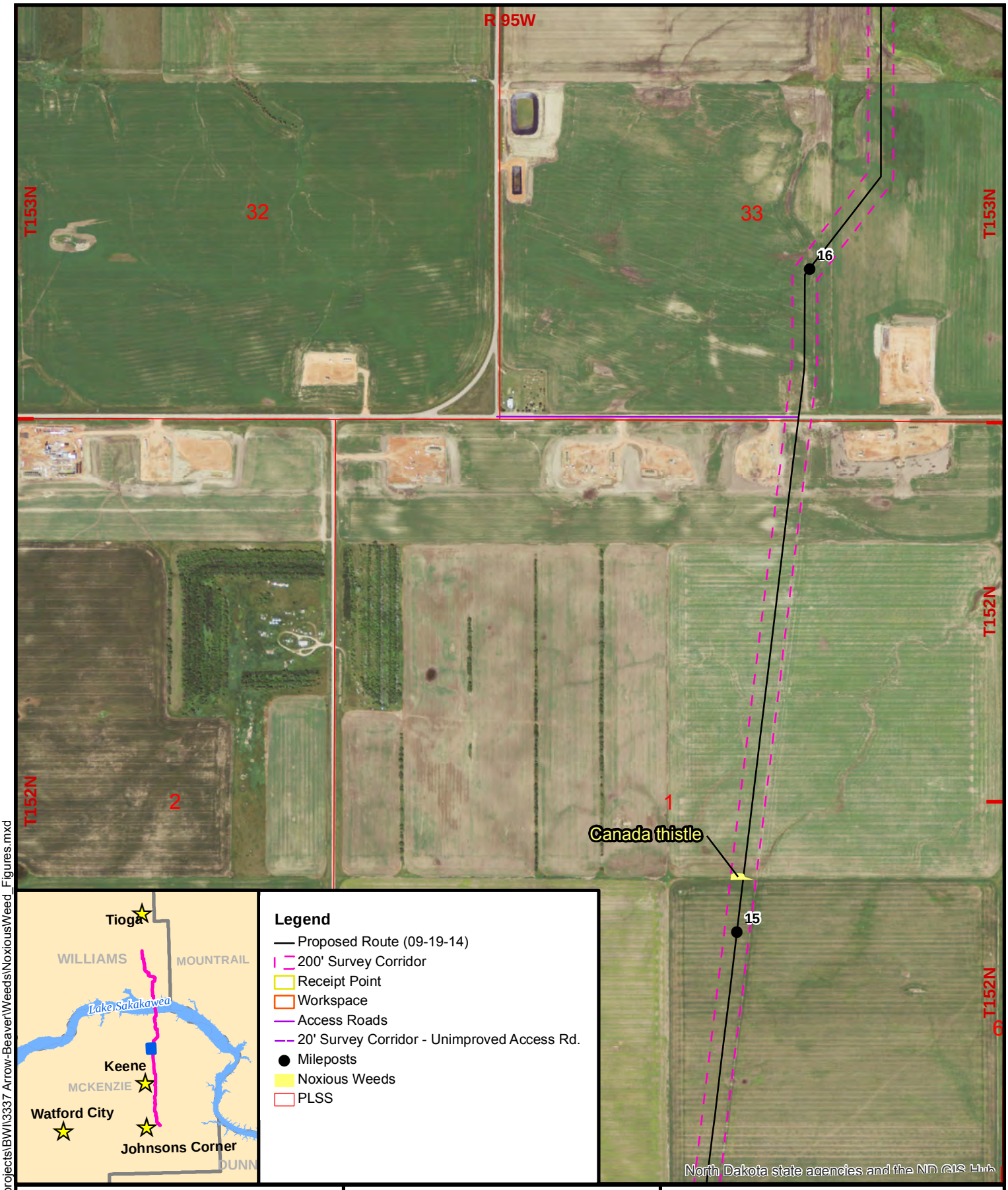

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Figure 10

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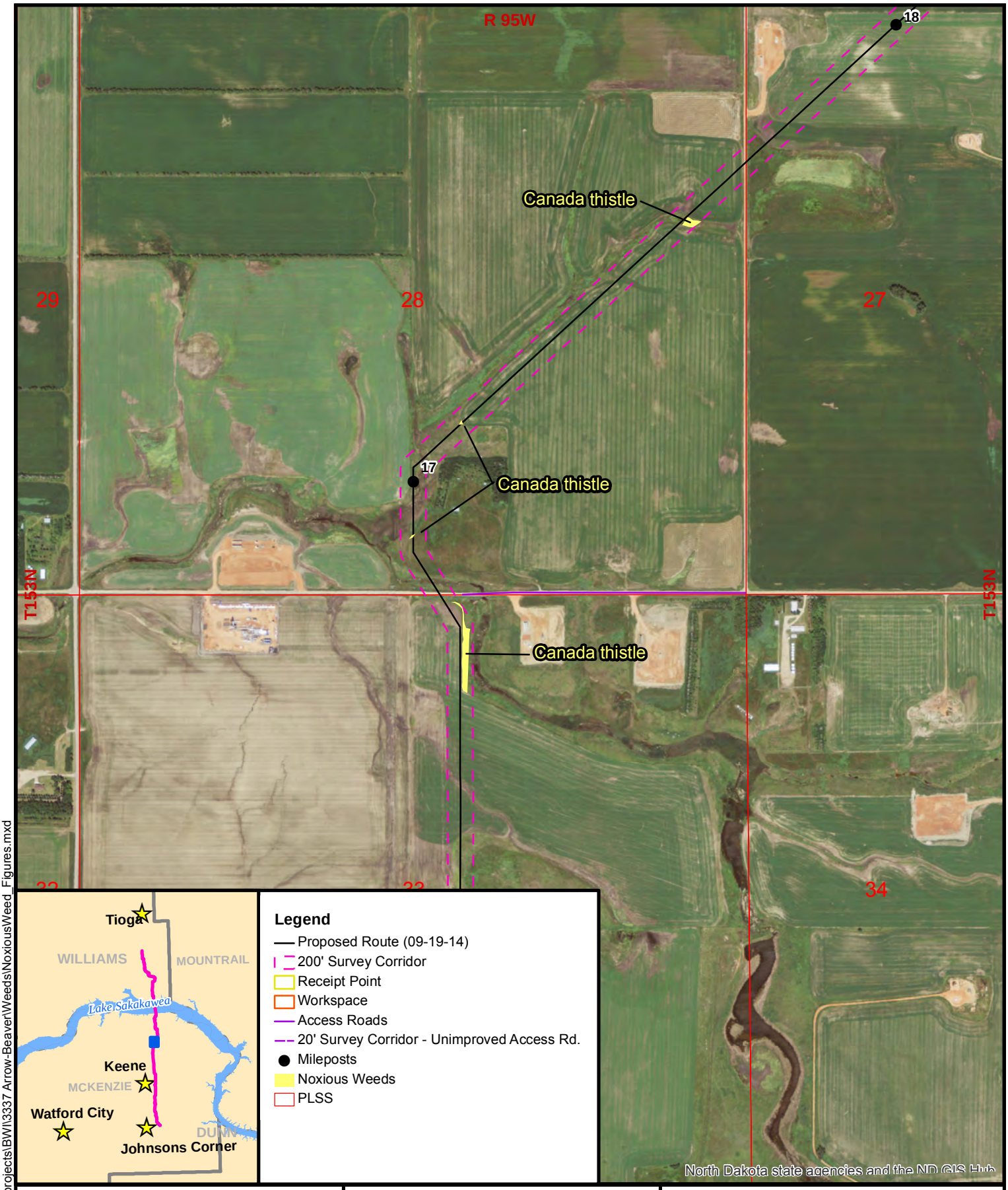

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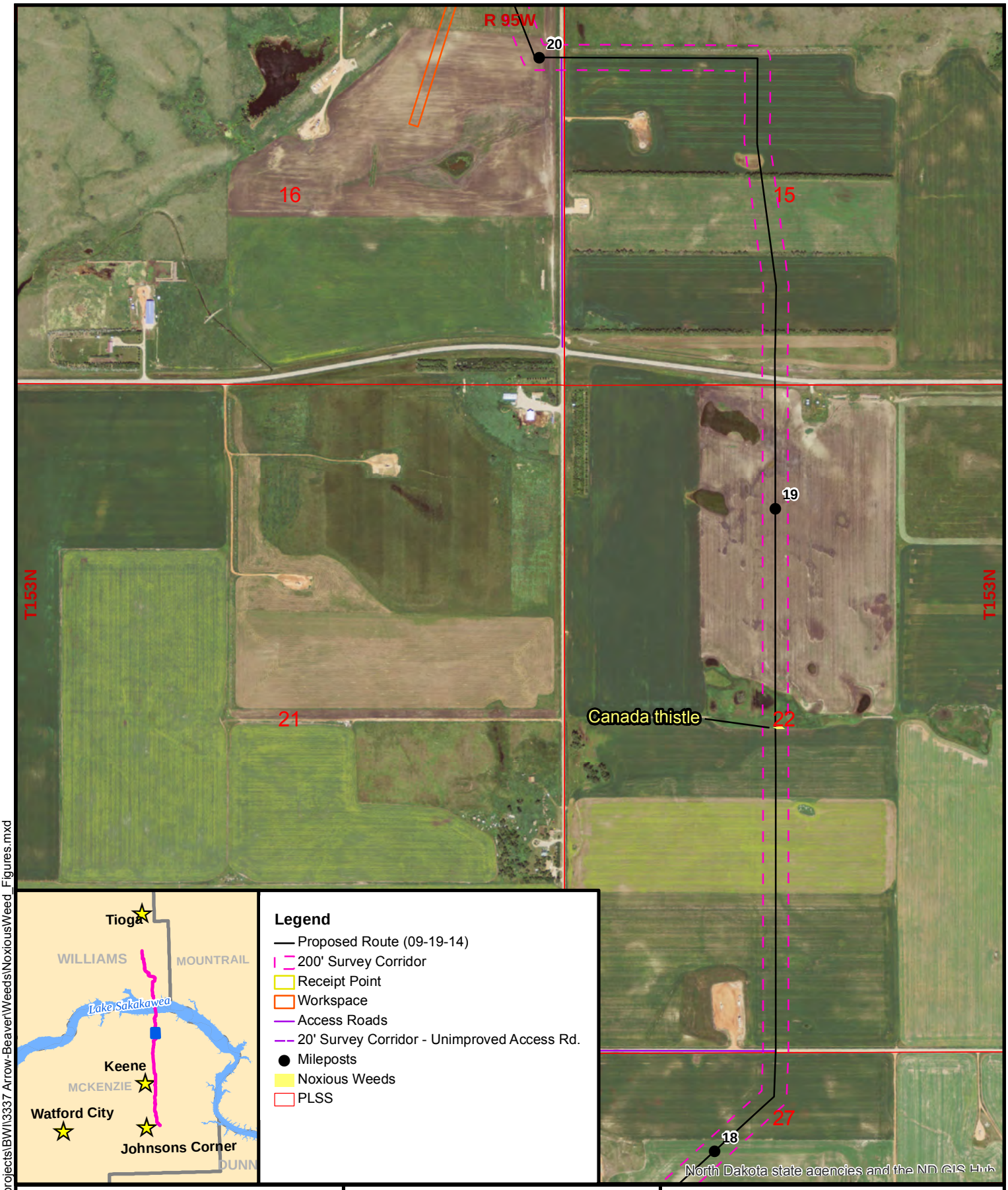

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Figure 12

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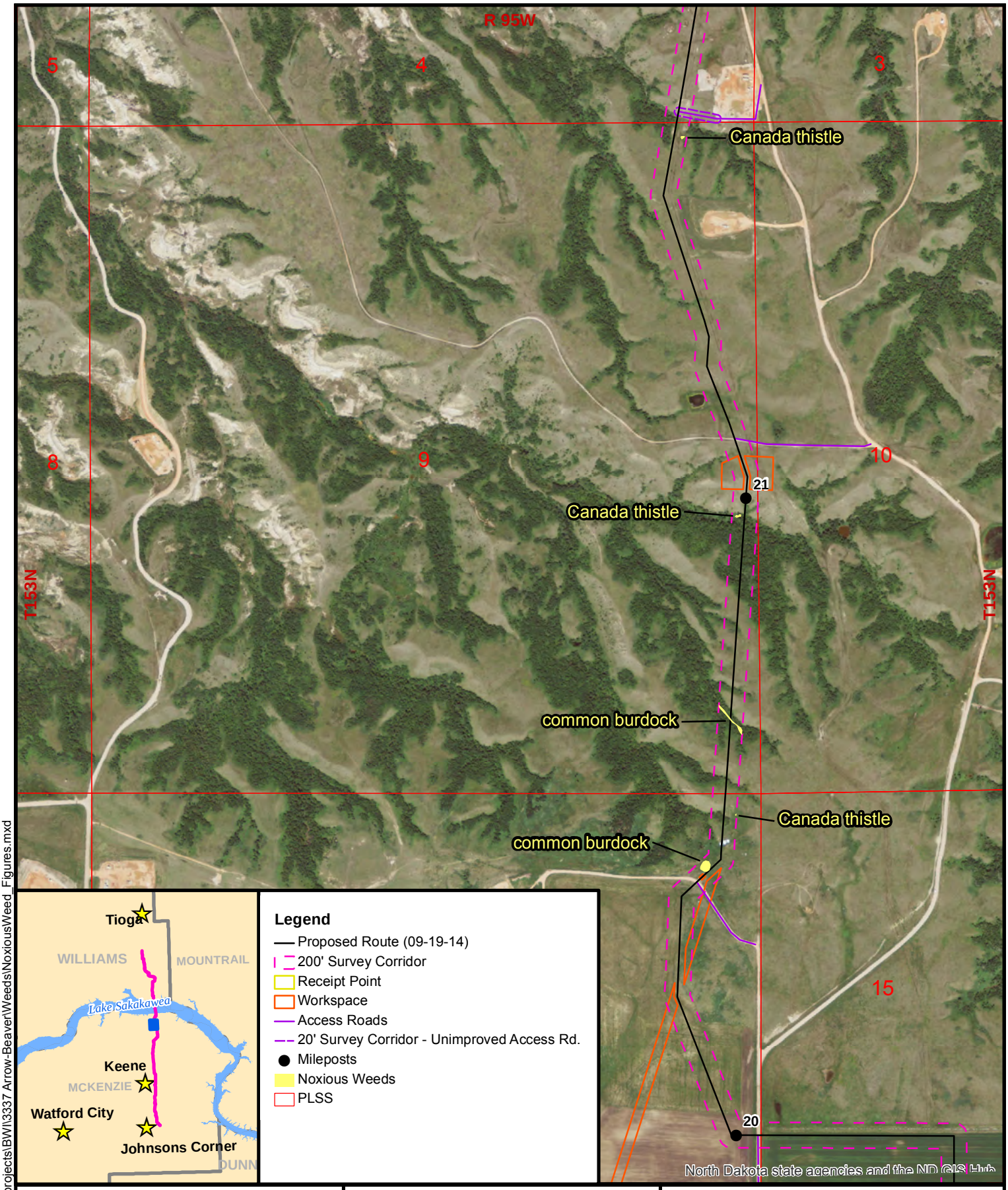

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BakkenLink Pipeline

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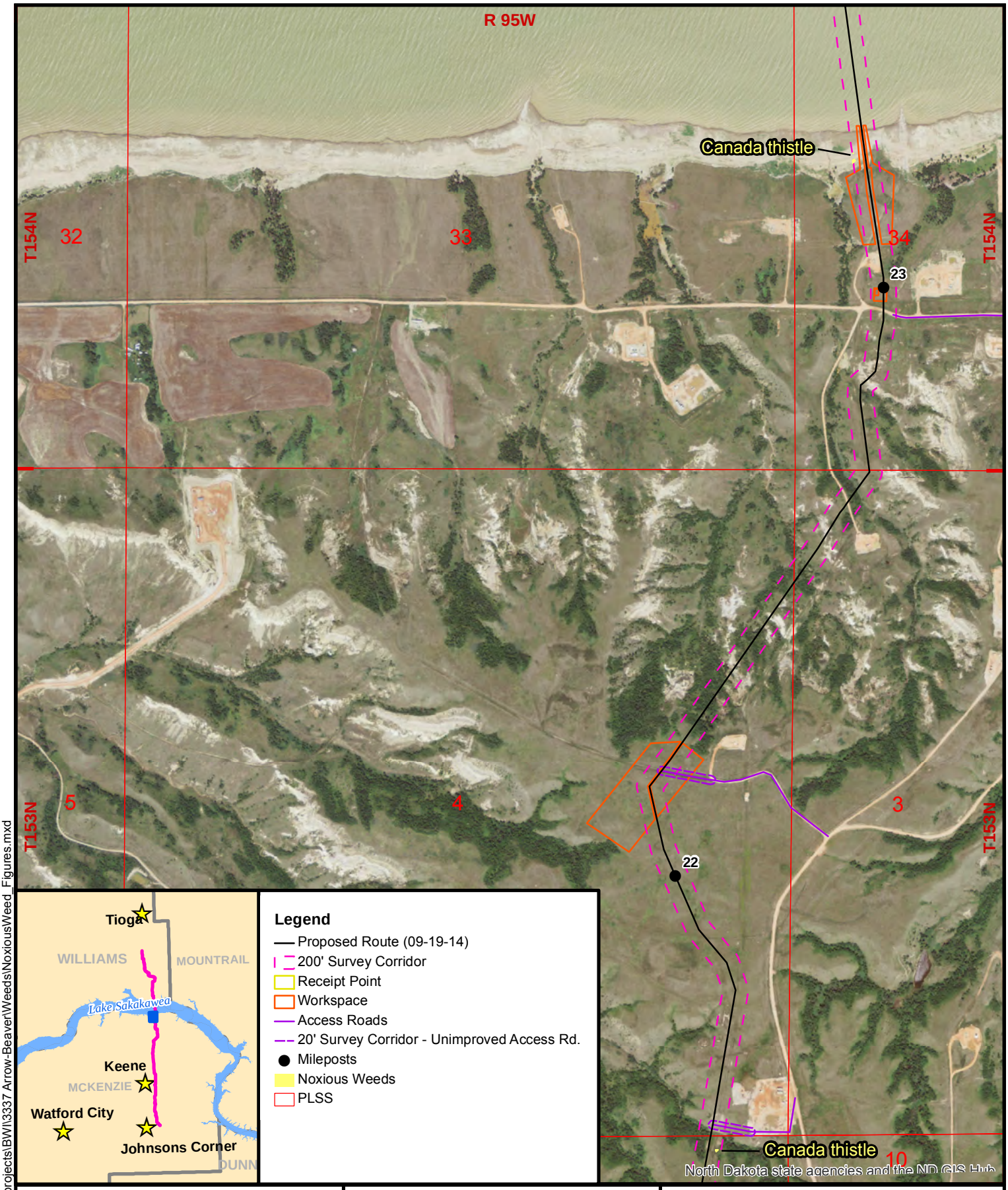

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Basemap: ND GIS Hub All Imagery 2012

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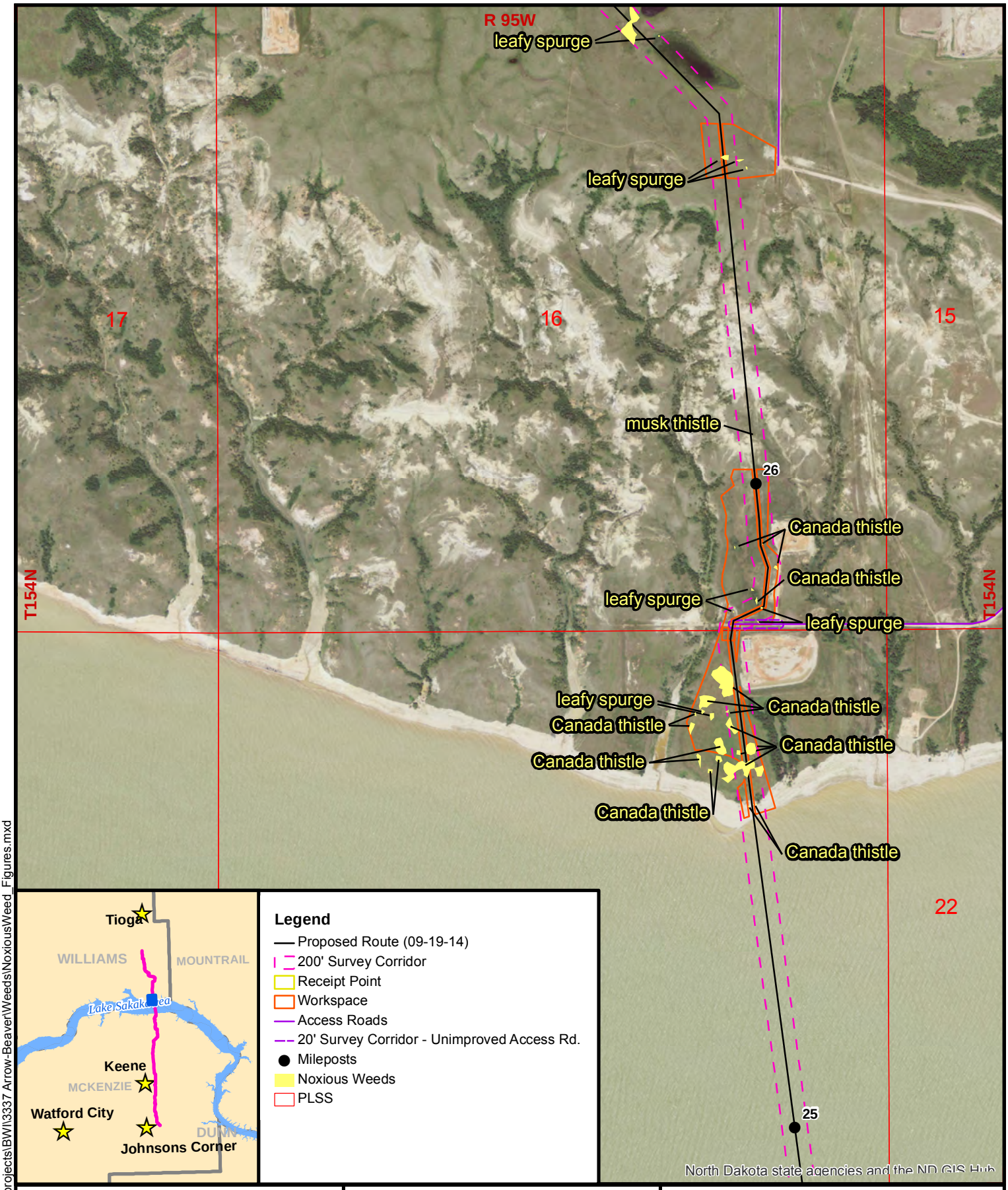
Figure 14

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

September 2014 R:\projects\BWI\3337 Arrow-Beaver\Weeds\NoxiousWeed_Figures.mxd



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Basemap: ND GIS Hub All Imagery 2012

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Figure 15

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

September 2014 R:\projects\BWI\3337 Arrow-Beaver\Weeds\NoxiousWeed_Figures.mxd

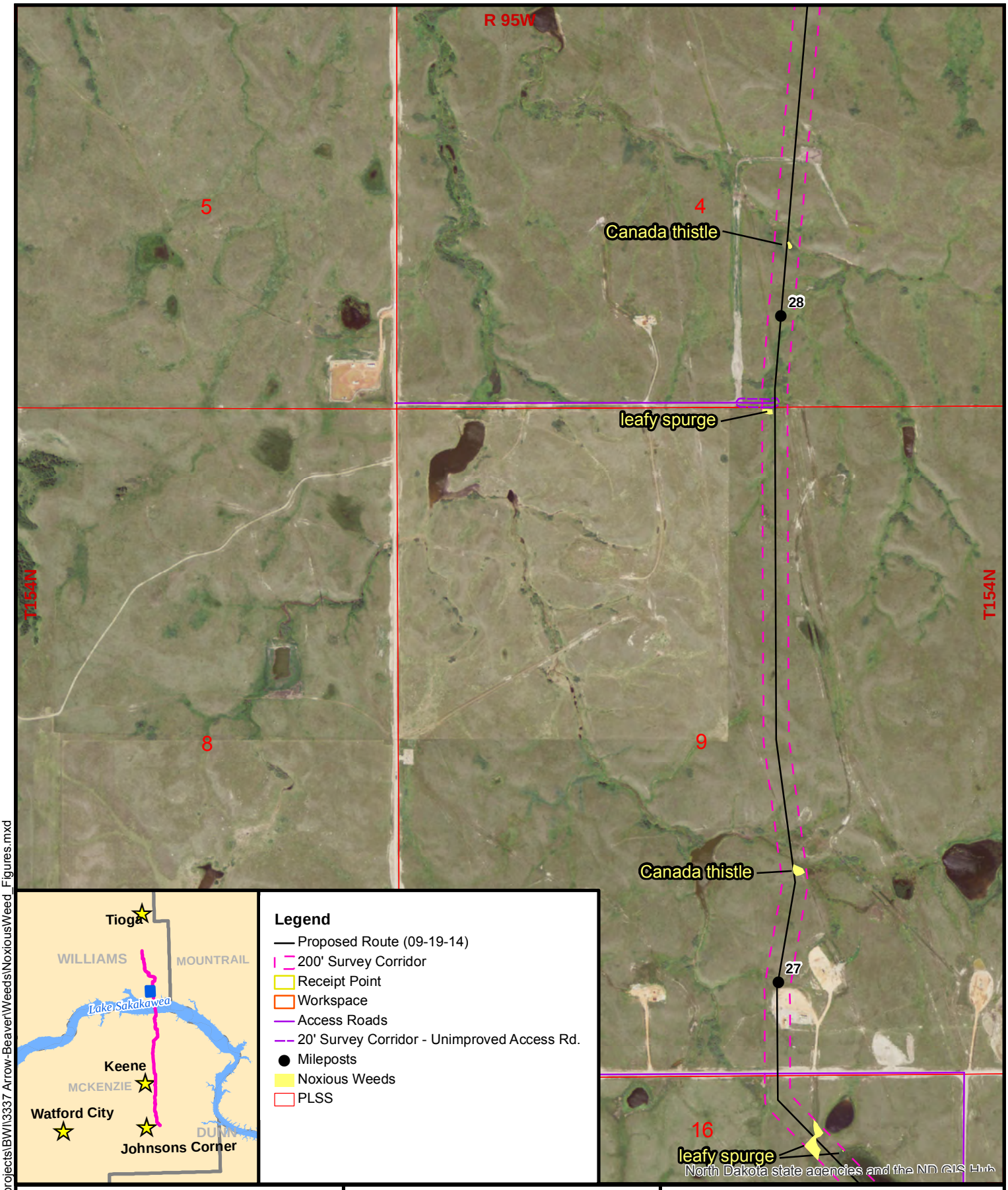

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Figure 16

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

September 2014 R:\projects\BWI\3337 Arrow-Beaver\Weeds\NoxiousWeed_Figures.mxd

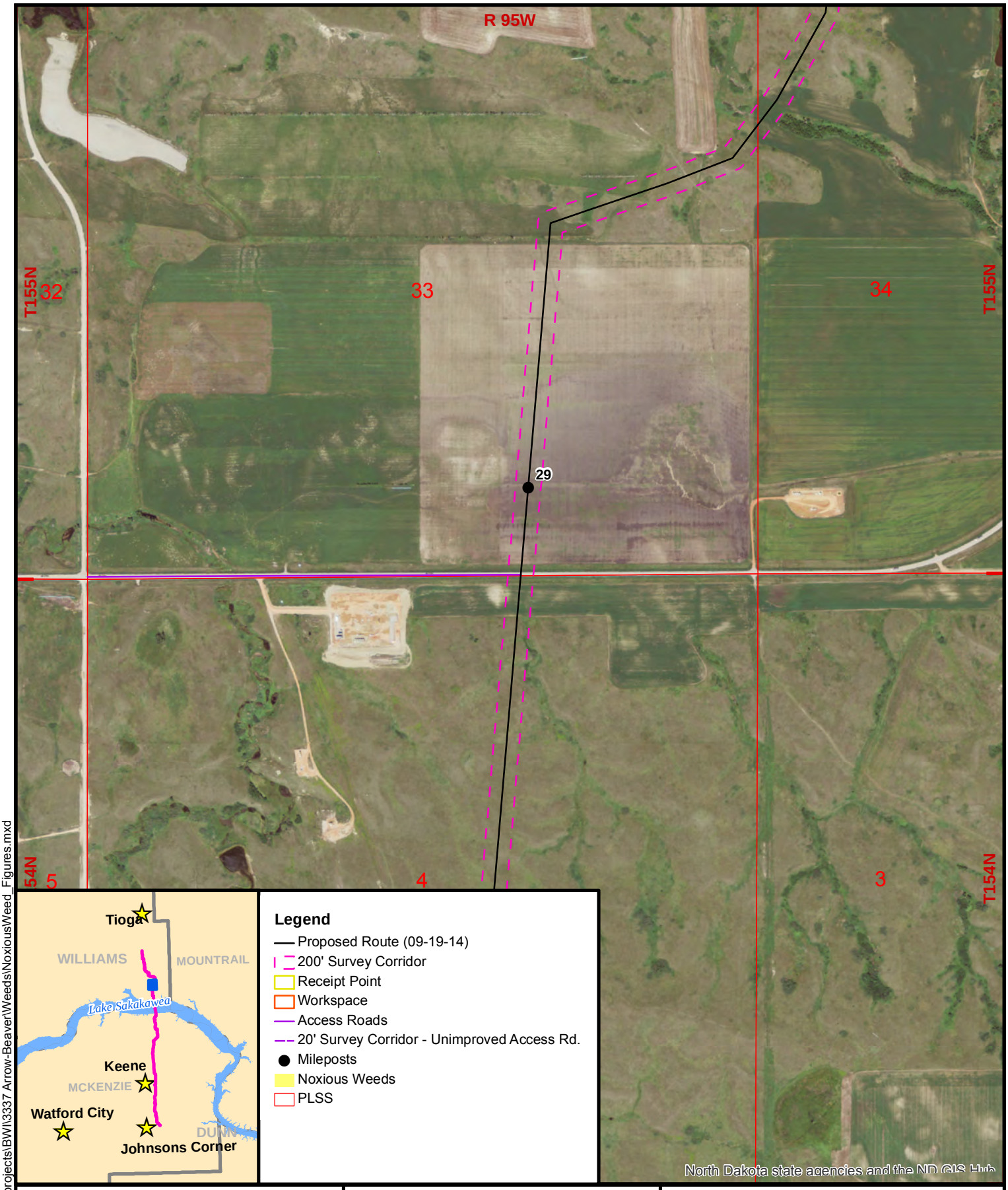

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Figure 17

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

September 2014 R:\projects\BWI\3337 Arrow-Beaver\Weeds\NoxiousWeed_Figures.mxd

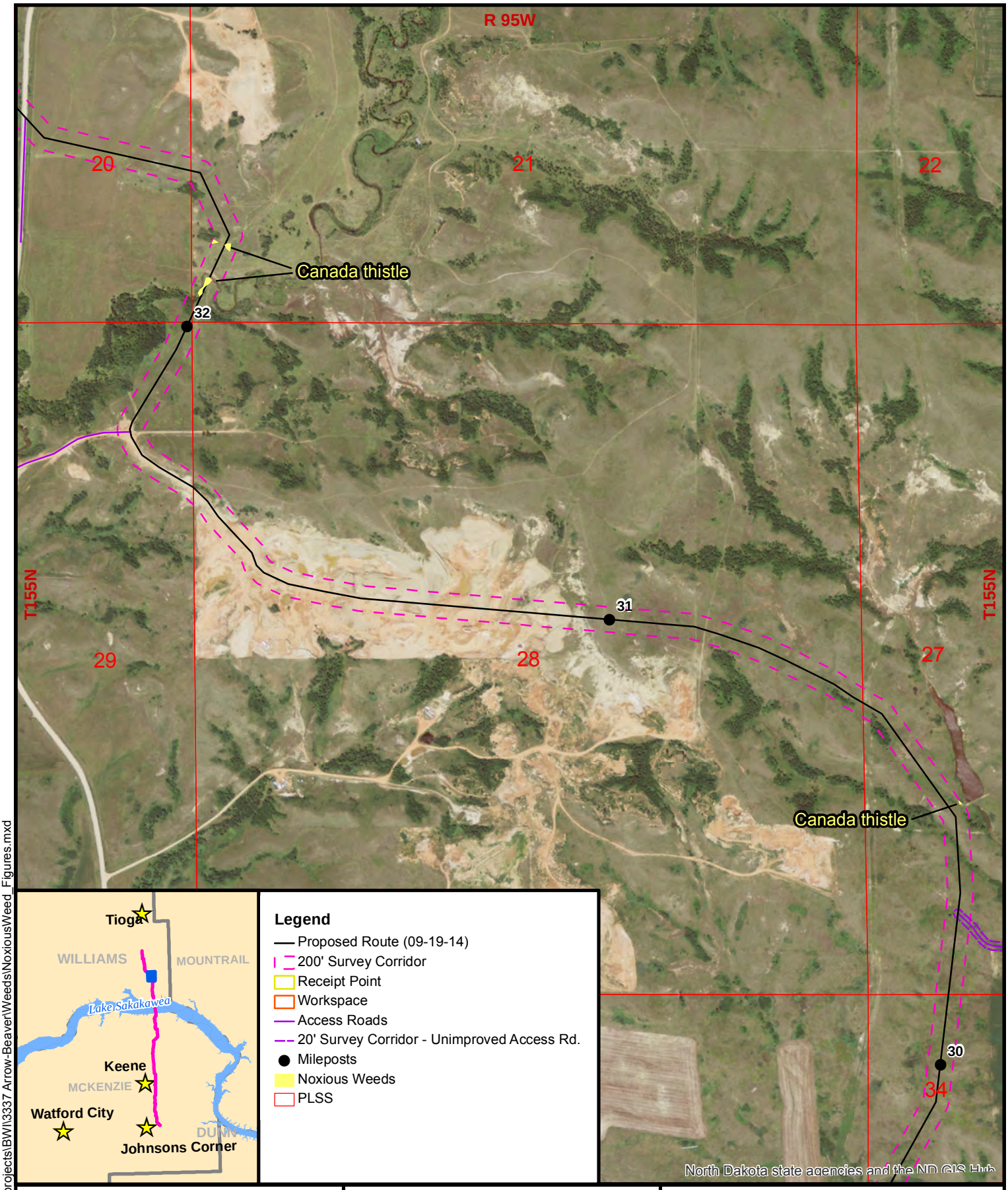

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Figure 18

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

September 2014 R:\projects\BWI\3337 Arrow-Beaver\Weeds\NoxiousWeed_Figures.mxd

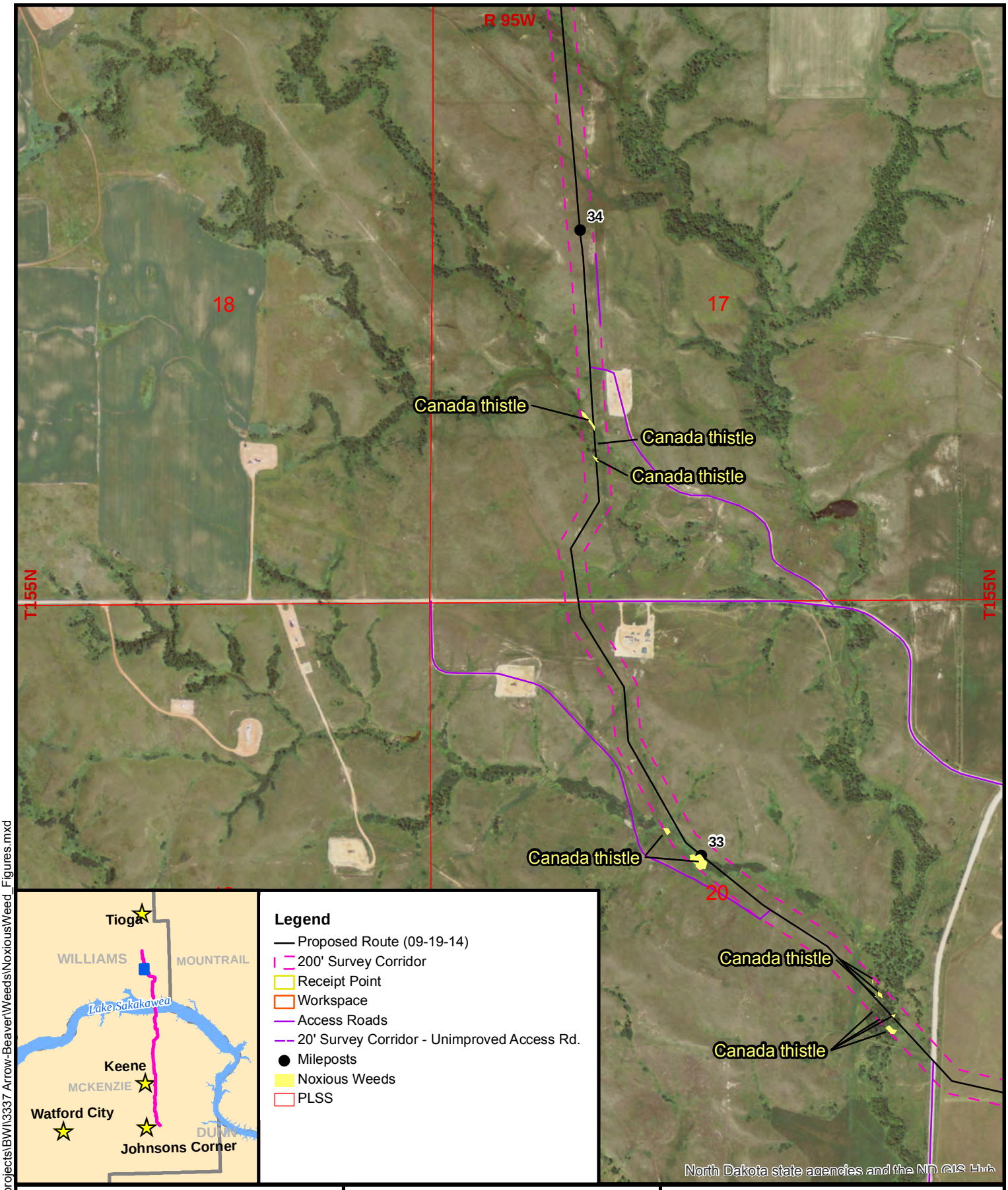

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Figure 19

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

September 2014 R:\projects\BWI\3337 Arrow-Beaver\Weeds\NoxiousWeed_Figures.mxd

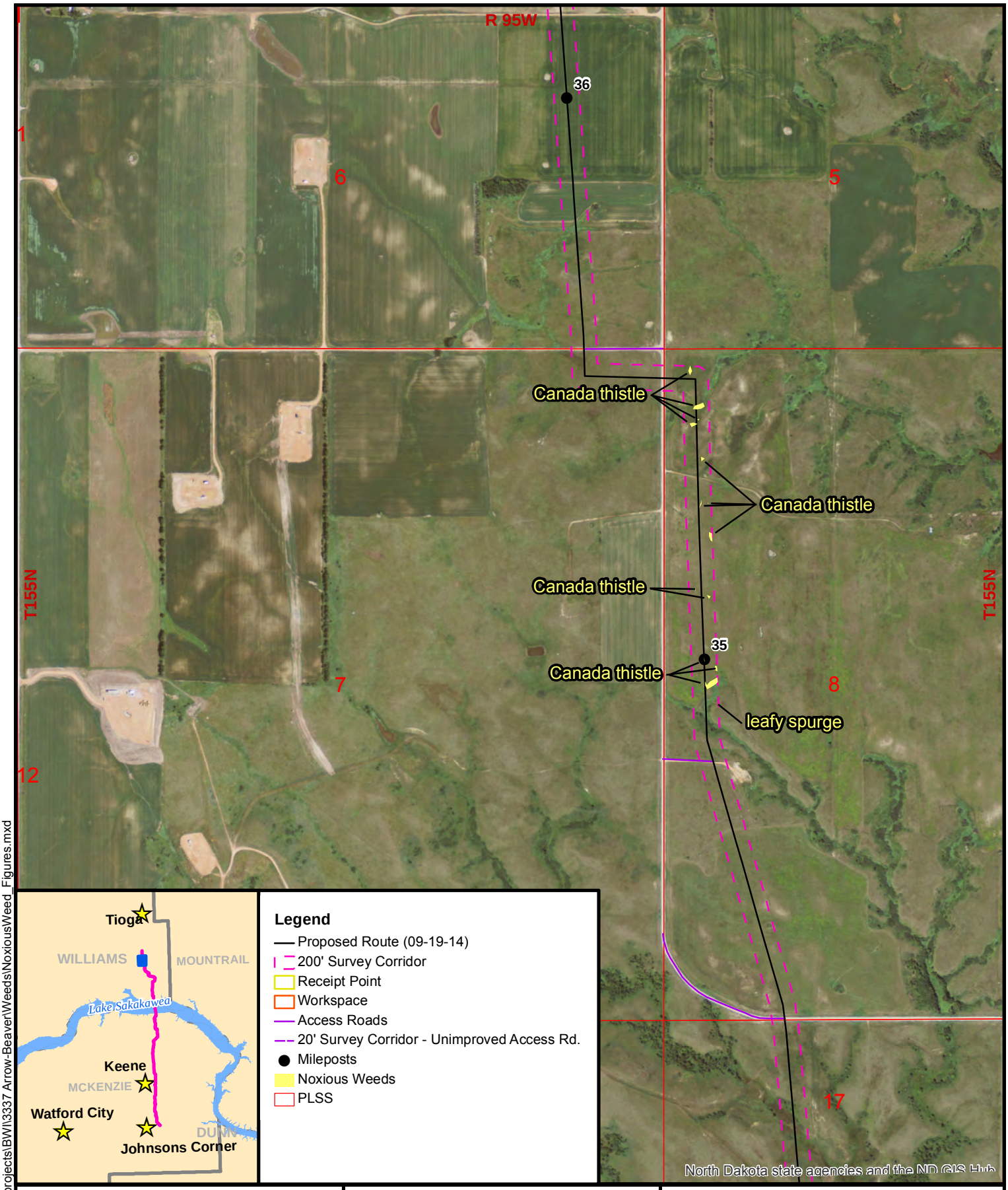

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Figure 20

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

September 2014 R:\projects\BWI\3337 Arrow-Beaver\Weeds\NoxiousWeed_Figures.mxd

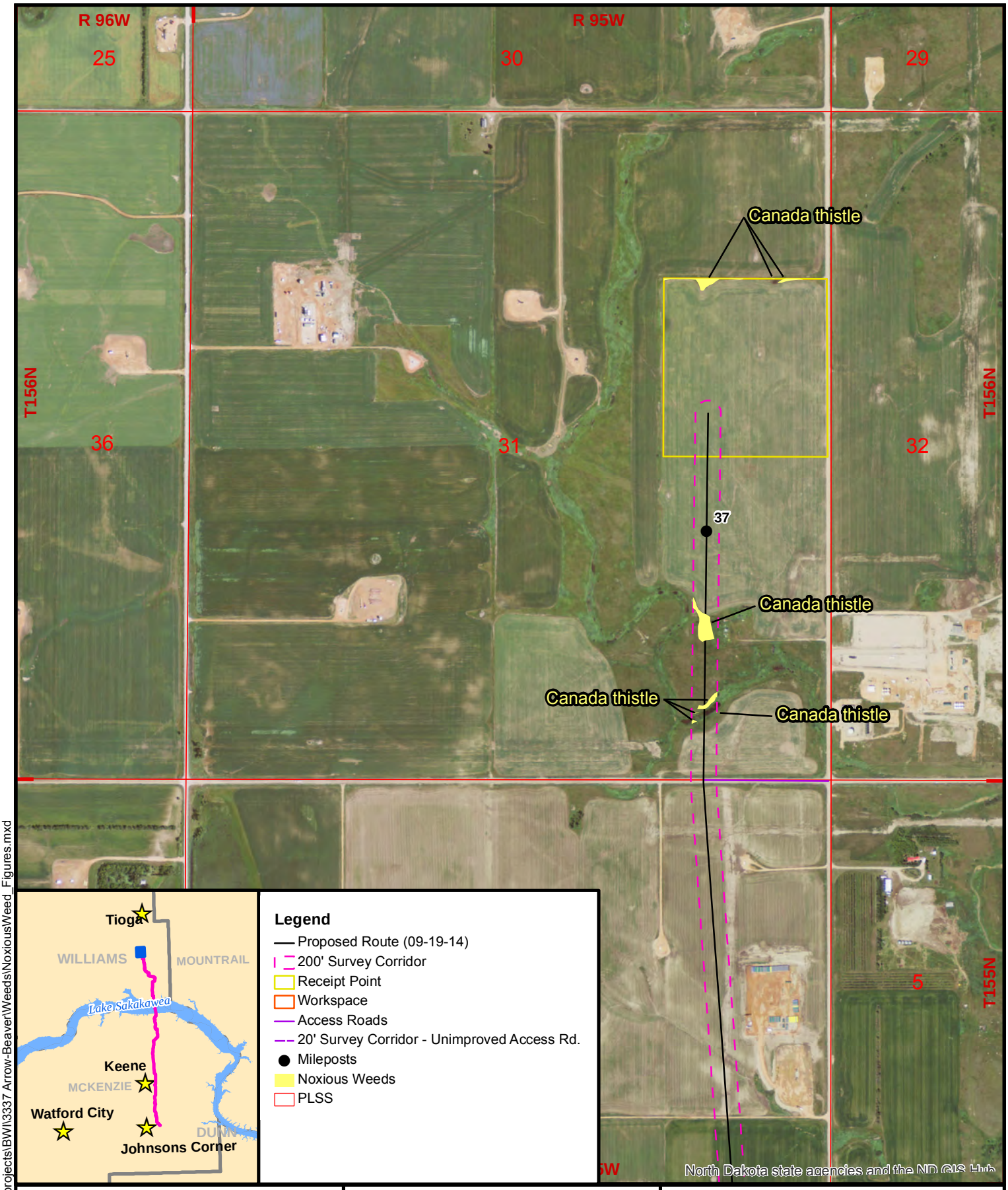

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Figure 21

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

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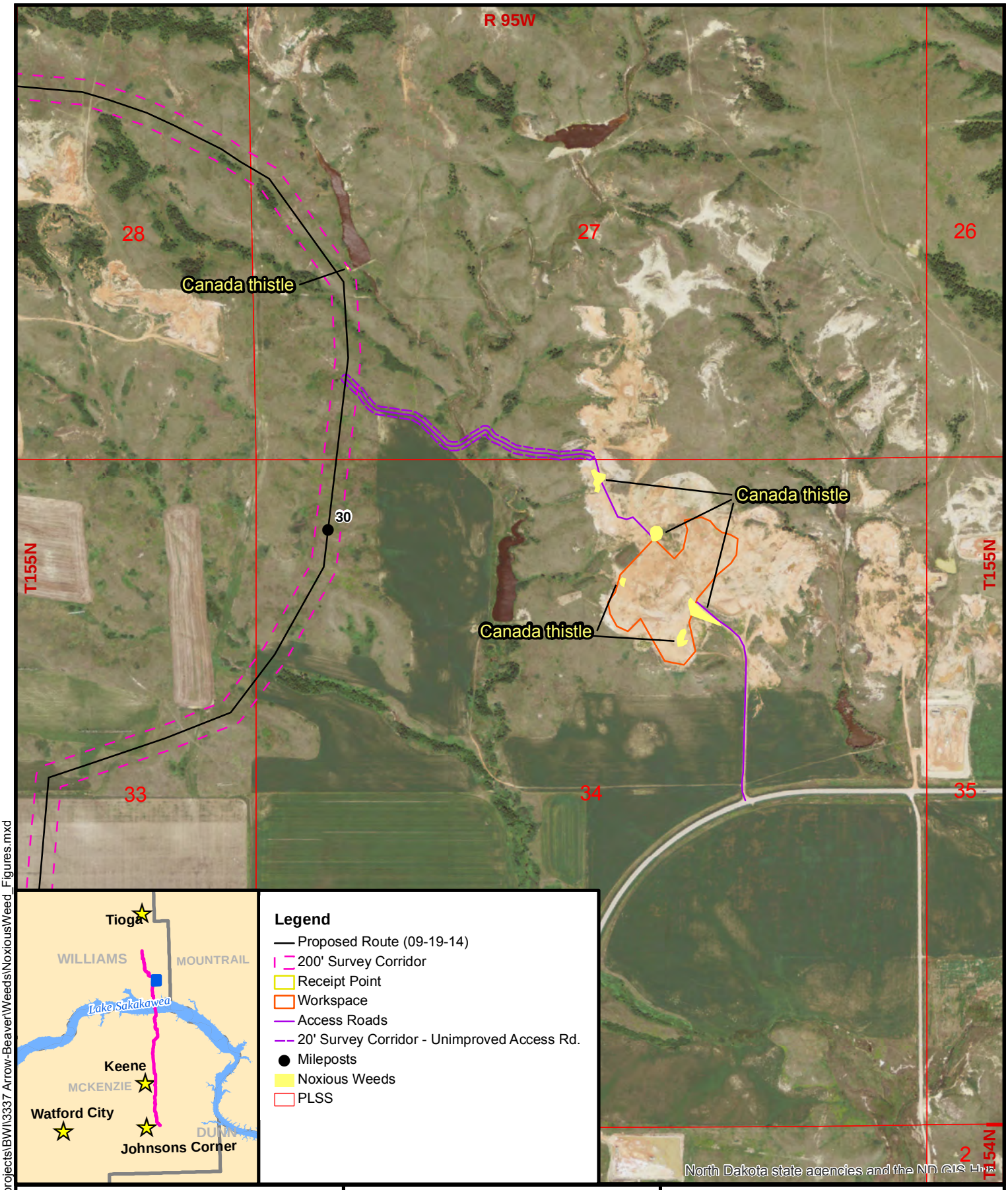

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Figure 22

Noxious Weed Locations
Dry Creek Terminal to Beaver Lodge
BakkenLink Pipeline

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Appendix D

USFS Stipulations for Herbicide
Approved Herbicides for Use on the Little Missouri National Grasslands
Noxious Weed Seed Viability Quick Reference Chart
Pesticide Use Proposal (Form FS-2100-2)
Pesticide Use Proposal Attachment A, Supplement (DPG-2100-2A)
Pesticide Application Records/Year End Report

USFS Stipulations for Herbicide

Noxious Weed Prevention & Control

The following are prescribed prevention and control measures which, when used in conjunction with other measures, will help the Operator or Holder meet their responsibilities in preventing and controlling noxious weeds and/or invasive plants as identified by the North Dakota Sate Dept of Agriculture, individual Counties, and within the 2007 Dakota Prairie Grasslands Noxious Weed Management Project.

Integrated Pest Management Program

The Operator or Holder must annually coordinate their noxious weed prevention and control plans with state or county management agencies. The plans may include biological, mechanical, and/or chemical treatments or a combination of all three.

Existing Weeds

Annual treatment is required if noxious weed species are present.

Construction & Drilling Equipment

Remove all mud, dirt, and plant parts from all off road construction and drilling equipment before moving into the project area. If this equipment was recently used on a weed infested site, it should be thoroughly cleaned with a pressure washer. Cleaning must occur off National Forest System Lands. This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area. Likewise, all equipment must be cleaned prior to leaving the project site if operating within infested areas.

New Construction and/or Reconstruction

- Areas infested with noxious weeds, which will be disturbed during the construction process, should be chemically treated during the normal growing season with herbicides a year prior to disturbance. If this is not possible, the infestations should be treated at least two to four weeks prior to disturbance.
- Excavated topsoil infested with noxious weeds shall be stored separately from other topsoil and periodically treated with herbicides if sprouting of either is detected.
- Keep construction sites closed to vehicles not involved with the construction until construction and revegetation is complete.
- If straw is used for road stabilization and erosion control, it must be certified weed free.

Borrow Materials (Scoria, Gravel, Dirt, Manure, & Topsoil)

- It is the Operator's or Holder's responsibility to obtain borrow materials from pits or sites that have been inspected and certified as weed free sites, and approved by the Forest Service prior to use.
- Certification shall be in writing and shall include the quarter/quarter, section, township, and range, and the name and address of the surface owner. If the Operator or Holder is in doubt as to whether a site has been inspected and certified, the Operator or Holder may request the individual County Weed Board or the Forest Service to inspect and certify the site.
- Borrow material will not be used if the weeds present at the borrow site are not found at the site of intended use. If weeds are present, they must be treated before transport and use.
- The borrow site may not be used if new invader species are found at the borrow site.

- It is in the Operator's or Holder's best interest to help maintain regularly used sites as weed free.

Road Maintenance

- Do not blade roads or pull ditches where new invaders are found.
- Coordinate road maintenance activities with herbicide application to maximize efficiency.

Road Obliteration

Chemically treat infested roads prior to obliteration and reclamation.

Plugged and Abandoned Sites

Noxious weeds and exotics should be sprayed prior to reclamation of the site and during the monitoring of the site until released. Use caution not to use herbicides that will have a detrimental effect to any seeding requirements.

Chemical Treatment

Reference Vegetative Control, Application of Herbicides, for the guidelines regarding the application of approved herbicides.

Monitoring

The Forest Service shall perform annual inspections to monitor the effectiveness of treatments. The Forest Service will also take the lead in identifying any new noxious weed occurrences in cooperation with the local County Weed Boards and the Operator or Holder.

Vegetative Control, Application of Herbicides

NOTE: Herbicides used for vegetative control are generally pre-emergence short-term (less than one year duration) herbicides that will kill all vegetation including grasses and forbs. Therefore, it is extremely important that these herbicides not be used to control noxious weeds and/or invasive species within those areas of the pad or road where native vegetative cover is being established under interim or final reclamation.

Chemical Treatment

The following mitigation measures shall apply to the ground application of all herbicides:

General

All chemical treatments must be approved in writing by the Forest Service prior to any surface application. A copy of the approval must be present on the site being treated. Failure to produce a copy of the approval may result in immediate shut down of operations.

Applications, Forms, Monitoring

Companies using herbicides for vegetative control or for control of noxious weeds and/or invasive species must annually complete, submit, and have approved prior to use the following documents:

a. Pesticide-Use Proposal (Form FS-2100-2).
b. Pesticide-Use Proposal Attachment A, Supplemental Information (Form DPG-2100-2A).
c. Spill Incident Response Plan for transporting herbicides.

A current and blank copy of forms 2100-2 and 2100-2A can be obtained from the Forest Service District Office upon request.

Do not combine vegetative control use with control of noxious weeds and/or invasive species use on the same forms. Separate forms must be submitted for each.

Herbicides

Only approved herbicides as specified within the 2007 Dakota Prairie Grasslands Noxious Weed Management Project can be used for chemical treatment. Since this listing may change from year to year, it is the Operator's or Holder's responsibility to request and submit use for the most current listing of approved herbicides. An approved current listing of vegetative control herbicides can be obtained from the Forest Service District Office upon request.

Ground Application

- General use herbicides must be applied by or under the direct supervision of a certified herbicide applicator in accordance with the laws of the State of North Dakota.
- Restricted use herbicides must be applied by a certified herbicide applicator in accordance with the laws of the State of North Dakota.
- Herbicide application must adhere to label instructions and restrictions. Tank mixes will be managed according to the most restrictive of the combined chemicals.
- No herbicide will be applied directly to surface water or where surface water from treated areas can run into live water sources.
    a. A buffer of at least one hundred (100) feet from bodies of water must be maintained.
    b. The buffer width would be determined based on soil, slope, etc.
- No spraying of liquid formulations will be done if temperatures exceed eighty (80) degrees.

- No spraying of liquid formulations will be done if the wind velocity exceeds ten (10) mph or per herbicide labeling directions.
- If boom spraying is done, boom pressure will not exceed forty (40) psi to minimize drift.
- Herbicide use will be permitted only within the areas identified within the applications.
- A sign saying the area has been treated with herbicides will be posted in areas receiving treatments at least one full day (unless the herbicide label says longer) after the treatment.

Monitoring

- The Forest Service will monitor the herbicide use in the form of random compliance inspections.
- All monitoring will be done under the direction of a Forest Service employee who is a licensed Commercial Pesticide Applicator.

Year End Report

When you have completed your herbicide treatment for the season and prior to October 1 of each year, you must submit the following information for each site treated and for each herbicide applied on National Forest System lands:

- Date of application
- Name of the treated site
- Legal description of treated site including quarter/quarter, section, township, range and county
- Chemical formulation and trade name of chemicals applied
- EPA registration number and manufacturer
- Rate of application of active ingredient, including pounds of active ingredient applied to the site
- Amount of diluted material applied and total acres treated on the site
- Time of day, temperature, and wind speed and direction at time of application
- Type of equipment used for application

In the case of a combination of herbicides being used, you will need to submit the information for each herbicide in the mixture.

DPG form 2100-2-B or a comparable form should be used to report the season's activities. An electronic version of the form can be obtained from the Forest Service District Office upon request.

Failure to submit the reports will delay the permitting of the following year's Pesticide Use Proposal.

Plugged and Abandoned Sites

- Noxious weeds should be sprayed prior to reclamation of the site and during the monitoring of the site until released. Use caution not to use herbicides that will have a detrimental effect to any seeding requirements.

NOXIOUS WEEDS REQUIRED TO BE TREATED.

COMMON NAME	SCIENTIFIC NAME	DPG OCCURRENCE	NOXIOUS WEED LIST	TREATMENT PRIORITY
Absinth wormwood	*Artemisia absinthium*	Known	ND, SD	High
Canada thistle	*Cirsium arvense*	Known	ND, SD, MT, MN	High
Diffuse knapweed	*Centaurea diffusa*	Unknown	ND, MT	High
Field bindweed	*Convolvulus arvensis*	Known	ND, SD, MT, MN	Low
Leafy spurge	*Euphorbia esula*	Known	ND, SD, MT, MN	High
Purple loosestrife	*Lythrum salicaria*	Potential	ND, SD, MT, MN	High
Russian knapweed	*Centaurea repens*	Known	ND, SD, MT	High
Spotted knapweed	*Centaurea maculosa*	Known	ND, MT	High
Yellow starthistle	*Centaurea solstititialis*	Unknown	ND, MT	High
Perennial sow thistle	*Sonchus arvensis*	Known	SD, MN	Low
Black henbane	*Hyoscyamus niger*	Known	Billings Co., ND	High
Dalmation toadflax	*Linaria dalmatica*	Unknown	ND, MT	High
Hoary cress	*Cardaria draba*	Known	SD, MT	Low
St. Johnswort	*Hypericum perforatum*	Unknown	MT	High
Saltcedar	*Tamarix ramosissima*	Known	ND, MT, SD	High
Yellow toadflax	*Linaria vulgaris*	Unknown	McKenzie Co., ND, MT	High
Bull thistle	*Cirsium vulgare*	Known	MN	Low
Musk thistle	*Cardus nutans*	Known	ND, MN, SD	High
Plumeless thistle	*Caruus acanthoides*	Known	MN, SD	Low
Houndstongue	*Cynoglossum officinale*	Known	MT	Low
Hemp	*Cannabis sativa*	Known	MN	High
Buckthorn	*Rhamnus cathartica*	Known	MN	High
Common Burdock	*Arctium minus*	Known	Billings Co, ND	Low

Chemical Name[1]	Residual[2]	Mobility[3]	Vegetation Controlled
imazapic	Moderate	Low	See label
chlorsulfuron	Moderate	High	All
glyphosate	Moderate	Low	All
imazapyr	Long	Variable	All
sulfometuron methyl	Moderate	Low	All
aminopyralid	Moderate	Low	Broadleaf, woody
clopyralid	Moderate	High	Broadleaf
dicamba	Short	High	Broadleaf
metsulfuron methyl	Moderate	High	Broadleaf
picloram	Moderate	Moderate	Broadleaf
2,4-D amine (dichlorophenoxyacetic)	Short	Moderate	Broadleaf
triclopyr	Moderate	Moderate	Broadleaf

[1]**CHEMICAL NAME**: Names the active ingredient in the herbicide formulation. Trade names and manufacturer do not matter as long as the active ingredients are on the approved list.

[2]**RESIDUAL**: Short = Remains active in soil for a short time - usually less than 30 days.

Moderate = Remains active in soil more than two weeks but generally less one year.

Long = Could potentially remain active in the soil for more than one year.

None = Does not remain active in the soil.

Note: The residual effects of a herbicide formulation may be highly variable based on soil pH, soil type, soil temperature, water content, presence of microbes, and other site-specific factors.)

[3]**MOBILITY**: The ability of the active ingredient to move through the soil.

The herbicides named in the above table may be used in combinations as long as all combined chemicals are included in the list. When chemicals are combined, they must be managed based on the most restrictive of the combined chemicals.

Species common *(and scientific)* name	**Perennial**	**Seed viability**	**Reproduction/ seed production**	**Flowers/seed maturity**	**Treatment (ALWAYS refer to herbicide label for correct application)**	**Timing (ALWAYS refer to label for correct timing)**
absinth wormwood *(Artemisia absinthium)*	long-lived perennial that grows back each year from a woody base	3-4 years	no evidence of vegetative reproduction but may regenerate from root stock; prolific seed producer; one stem can produce between 674-1468 flower heads with 35-38 seeds per head (over 51,000 seeds/plant)	July – September; seeds mature in early fall; seedlings emerge early spring to August or whenever moisture and warmth are available	easily controlled by herbicides and vigorous competition from grasses; picloram; clopyralid; dicamba; 2,4-D; glyphosate; aminopyralid; clopyralid plus triclopyr;	treat when plant is at least 12" tall and actively growing (late June to mid August); refer to individual label instructions for best timing of each herbicide
Canada thistle *(Cirsium arvense)*	creeping perennial	up to 22 years; deep burial (more than 8") promotes survival longevity	adventitious creeping root buds; root fragments as short as 0.2" if vegetative material is moved on equipment or in the soil; also reproduces by seed; up to 40,000 seeds per stem	June through August; seeds mature in as few as ten days after flowering	persistent treatment is imperative to continually stress plant and exhaust root nutrient stores; treatment must be followed through for several years to be successful; picloram; aminopyralid; clopyralid; dicamba; chlorsulfuron; glyphosate; imazapyr;	bud, rosette, and bolt stages; early spring or fall; refer to individual label instructions for best timing of each herbicide
knapweeds diffuse knapweed *(Centaurea diffusa)* spotted knapweed *(Centaurea maculosa)*	annual, biennial or perennial; individual spotted knapweed plants can live up to 9 years	5-8 years	plants regrow from buds on the root crown but reproduction is primarily by seed; seed production varies widely with site conditions; avg 680 – 25,260 seeds/plant;	flowers July through September; mature seeds usually formed by mid-August, followed by the death of the plant; dead plants break off at ground level and tumble with the wind to spread seed	although knapweeds are easily killed by herbicide application, a careful follow-up program is essential to control missed plants and seedlings; picloram; dicamba; dicamba plus 2,4-D; clopyralid plus 2,4-D; 2,4-D; triclopyr; aminopyralid	spring rosette to bloom stage or fall rosette; refer to individual label instructions for best timing of each herbicide

Species common *(and scientific)* name	**Perennial**	**Seed viability**	**Reproduction/ seed production**	**Flowers/seed maturity**	**Treatment (ALWAYS refer to herbicide label for correct application)**	**Timing (ALWAYS refer to label for correct timing)**
Russian knapweed *(Centaurea repens)*	creeping perennial	2-3 years; once established very difficult to control	seed and vegetative root buds; roots can grow as deep as 6' below surface after 1 years growth and 23' after 2 years; 1200 seeds per plant	June - September	2,4-D; dicamba; picloram; clopyralid; clopyralid plus 2,4-D; clopyralid plus triclopyr; metsulfuron plus 2,4-D; imazapic	generally in the fall following several hard frosts; metsulfuron plus 2,4-D can also be effective in bud to early bloom stage; refer to individual label instructions for best timing of each herbicide
field bindweed *(Convolvulus arvensis)*	long-lived perennial; life span unknown but believed to be up to 30 years	20 years or more; seed that is 60 years old has been found to be alive! once established very difficult to control	roots can reach depth of 20'; shoots capable of budding have been found at 14' depth; rhizomes develop from root buds and emerge as new plants; root fragments may generate new plants; 25-300 seeds per plant	June through fall frost	dicamba; glyphosate; picloram; 2,4-D; triclopyr; dicamba plus 2,4-D; metsulfuron	during periods of active growth and stems at least 12" long; bud to full-bloom; spring or fall depending on herbicide; refer to individual label instructions for best timing of each herbicide
leafy spurge *(Euphorbia esula)*	persistent, long-lived, deep rooted perennial; unknown life span	8 years or more	regenerates from very small root fragments, vegetative root buds, and by seed; average 140 seeds per plant; first year plants do not produce seeds	yellow-green bracts develop May – early June and true flowers develop a few weeks later; flowering is usually complete by mid-July; seeds mature about 30 days after pollination	picloram; dicamba; imazapic; 2,4-D; glyphosate	true flower growth stage and seed development or during fall re-growth; refer to individual label instructions for best timing of each herbicide
purple loosestrife *(Lythrum salicaria)*	yes; individual plants may live up to 22 years	3+ years	primarily by seed but also vegetatively by cuttings; estimated 2.7 million seeds per plant	early June – mid September	glyphosate if labeled for aquatic use; triclopyr if labeled for use in wetland sites; 2,4-D if labeled for use near water	July – early September; refer to individual label instructions for best timing of each herbicide

Species common *(and scientific)* name	**Perennial**	**Seed viability**	**Reproduction/ seed production**	**Flowers/seed maturity**	**Treatment (ALWAYS refer to herbicide label for correct application)**	**Timing (ALWAYS refer to label for correct timing)**
yellow starthistle *(Centaurea solstititialis)*	winter annual or rarely biennial or short-lived perennial	10+ years	reproduces by seed only; up to 80,000 seeds per plant	early July through September	clopyralid plus 2,4-D; clopyralid plus triclopyr; dicamba; picloram; imazapic; aminopyralid; use surfactants to improve herbicide performance	refer to individual label instructions for best timing of each herbicide
perennial sow thistle *(Sonchus arvensis)*	creeping perennial	1-5 years	vegetative root buds; rhizomes develop as deep as 10' below surface; average 30 seeds per flower with numerous flowers per plant; known to produce up to 9750 seeds on a single plant	blooms June & July; seeds mature July & August	clopyralid; aminopyralid; glyphosate; 2,4-D; dicamba; picloram	spring pre-bud or bud stage or fall; refer to individual label instructions for best timing of each herbicide
black henbane *(Hyoscyamus niger)*	annual or biennial	up to 5 years	reproduces by seed only; a single plant can produce up to a half million seeds	flowers June – August; seed production July - October	2,4-D; dicamba; picloram; glyphosate; metsulfuron; metsulfuron plus chlorsulfuron	rosette stage to early bolting; when the plant is actively growing; refer to individual label instructions for best timing of each herbicide
dalmation toadflax *(Linaria dalmatica)* yellow toadflax *(Linaria vulgaris)*	deep-rooted, short-lived perennials; individual plants live 3 – 5 years	up to 10 years	seed reproduction, vegetative buds on creeping roots, and by root fragments; a single plant can produce over 500,000 seeds	late June through August; seed production July through October	picloram for both; imazapic or chlorsulfuron for dalmation toadflax; glyphosate; dicamba	although slow to establish, this weed is difficult to control once it takes root because many herbicides are ineffective; requires repeated treatments at high rates; apply pre-bloom to flowering or in the fall; refer to individual label instructions for best timing of each herbicide

Species common *(and scientific)* name	**Perennial**	**Seed viability**	**Reproduction/ seed production**	**Flowers/seed maturity**	**Treatment (ALWAYS refer to herbicide label for correct application)**	**Timing (ALWAYS refer to label for correct timing)**
hoary cress *Cardaria draba)*	deep-rooted perennial with spreading root system from which many aerial shoots are produced; individual plants can live up to 8 years	about 3 years	vegetatively by persistent, adventitious roots and by seed production; a single plant produces between 1200 – 4800 seeds	flowers May – June; seed production by July; if conditions are favorable, hoary cress can produce a second crop of seeds by fall	metsulfuron; chlorsulfuron; dicamba; glyphosate; 2,4-D; dicamba plus 2,4-D; use surfactants to improve herbicide performance	up to 76% of this plant's biomass is below ground; May or June, bud or flowering stage; refer to individual label instructions for best timing of each herbicide
St Johnswort *(Hypericum perforatum)*	yes; individual plants can live up to 8 years	6-10 years	vegetatively by short creeping stems and by seed production; a single plant can produce up to 100,000 seeds; average seed production is 15,000 – 30,000	flowers May – September;	repeated applications of 2,4-D during seedling and pre-bloom stages; metsulfuron with a surfactant post-emergent; picloram; aminopyralid; glyphosate;	extensive root system makes it hard to eradicate; refer to individual label instructions for best timing of each herbicide
saltcedar *(Tamarix ramosissima)*	yes; long-lived; in New Mexico, plants up to 100 years old show no signs of deteriorating from age	less than 6 months especially if subject to desiccation	vegetatively by adventitious roots or by seed production; a single mature plant can produce >500,000 seeds per season	early to mid-April through July; seeds are shed throughout the growing season	imazapyr for green leaved plants; triclopyr for cut-stump control	refer to individual label instructions for best timing of each herbicide
bull thistle *(Cirsium vulgare)*	biennial or sometimes monocarpic perennial (flowers and fruits only once, then dies)	up to 3 years if buried at least 5" deep; seeds on the surface usually don't remain viable for longer than a year	by seed only; a single mature, healthy plant can produce up from 5000 to 50,000 seeds	July - September	picloram; dicamba; glyphosate; clopyralid; clopyralid plus triclopyr; 2,4-D; metsulfuron; chlorsulfuron; imazapic; imazapic plus glyphosate; aminopyralid	late fall or early spring; seedling to rosette stage; bolting to bud stage; refer to individual label instructions for best timing of each herbicide

Species common *(and scientific)* name	**Perennial**	**Seed viability**	**Reproduction/ seed production**	**Flowers/seed maturity**	**Treatment (ALWAYS refer to herbicide label for correct application)**	**Timing (ALWAYS refer to label for correct timing)**
musk thistle *(Carduus nutans)* musk thistle (Cont) *(Carduus nutans)*	herbaceous tap rooted biennial; spring annual; occasionally a winter annual	about 10 years	by seed only; a single plant produces about 10,000 seeds	May or early June through August;	picloram; dicamba; glyphosate; clopyralid; clopyralid plus triclopyr; 2,4-D; metsulfuron; chlorsulfuron; imazapic; imazapic plus glyphosate; aminopyralid	late fall or early spring; seedling to rosette stage; refer to individual label instructions for best timing of each herbicide
plumeless thistle *(Carduus acanthoides)*	winter annual or biennial	10 years or more	by seed only; up to 9000 seeds per plant	May to August; seeds are dispersed 1-3 weeks after flowering	picloram; dicamba; glyphosate; clopyralid; clopyralid plus triclopyr; 2,4-D; metsulfuron; chlorsulfuron; imazapic; imazapic plus glyphosate; aminopyralid	late fall or early spring; seedling to rosette stage; refer to individual label instructions for best timing of each herbicide
houndstongue *(Cynoglossum officinale)*	biennial or short lived perennial	2-3 years unless buried; then only about a year	average 300-675 seeds per plant but single plants can produce over 2000 seeds	flowering May through July; seeds mature July through August	picloram; dicamba; chlorsulfuron; 2,4-D; metsulfuron; use surfactants to improve herbicide performance	1st year rosettes in spring, summer or fall; early spring before bloom for second year rosettes; when plant is actively growing; refer to individual label instructions for best timing of each herbicide
hemp *(Cannabis sativa)*	annual		by seed only;	flowering July to September; seed production August until frost	2,4-D; sulfometuron;	refer to individual label instructions for best timing of each herbicide
buckthorn *(Rhamnus cathartica)*	perennial	up to 5 years	reproduces by seed or by stump sprouting	flowers May – June; berries ripen during August and September	triclopyr for cut-stump method within 2 hours of cutting; glyphosate	late summer and throughout the fall; refer to individual label instructions for best timing of each herbicide

Species common *(and scientific)* name	**Perennial**	**Seed viability**	**Reproduction/ seed production**	**Flowers/seed maturity**	**Treatment (ALWAYS refer to herbicide label for correct application)**	**Timing (ALWAYS refer to label for correct timing)**
common burdock *(Arctium minus)*	biennial	2-10 years	by seed only; each plant produces 15,000 – 60,000 seeds	flowers July – frost; seeds mature by September and are shed continuously throughout the fall, winter, and following spring	2,4-D; picloram; dicamba; glyphosate; clopyralid; clopyralid plus triclopyr; aminopyralid; metsulfuron	herbicides are most effective when applied to first-year rosettes and before bloom stage; refer to individual label instructions for best timing of each herbicide
halogeton *Halogeton glomeratus*	winter annual; plants can germinate in fall, winter, or spring depending on soil moisture	black seeds have no dormancy and are viable for up to 1 year; brown seeds have a dormancy and are viable for up to 10 years	by seed only; a single large plant can produce 100,000 seeds	flowers July – August; seed maturity August - October	halogeton alters soil properties, making it difficult to establish desirable plants, so it's best not to allow this plant to establish; metsulfuron; imazapyr; chlorsulfuron; 2,4-D; imazapic; aminopyralid; sulfometuron;	apply when actively growing or very early in spring prior to flowering; refer to individual label instructions for best timing of each herbicide
baby's breath *Gypsophila paniculata*	herbaceous perennial;	2 years	new shoots can grow from the crown, but not the root; reproduces by seed only; a single plant can produce up to 14,000 seeds	flowers late June to late August;	hard to get good coverage with herbicides because of sparse foliage; picloram; dicamba, 2,4-D; glyphosate;	bolting to pre-flower; refer to individual label instructions for best timing of each herbicide

Chemical Name[1]	Residual[2]	Mobility[3]	Vegetation Controlled
imazapic	Moderate	Low	See label
chlorsulfuron	Moderate	High	All
glyphosate	Moderate	Low	All
imazapyr	Long	Variable	All
sulfometuron methyl	Moderate	Low	All
aminopyralid	Moderate	Low	Broadleaf, woody
clopyralid	Moderate	High	Broadleaf
dicamba	Short	High	Broadleaf
metsulfuron methyl	Moderate	High	Broadleaf
picloram	Moderate	Moderate	Broadleaf
2,4-D amine (dichlorophenoxyacetic)	Short	Moderate	Broadleaf
triclopyr	Moderate	Moderate	Broadleaf

[1]**CHEMICAL NAME**: Names the active ingredient in the herbicide formulation. Trade names and manufacturer do not matter as long as the active ingredients are on the approved list.

[2]**RESIDUAL**: Short = Remains active in soil for a short time - usually less than 30 days.

Moderate = Remains active in soil more than two weeks but generally less one year.

Long = Could potentially remain active in the soil for more than one year.

None = Does not remain active in the soil.

Note: The residual effects of a herbicide formulation may be highly variable based on soil pH, soil type, soil temperature, water content, presence of microbes, and other site-specific factors.)

[3]**MOBILITY**: The ability of the active ingredient to move through the soil.

The herbicides named in the above table may be used in combinations as long as all combined chemicals are included in the list. When chemicals are combined, they must be managed based on the most restrictive of the combined chemicals.

Noxious Weed Seed Viability Quick Reference Chart

Species Common Name (*scientific name*)	Perennial	Seed Viability	Reproduction/ Seed Production	Flowers/Seed Maturity	Treatment (ALWAYS refer to herbicide label for correct application)	Timing (ALWAYS refer to label for correct timing)
Absinth wormwood *(Artemisia absinthium)*	Long-lived perennial that grows back each year from a woody base	3-4 years	No evidence of vegetative reproduction but may regenerate from root stock; prolific seed producer; one stem can produce between 674-1468 flower heads with 35-38 seeds per head (over 51,000 seeds/plant)	July – September; seeds mature in early fall; seedlings emerge early spring to August or whenever moisture and warmth are available	Easily controlled by herbicides and vigorous competition from grasses; picloram; clopyralid; dicamba; 2,4-D; glyphosate; aminopyralid; clopyralid plus triclopyr;	Treat when plant is at least 12" tall and actively growing (late June to mid August); refer to individual label instructions for best timing of each herbicide
Canada thistle *(Cirsium arvense)*	Creeping perennial	Up to 22 years; deep burial (more than 8") promotes survival longevity	Adventitious creeping root buds; root fragments as short as 0.2" if vegetative material is moved on equipment or in the soil; also reproduces by seed; up to 40,000 seeds per stem	June through August; seeds mature in as few as ten days after flowering	Persistent treatment is imperative to continually stress plant and exhaust root nutrient stores; treatment must be followed through for several years to be successful; picloram; aminopyralid; clopyralid; dicamba; chlorsulfuron; glyphosate; imazapyr;	Bud, rosette, and bolt stages; early spring or fall; refer to individual label instructions for best timing of each herbicide
Knapweeds Diffuse knapweed *(Centaurea diffusa)* Spotted knapweed *(Centaurea maculosa)*	Annual, biennial or perennial; individual spotted knapweed plants can live up to 9 years	5-8 years	Plants regrow from buds on the root crown but reproduction is primarily by seed; seed production varies widely with site conditions; avg 680 – 25,260 seeds/plant;	Flowers July through September; mature seeds usually formed by mid-August, followed by the death of the plant; dead plants break off at ground level and tumble with the wind to spread seed	Although knapweeds are easily killed by herbicide application, a careful follow-up program is essential to control missed plants and seedlings; picloram; dicamba; dicamba plus 2,4-D; clopyralid plus 2,4-D; 2,4-D; triclopyr; aminopyralid	Spring rosette to bloom stage or fall rosette; refer to individual label instructions for best timing of each herbicide
Russian knapweed *(Centaurea repens)*	Creeping perennial	2-3 years; once established very difficult to control	Seed and vegetative root buds; roots can grow as deep as 6' below surface after 1 years growth and 23' after 2 years; 1200 seeds per plant	June - September	2,4-D; dicamba; picloram; clopyralid; clopyralid plus 2,4-D; clopyralid plus triclopyr; metsulfuron plus 2,4-D; imazapic	Generally in the fall following several hard frosts; metsulfuron plus 2,4-D can also be effective in bud to early bloom stage; refer to individual label instructions for best timing of each herbicide

Species Common Name (*scientific name*)	Perennial	Seed Viability	Reproduction/ Seed Production	Flowers/Seed Maturity	Treatment (ALWAYS refer to herbicide label for correct application)	Timing (ALWAYS refer to label for correct timing)
Field bindweed *(Convolvulus arvensis)*	Long-lived perennial; life span unknown but believed to be up to 30 years	20 years or more; seed that is 60 years old has been found to be alive! once established very difficult to control	Roots can reach depth of 20'; shoots capable of budding have been found at 14' depth; rhizomes develop from root buds and emerge as new plants; root fragments may generate new plants; 25-300 seeds per plant	June through fall frost	Dicamba; glyphosate; picloram; 2,4-D; triclopyr; dicamba plus 2,4-D; metsulfuron	During periods of active growth and stems at least 12" long; bud to full-bloom; spring or fall depending on herbicide; refer to individual label instructions for best timing of each herbicide
Leafy spurge *(Euphorbia esula)*	Persistent, long-lived, deep rooted perennial; unknown life span	8 years or more	regenerates from very small root fragments, vegetative root buds, and by seed; average 140 seeds per plant; first year plants do not produce seeds	Yellow-green bracts develop May – early June and true flowers develop a few weeks later; flowering is usually complete by mid-July; seeds mature about 30 days after pollination	Picloram; dicamba; imazapic; 2,4-D; glyphosate	True flower growth stage and seed development or during fall re-growth; refer to individual label instructions for best timing of each herbicide
Purple loosestrife *(Lythrum salicaria)*	Yes; individual plants may live up to 22 years	3+ years	Primarily by seed but also vegetatively by cuttings; estimated 2.7 million seeds per plant	Early June – mid September	Glyphosate if labeled for aquatic use; triclopyr if labeled for use in wetland sites; 2,4-D if labeled for use near water	July – early September; refer to individual label instructions for best timing of each herbicide
Yellow starthistle *(Centaurea solstititialis)*	Winter annual or rarely biennial or short-lived perennial	10+ years	Reproduces by seed only; up to 80,000 seeds per plant	Early July through September	Clopyralid plus 2,4-D; clopyralid plus triclopyr; dicamba; picloram; imazapic; aminopyralid; use surfactants to improve herbicide performance	Refer to individual label instructions for best timing of each herbicide
Perennial sow thistle *(Sonchus arvensis)*	Creeping perennial	1-5 years	Vegetative root buds; rhizomes develop as deep as 10' below surface; average 30 seeds per flower with numerous flowers per plant; known to produce up to 9750 seeds on a single plant	Blooms June & July; seeds mature July & August	Clopyralid; aminopyralid; glyphosate; 2,4-D; dicamba; picloram	Spring pre-bud or bud stage or fall; refer to individual label instructions for best timing of each herbicide

Species Common Name (*scientific name*)	Perennial	Seed Viability	Reproduction/ Seed Production	Flowers/Seed Maturity	Treatment (ALWAYS refer to herbicide label for correct application)	Timing (ALWAYS refer to label for correct timing)
Black henbane *(Hyoscyamus niger)*	Annual or biennial	Up to 5 years	Reproduces by seed only; a single plant can produce up to a half million seeds	Fowers June – August; seed production July - October	2,4-D; dicamba; picloram; glyphosate; metsulfuron; metsulfuron plus chlorsulfuron	Rosette stage to early bolting; when the plant is actively growing; refer to individual label instructions for best timing of each herbicide
Toadflaxes Dalmation toadflax *(Linaria dalmatica)* Yellow toadflax *(Linaria vulgaris)*	Deep-rooted, short-lived perennials; individual plants live 3 – 5 years	Up to 10 years	Seed reproduction, vegetative buds on creeping roots, and by root fragments; a single plant can produce over 500,000 seeds	Late June through August; seed production July through October	Picloram for both; imazapic or chlorsulfuron for dalmation toadflax; glyphosate; dicamba	Although slow to establish, this weed is difficult to control once it takes root because many herbicides are ineffective; requires repeated treatments at high rates; apply pre-bloom to flowering or in the fall; refer to individual label instructions for best timing of each herbicide
Hoary cress *(Cardaria draba)*	Deep-rooted perennial with spreading root system from which many aerial shoots are produced; individual plants can live up to 8 years	About 3 years	Vegetatively by persistent, adventitious roots and by seed production; a single plant produces between 1200 – 4800 seeds	Flowers May – June; seed production by July; if conditions are favorable, hoary cress can produce a second crop of seeds by fall	Metsulfuron; chlorsulfuron; dicamba; glyphosate; 2,4-D; dicamba plus 2,4-D; use surfactants to improve herbicide performance	Up to 76% of this plant's biomass is below ground; May or June, bud or flowering stage; refer to individual label instructions for best timing of each herbicide
St Johnswort *(Hypericum perforatum)*	Yes; individual plants can live up to 8 years	6-10 years	Vegetatively by short creeping stems and by seed production; a single plant can produce up to 100,000 seeds; average seed production is 15,000 – 30,000	Flowers May – September;	Repeated applications of 2,4-D during seedling and pre-bloom stages; metsulfuron with a surfactant post-emergent; picloram; aminopyralid; glyphosate;	Extensive root system makes it hard to eradicate; refer to individual label instructions for best timing of each herbicide
Saltcedar *(Tamarix ramosissima)*	Yes; long-lived; in New Mexico, plants up to 100 years old show no signs of deteriorating from age	Less than 6 months especially if subject to desiccation	Vegetatively by adventitious roots or by seed production; a single mature plant can produce >500,000 seeds per season	Early to mid-April through July; seeds are shed throughout the growing season	Imazapyr for green leaved plants; triclopyr for cut-stump control	Refer to individual label instructions for best timing of each herbicide

Species Common Name (*scientific name*)	Perennial	Seed Viability	Reproduction/ Seed Production	Flowers/Seed Maturity	Treatment (ALWAYS refer to herbicide label for correct application)	Timing (ALWAYS refer to label for correct timing)
Bull thistle *(Cirsium vulgare)*	Biennial or sometimes monocarpic perennial (flowers and fruits only once, then dies)	Up to 3 years if buried at least 5" deep; seeds on the surface usually don't remain viable for longer than a year	By seed only; a single mature, healthy plant can produce up from 5000 to 50,000 seeds	July - September	Picloram; dicamba; glyphosate; clopyralid; clopyralid plus triclopyr; 2,4-D; metsulfuron; chlorsulfuron; imazapic; imazapic plus glyphosate; aminopyralid	Late fall or early spring; seedling to rosette stage; bolting to bud stage; refer to individual label instructions for best timing of each herbicide
Musk thistle *(Carduus nutans)*	Herbaceous tap rooted biennial; spring annual; occasionally a winter annual	About 10 years	By seed only; a single plant produces about 10,000 seeds	May or early June through August;	Picloram; dicamba; glyphosate; clopyralid; clopyralid plus triclopyr; 2,4-D; metsulfuron; chlorsulfuron; imazapic; imazapic plus glyphosate; aminopyralid	Late fall or early spring; seedling to rosette stage; refer to individual label instructions for best timing of each herbicide
Plumeless thistle *(Carduus acanthoides)*	Winter annual or biennial	10 years or more	By seed only; up to 9000 seeds per plant	May to August; seeds are dispersed 1-3 weeks after flowering	Picloram; dicamba; glyphosate; clopyralid; clopyralid plus triclopyr; 2,4-D; metsulfuron; chlorsulfuron; imazapic; imazapic plus glyphosate; aminopyralid	Late fall or early spring; seedling to rosette stage; refer to individual label instructions for best timing of each herbicide
Houndstongue *(Cynoglossum officinale)*	Biennial or short lived perennial	2-3 years unless buried; then only about a year	Average 300-675 seeds per plant but single plants can produce over 2000 seeds	Flowering May through July; seeds mature July through August	Picloram; dicamba; chlorsulfuron; 2,4-D; metsulfuron; use surfactants to improve herbicide performance	1st year rosettes in spring, summer or fall; early spring before bloom for second year rosettes; when plant is actively growing; refer to individual label instructions for best timing of each herbicide
Hemp *(Cannabis sativa)*	Annual		By seed only	Flowering July to September; seed production August until frost	2,4-D; sulfometuron;	Refer to individual label instructions for best timing of each herbicide
Buckthorn *(Rhamnus cathartica)*	Perennial	Up to 5 years	Reproduces by seed or by stump sprouting	Flowers May – June; berries ripen during August and September	Triclopyr for cut-stump method within 2 hours of cutting; glyphosate	Late summer and throughout the fall; refer to individual label instructions for best timing of each herbicide

Species Common Name (*scientific name*)	**Perennial**	**Seed Viability**	**Reproduction/ Seed Production**	**Flowers/Seed Maturity**	**Treatment (ALWAYS refer to herbicide label for correct application)**	**Timing (ALWAYS refer to label for correct timing)**
Common burdock *(Arctium minus)*	Biennial	2-10 years	By seed only; each plant produces 15,000 – 60,000 seeds	Flowers July – frost; seeds mature by September and are shed continuously throughout the fall, winter, and following spring	2,4-D; picloram; dicamba; glyphosate; clopyralid; clopyralid plus triclopyr; aminopyralid; metsulfuron	Herbicides are most effective when applied to first-year rosettes and before bloom stage; refer to individual label instructions for best timing of each herbicide
Halogeton *(Halogeton glomeratus)*	Winter annual; plants can germinate in fall, winter, or spring depending on soil moisture	Black seeds have no dormancy and are viable for up to 1 year; brown seeds have a dormancy and are viable for up to 10 years	By seed only; a single large plant can produce 100,000 seeds	Flowers July – August; seed maturity August - October	Halogeton alters soil properties, making it difficult to establish desirable plants, so it's best not to allow this plant to establish; metsulfuron; imazapyr; chlorsulfuron; 2,4-D; imazapic; aminopyralid; sulfometuron;	Apply when actively growing or very early in spring prior to flowering; refer to individual label instructions for best timing of each herbicide
Baby's breath *(Gypsophila paniculata)*	Herbaceous perennial;	2 years	New shoots can grow from the crown, but not the root; reproduces by seed only; a single plant can produce up to 14,000 seeds	flowers late June to late August;	Hard to get good coverage with herbicides because of sparse foliage; picloram; dicamba, 2,4-D; glyphosate;	Bolting to pre-flower; refer to individual label instructions for best timing of each herbicide

PESTICIDE - USE PROPOSAL (Reference FSM 2150)	DEPARTMENT/ AGENCY	CONTACT/PHONE NO.	
	USDA / FS DPG / District 7	**Minerals/Lands Dept. (701) 227-7819**	
	REGION	FOREST	DATE SUBMITTED
	01	**18**	

1) OBJECTIVE a) Project No. b) Specific Target Pest c) Purpose	
2) PESTICIDE a) Common Name b) Formulation c) % AI,AE,or lb / Gal. d) Registration No.	
3) a) Form Applied b) Use Strength (%) or Dilution Rate c) Diluent	
4) lbs. AI Per Acre or Other Rate	
5) APPLICATION a) Method b) Equipment	
6) a) Acres or Other Unit to be Treated b) Number of Applications c) Number of Sites d) Specific Description of Sites	
7) a) Month(s) of Year b) States	
8) SENSITIVE AREAS a) Areas to be Avoided b) Areas to be Treated with Caution	
9) REMARKS a) Precautions to be Taken b) Use of Trained / Certified Personnel c) State and Local Coordination d) Other Pesticides Being Applied to Same Site e) Monitoring f) Other	

Approval (Signature of USFS Approving Official)	Date (mm/dd/yy):

PESTICIDE - USE PROPOSAL (Reference FSM 2150)	DEPARTMENT/ AGENCY	CONTACT/PHONE NO.	
	USDA / FS DPG / District 7	**Minerals/Lands Dept. (701) 227-7819**	
	REGION	FOREST	DATE SUBMITTED
	01	**18**	**mm / dd / yy**

1) OBJECTIVE a) Project No. b) Specific Target Pest c) Purpose	a) Big-Crude Oil Co., Big Wind Field, FY-2010 b) Emergent and pre-emergent vegetation/weeds c) Control vegetation/weeds on and around well pads/pump stations
2) PESTICIDE a) Common Name b) Formulation c) % AI, AE, or lb / Gal. d) Registration No.	And/Or / And/Or a) Glyphosate / a) Dicamba / a) Imazapic b) Water-soluble / b) Water-soluble / b) dispersible granules c) 41%-3 lbs. per gal. / c) 48.2%-4 lbs, per gal. / c) 80% active ingredients d) EPA # 524-475 / d) EPA # 55947-1 / d) EPA # 535-392
3) a) Form Applied b) Use Strength (%) or Dilution Rate c) Diluent	a) Solution b) 1½ gal. glyphosate to 300 gal. water, 1 qt. dicamba to 300 gal. water c) Water
4) lbs. Applied Per Acre or Other Rate	1.5 pounds per acre
5) APPLICATION a) Method b) Equipment	a) Ground b) Hand gun sprayer
6) a) Acres or Other Unit to be Treated b) Number of Applications c) Number of Sites d) Specific Description of Sites	a) One acre per site. Total of six acres b) One initial treatment and spot treatments as needed. c) Six d) Area of operations for well site(s) noted on attachment A, block 3 (Other attachments may be used if considered necessary)
7) a) Month(s) of Year b) States	a) May and June b) North Dakota, Billings County
8) SENSITIVE AREAS a) Areas to be Avoided b) Areas to be Treated with Caution	a) Trees, drainages/waterways/surface water. b) Areas adjacent to waterways, sloped areas. Other Areas - None
9) REMARKS a) Precautions to be Taken b) Use of Trained / Certified Personnel c) State and Local Coordination d) Other Pesticides Being Applied to Same Site e) Monitoring f) Other	a) Will follow recommended standards within F.S. COA's 2308 & 2319 and COA's Other 3715 and 3732B. PPE will be worn by applicator(s). Signs will be posted warning that the area has been treated with herbicides . b) Note attachment A, block #1 c) Local d) None e) Operations will be monitored by company representative and/or contractor foreman. f) Additional herbicide applications may be needed at a later date depending on effectiveness of initial application.

Approval (Signature of USFS Approving Official) **Signature of USFS Official Only**	Date (mm/dd/yy)

Example

ATTACHMENT A **Supplemental Information for Pesticide Use Proposal Form FS-2100-2**	USDA Forest Service, Region One Dakota Prairie Grasslands Medora Ranger District	**Check One** (____) Noxious Weed Control (____) Vegetative Control
	Minerals / Lands Department	FS Contact – **Carmen Waldo** Phone Number - (701) 227-7819

Company, Proposal Submitted For	**Contractor**	**Date Submitted**

1) Applicator Information a) Applicators Name(s) b) N.D. State License or Certificate # c) Expiration Date	a) b) c)
2) Delegation of Authority (If applicable) a) Delegation Statement b) Company Officials Signature	a) b)
NOTE:	If a contracting herbicide applicator is going to submit the Pesticide Use Proposal Form for a company, the FS will need written notification from the company, designating said contractor to represent the company. The company is responsible for making sure that the form is complete and accurate.
3) Specific Site Description a) Name and/or number of well pads, central tank batteries, stations or other sites. b) Legal descriptions: quarter/quarter, section, township, range, and county.	**Well / Station** **Legal Description**
4) Remarks a) End of Year Report	

Approval Signature of Company Official or Representative	**Date (mm/dd/yy):**
Approval Signature of USFS Official	**Date (mm/dd/yy):**

ATTACHMENT A **Supplemental Information for Pesticide Use Proposal Form FS-2100-2**	USDA Forest Service, Region One Dakota Prairie Grasslands Medora Ranger District	**Check One** (____) Noxious Weed Control (____) Vegetative Control
	Minerals / Lands Department	FS Contact – **Carmen Waldo** Phone Number - (701) 227-7819

Company, Proposal Submitted For	**Contractor**	**Date Submitted**
Big-Crude Oil Co. Or Weed Wackers Inc for Big-Crude Oil	Weed Wackers Inc.	04/15/10

1) Applicator Information a) Applicators Name(s) b) N.D. State License or Certificate # c) Expiration Date	a) Reed Wacker b) Certificate # 101010 c) 12/31/10
2) Delegation of Authority (If applicable) a) Delegation Statement b) Company Officials Signature	a) Reed Wacker of Weed Wackers Inc. is hereby authorized to represent Big-Crude Oil Co. in matters pertaining to the submission of the Forest Service Pesticide Use Proposal Forms, FS –2100-2 and DPG 2100-2-A. He and/or his designate (being a North Dakota licensed applicator) is also authorized to oversee the application of the pesticides/herbicides on Big-Crude Oil sites indicated within Attachment A, Part 3, below. b) *I. M. Big* I. M. Big, Big-Crude Oil Co.
NOTE:	If a contracting herbicide applicator is going to submit the Pesticide Use Proposal Form for a company, the FS will need written notification from the company, designating said contractor to represent the company. The company is responsible for making sure that the form is complete and accurate.

3) Specific Site Description

a) Name and/or number of well pad, central tank battery, station or other site.

b) Legal description: quarter/quarter, section, township, range, and county.

Well/Station	**Legal Description**
Big # 1	NWNW, Sec. 1, T140N, R100W, Billings Co., ND
Big # 2	NWNE, Sec. 2, T140N, R100W, Billings Co., ND
Big # 3	SWNW, Sec. 3, T140N, R100W, Billings Co., ND
Big # 4	SWSE, Sec. 4, T140N, R100W, Billings Co., ND
Big # 5	NENE, Sec. 5, T140N, R100W, Billings Co., ND
Big-X Central Battery	NWSW, Sec. 3, T140N, R100W, Billings Co., ND

Or

Note attached list of specific site descriptions.

4) Remarks

a) End of Year Report

A report, pertaining to the herbicide treated sites will be submitted to the Forest Service prior to October 1, 2010, regarding the information requested within the F.S. letter dated April 13, 2010.

Approval Signature of Company Official or Representative	**Date (mm/dd/yy):**
Reed Wacker	04/15/10
Approval Signature of USFS Official	**Date (mm/dd/yy):**

Example

Pesticide Application Records / Year End Report

Customer/Company : _____ **Contractor :** _____

Applicators Name : _____ **License/Certification # :** _____

Specific Target Pest : _____

Application Information	Site	Site	Site	Site
Site Name or Number				
Legals: ¼¼ / Sec / Twn / Rng, County				
Application Date				
Start Time / Stop Time				
Pesticide Chemical Name				
Pesticide Trade Name				
Pesticide Registrant / Mfr.				
EPA Registration Number				
Wind Direction				
Wind Velocity				
Temperature – ^{o}F				
Pesticide Rate (per acre, sq. ft., etc.)				
Diluted Material (per acre/1000 sq. ft., etc.)				
Total Acres or Sq. Ft. Treated				
Equipment Used				
Applicators Signature				

Field Notes:

Pesticide Application Records / Year End Report

Customer/Company : Big Crude Oil Co. **Contractor :** Weed Wackers Inc.

Applicators Name : Reed Wacker **License/Certification # :** 101010

Specific Target Pest : Control vegetation / weeds on and around well pads / pump stations

Application Information	Site	Site	Site	Site
Site Name or Number	Big #1			
Legals: ¼¼ / Sec / Twn / Rng, County	NWNW, Sec. 1/ 140 / 100 Billings Co.			
Application Date	06 / 15/ 10			
Start Time / Stop Time	8:00 am / 9:00 am			
Pesticide Chemical Name	Glyphosate			
Pesticide Trade Name	Roundup			
Pesticide Registrant / Mfr.	Monsanto			
EPA Registration Number	524-475			
Wind Direction	NNW			
Wind Velocity	2 MPH			
Temperature	65° F			
Pesticide Rate (per acre, sq. ft., etc.)	1.5 pounds per acre			
Diluted Material (per acre/1000 sq. ft., etc.)	1½ gal. to 300 gal. water			
Total Acres or Sq. Ft. Treated	2.2 acres			
Equipment Used	Hand gun			
Applicators Signature	*Reed Wacker*			

Field Notes:

Example

Appendix XXVIII

Paleontological Plan

Unanticipated Discoveries for Paleontological Resources

Pipeline excavations can have significant impact on surface and subsurface paleontological resources. Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used to assess the potential for occurrence of paleontological resources. The Bureau of Land Management (BLM) uses the Potential Fossil Yield Classification (PFYC) system to rank geological unit based on their potential to yield paleontological resources. Geological units ranked as PFYC 1 have limited potential to yield scientifically significant paleontological resources. Geological units ranked as PFYC 3 have moderate or unknown potential to yield scientifically significant paleontological resources. Geological units ranked as PFYC 5 have the highest potential to yield scientifically significant paleontological resources.

The proposed BakkenLink Pipeline Project area is underlain by Paleocene-age Tongue River/Bullion Creek and Sentinel Butte formations of the Fort Union Group and Quaternary surficial deposits. These formations were ranked using the Potential Fossil Yield Classification (PFYC) system. Both the Sentinel Butte and Tongue River/Bullion Creek Formations of the Fort Union Group have high paleontological potential (PFYC Class 4).

A pedestrian survey of exposed bedrock outcrops was conducted within a 200-foot-wide corridor centered on the proposed pipeline centerline. No new scientifically significant paleontological resources were discovered during the survey. Although no new paleontological resources were discovered during the survey, data provided by the North Dakota Geological Survey and University of North Dakota show numerous paleontological resource localities within proximity of the proposed ROW, which suggest that ground-disturbing Project activities through areas underlain by these bedrock units could uncover paleontological resources. Therefore, monitoring for paleontological resources during ground-disturbing activities in areas identified with PFYC Class 4 bedrock may be warranted.

According to BLM Instructional Memorandum No. 2009-011 (Assessment and Mitigation of Potential Impacts to Paleontological Resources), which supersedes BLM Handbook 8270-1, paleontological resources collected from privately-owned or split-estate lands are the property of the surface-estate owner, and their disposition shall be in accordance with the surface agreement between the landowner and the permittee.

<u>Discovery of Unanticipated Paleontological Resources</u>

The process for handling unanticipated paleontological resources will be in accordance with BLM rules and guidance. All Project personnel should be instructed on procedures to be followed in the event of an unanticipated paleontological resource.

1. In the event that paleontological resources are encountered during the construction phase, all undertaking-related activities, including vehicular traffic, within 100 feet of the discovery should immediately be halted. Fossils will be left in place untouched until further instructions are received from the BLM Authorized Officer.

    a. If the discovery is on public (Federal or State) land, BakkenLink will immediately notify the BLM, the North Dakota Industrial Commission – Department of Mineral Resource-Division of Paleontology, and BakkenLink's Paleontological Resource Consultant (PRC). If the discovery is on Federal land, BakkenLink will notify the BLM Authorized Officer and the PRC. For discoveries on State land, BLM will notify the North Dakota Industrial Commission – Department of Mineral Resource-Division of Paleontology. These agencies, in consultation with BakkenLink's PRC shall determine the significance of the paleontological discovery and the need for mitigation. If the discovery is on private land,

BakkenLink will immediately notify the BLM and BakkenLink's PRC. The landowner will be notified. The BLM, in consultation with BakkenLink's PRC, and the landowner, shall determine the significance of the paleontological discovery and the need for mitigation.

2. If mitigation measures are determined appropriate, BakkenLink's PRC shall consult with the BLM and the PRC as appropriate regarding the preferred mitigation measures within two working days of the discovery.

    a. If deemed necessary by the BLM, and the PRC as appropriate, a mitigation program would be developed and implemented to document and remove significant paleontological resources prior to ground disturbing activities. BakkenLink's PRC shall prepare and submit a mitigation plan for approval by the BLM as appropriate. The BLM shall approve a mitigation plan within seven (7) days of submittal.

    b. Significant paleontological resources recovered during mitigation shall be prepared for curation in accordance with standard professional paleontological techniques and reposited at an appropriate, BLM approved, repository. The mitigation plan developed by the PRC shall identify qualified personnel per BLM regulations who shall conduct mitigation activities.

3. BakkenLink will ensure that reports of mitigation efforts for discovery situations are completed in a timely manner and conform to the standards for paleontological resource reports. For fossils collected from Federal lands, a report on the findings of the salvage program, including a list of the recovered fossils, shall be prepared following completion of the program. A copy of this report shall accompany the fossils to the BLM approved curation facility (repository). Final reports will be submitted to all applicable agencies.

4. Undertaking-related activities within 100 feet of the discovery will not resume until the BLM notifies BakkenLink (in writing) that mitigation is not required or that mitigation is complete and activities can resume.

5. BakkenLink will be responsible for all expenses associated with the discovery including evaluations, preparation of mitigation plans, excavation, preparation, reporting, and curation.

Recording Procedures, Emergency Salvage, and Reporting

Every paleontological occurrence is a unique situation which must be assessed on a case-by-case basis. Assessment of mitigation requirements, including the need for emergency salvage, excavation, recording, and reporting procedures (collectively called a mitigation plan) will be conducted on a case-by-case basis. At a minimum, recording procedures will include procedures outlined in Moses et al. (2014). The PRC will present recommended mitigation actions to the BLM within two working days of the discovery. The recommendations will provide the framework for the Mitigation Plan, including documentation, sampling, testing, excavation, screen washing, emergency salvage, reporting and other paleontological protocol as appropriate**.**

Contact Information

Name	Title/Agency	Phone	E-mail
Bureau of Land Management			
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Contact Information

Name	Title/Agency	Phone	E-mail
North Dakota Industrial Commission, Department of Mineral Resource, Division of Paleontology			
Jeff Person	Paleontologist	701-328-8000 (office) [need direct line]	jjperson@nd.gov
Paleontological Resources Consultant			
?	Paleontologist	**?**	**?**
BakkenLink			
?	Environmental Project Manager	**?**	**?**
Stantec			
?	Environmental Inspector	**?**	**?**

Reference:

Moses, R.J., Martin, J.E., Schaaf, C.A., Shoup, B.E., and Adams, J.S. 2014. *Recommended Standards for Field Assessments in Mitigation Paleontology*, Proceedings of the 10th Conference on Fossil Resources, Dakoterra, Vol. 6, p. 286-300.