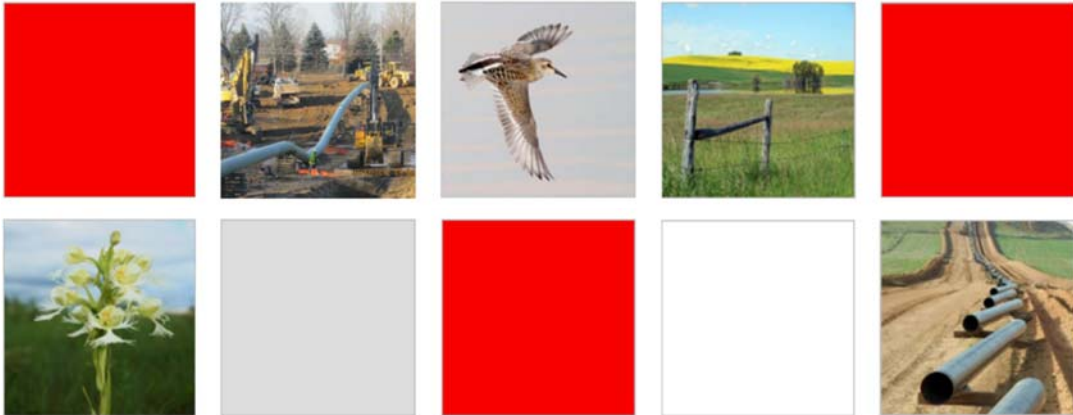


Appendix D

Summary of Construction Methods and Procedures for Wetlands and Waterbody Crossings

This information was not previously submitted as part of the Enbridge Energy, Limited Partnership Application for a Pipeline Routing Permit on April 24, 2015.



SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES FOR WETLAND AND WATERBODY CROSSINGS

September 2015

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	PIPELINE CONSTRUCTION THROUGH WETLANDS	1
2.1	CHOOSING A CONSTRUCTION METHOD	1
2.2	WETLAND AVOIDANCE AND MITIGATION MEASURES	1
3.0	PIPELINE CONSTRUCTION THROUGH WATERBODIES	6
3.1	UNFORSEEN CONDITIONS	6
3.2	BRIDGES	10
4.0	REFERENCES.....	12

LIST OF TABLES

Table 2-1	Pipeline Wetland Installation Methods	3
Table 3-1	Pipeline Waterbody Installation Methods	7
Table 3-2	Types of Bridges	11

LIST OF APPENDICES

Appendix A	Construction Typical Drawings
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1.0 INTRODUCTION

This Summary outlines the various construction methods that Enbridge will utilize to construct through wetlands and waterbodies. The discussion of each construction method includes:

- Description of the construction procedures;
- Conditions required to employ the method (applicability of the method);
- Environmental and/or constructability advantages and disadvantages associated with the method; and
- Mitigation measures that Enbridge will implement to avoid or reduce impacts associated with implementing the method.

2.0 PIPELINE CONSTRUCTION THROUGH WETLANDS

Enbridge identified and delineated wetland resources according to the procedures in the U.S. Army Corps of Engineers 1987 Manual and the associated Regional Supplement applicable to the Projects' locations. To facilitate wetland impact assessment, Enbridge classified delineated wetlands into emergent, unconsolidated bottom, scrub-shrub, or forested wetland components (Cowardin Classification System), by the Eggers and Reed Classification System, and Circular 39 Classification System by watershed (8-digit Hydrologic Unit Code).

2.1 CHOOSING A CONSTRUCTION METHOD

Table 2-1 describes the wetland crossing techniques Enbridge intends to utilize during construction. Enbridge and the Contractor will select the method of pipeline installation and post-construction restoration in wetlands that depend on the season, saturation level, and stability of the soils at the time of construction.

Enbridge will typically install the pipelines through wetlands with moderate- to high-bearing strength soils using standard upland crossing methods using timber mats or equivalent to avoid rutting and to minimize disturbance to soils and vegetation. Enbridge may install the pipelines through saturated wetlands with low bearing strength peat soils by using push-pull techniques during the spring, summer, or fall, if practicable, or by using standard upland crossing techniques such as frost or ice roads in the winter. Enbridge may install the pipelines through narrow wetlands or ditches adjacent to roads or railroads and sensitive wetlands or riparian wetlands adjacent to waterbody crossings using trenchless techniques such as the auger bore or the horizontal directional drill ("HDD") method.

2.2 WETLAND AVOIDANCE AND MITIGATION MEASURES

The Project-specific Environmental Protection Plan ("EPP") provides additional details on wetland construction and restoration techniques and avoidance and minimization measures. Avoidance and/or minimization measures that are generally applicable to all wetland crossings include the following:

- Reduced construction workspace compared to uplands;
- Perform right-of-way clearing using low ground-pressure equipment or operate off timber mats to limit disturbance to the wetland (Section 3.2 of the EPP);

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

- Locating additional temporary workspace (“ATWS”) outside of wetlands to the extent practicable to minimize the area of disturbance (Section 3.3 of the EPP);
- Confine grading to the area of the trench and minimize to the extent practicable (Section 3.4 of the EPP);
- Install and maintain erosion control devices to prevent sediment flow into wetlands (Section 3.4 of the EPP); and
- Strip and segregate up to 1 foot of the organic layer and/or topsoil (i.e., “O” and/or “A” horizons) from the trench line and separate from trench spoil to preserve the native seed stock from wetlands without standing water. In standing water wetlands, the Contractor will attempt to segregate as much of the soil surface as possible based on site and saturation conditions (Section 3.6.1 of the EPP).

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

TABLE 2-1 Pipeline Wetland Installation Methods				
Method (Season)	Description ^a	Applicability	Advantages	Disadvantages
Modified Upland Construction Method (Spring-Fall)	Conduct from timber mats or equivalent (refer to Figure 24 from the EPP provided in Appendix A).	Generally suitable in wetlands with unsaturated mineral soils constructed during unfrozen conditions. Generally suitable in saturated wetlands with moderate to high bearing strength, shallow peat soils over mineral substrate, or forested peatlands where roots provide a relatively firm foundation for timber mats or equivalent.	• Rapid construction/installation • No need for specialized equipment • Minimizes impacts on soils and vegetation • Facilitates revegetation from seedbank and provides favorable plant growth conditions	• Potential need for wider than normal trench and therefore additional construction workspace to avoid trench sidewall slump in loose, poorly graded sands • Requires additional time for installation of multiple timber mats • Increased disturbance and compaction of the travel lane • Difficulty removing timber mats • Additional restoration efforts of travel lane as compressed surface rebounds • Clearing and brush/stump removal required along travel lane in forested wetlands
Modified Upland Construction Method (Winter)	Conduct construction from frost or ice pad/road, and/or timber mats, or equivalent. Topsoil segregation performed as practicable, but modified dependent on depth of frost and thickness of topsoil. May use a ripper to break up frozen topsoil over the trench line only. Topsoil in spoil storage graded smooth to minimize mixing during backfilling	Generally suitable for wetlands with unsaturated mineral soils or saturated wetlands with moderate to low strength peat over mineral soils during frozen conditions.	• Rapid construction/installation • No need for specialized equipment • Minimizes impacts on wetland soils and vegetation • Stable foundations for spoil storage and travel lane • Facilitates revegetation from seedbank and provides favorable plant growth conditions	• Potential need for wider than normal trench and therefore additional construction workspace to avoid trench sidewall slump in loose, poorly graded sands • Susceptible to winter thaw; limited to freezing conditions and contingency required for thawing conditions • Additional safety concerns associated with cold weather work • Potential for mixing of topsoil and subsoil during excavation • Backfilling of frozen spoil piles may result in subsidence of the trench during thaw and require a significant increase in backfill volume and/or additional restoration efforts • If post-thaw restoration is necessary, mats will typically be left in place increasing the period of disturbance • Frost/ice roads often require a water source

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

TABLE 2-1 Pipeline Wetland Installation Methods				
Method (Season)	Description ^a	Applicability	Advantages	Disadvantages
Push-Pull Method: Excavator (Spring-Fall)	Use an excavator to excavate the trench operating from timber mats "walked" down the trenchline. Float and sink the pre-assembled pipe then backfill. May or may not use a travel lane depending on conditions with backfilling occurring from the spoil storage side or the working side	Generally suitable in saturated wetlands, typically with relatively competent peat soils, shallow peat over mineral soils, or forested peatlands with moderate bearing strength soils.	- Minimizes impacts on wetland soils and vegetation - No specialized equipment needed and allows for construction in unfrozen, saturated wetlands - Little or no travel lane and reduced heavy equipment traffic further reduces impacts on wetland soils and vegetation	- Topsoil segregation typically not practical; inability to maintain a cohesive spoil pile due to liquid nature of soil - Potential for stranding of the excavator if extremely loose, deep peat soils are encountered unexpectedly - Additional workspace required for pipe assembly or pipe may be fabricated off-site and brought in as a drag section - Due to lack of travel lane, additional adjacent workspace required for equipment turnarounds - Difficult to maintain depth and to ensure bottom of the trench is free of injurious materials
Push-Pull Method: Swamphoe (Spring-Fall)	Excavate the trench using an excavator mounted on tracked pontoons operating along the trenchline. Float and sink the pre-assembled pipe then backfill. May or may not use a travel lane depending on conditions with backfilling occurring from the spoil storage side or the working side	Generally suitable in saturated emergent and scrub-shrub wetlands with loose, deep peat soils or floating mat peat, low-bearing strength soils.	- Allows for construction in saturated wetlands during unfrozen conditions - No travel lane and reduced heavy equipment traffic further reduces impacts to wetland soils and vegetation	- Specialized equipment (i.e., swamphoe) required - Topsoil segregation typically not practical; inability to maintain a cohesive spoil pile due to liquid nature of soil - Potential for spoil settlement preventing complete replacement of backfill and potentially resulting in open water along the trenchline - Additional adjacent workspace required for pipe assembly or pipe may be fabricated off-site and brought in as a drag section - Additional adjacent workspace may be required for equipment turnarounds - Difficult to maintain depth and to ensure bottom of the trench is free of injurious materials

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

TABLE 2-1 Pipeline Wetland Installation Methods				
Method (Season)	Description ^a	Applicability	Advantages	Disadvantages
Auger Bore	Auger bore under wetland from bell hole on one side to bell hole on the other side with or without casing	Generally suitable for narrow wetlands or ditches adjacent to roads and railroads. Not suitable where there are high water tables, loose sand/gravel substrates, or adjacent steep slopes.	• Avoids disturbance in the wetland or ditch adjacent to the road/railroad feature • No sediment release	• Deep bell holes may require dewatering and sheet-piling • Pump(s) may be required to drain seepage within the bell holes onto surrounding lands • Possibility of sump-water causing sediment release into wetland • Requires additional workspace for bell holes, spoil piles, and sump(s) • Potential for borehole cave-in and/or dewatering • Slower than other crossing techniques • Large excavations required on both sides of the crossing • Increases potential for subsidence
HDD	Place a rig on one side of the wetland and drill a small-diameter pilot-hole under the wetland along a prescribed profile. Upon completion of the pilot-hole, the Contractor uses a combination of cutting and reaming tools to accommodate the desired pipeline diameter. Drilling mud is necessary to remove cuttings and maintain the integrity of the hole. The Contractor then pulls the welded pipe section through the drilled hole	Generally suitable to cross sensitive wetland areas and riparian wetlands adjacent to waterbody crossings. Dependent on site-specific topography and the local geologic substrate. Not feasible in areas of glacial till or outwash interspersed with boulder and cobbles, fractured bedrock, or non-cohesive coarse sands and gravels.	• Avoids surface ground disturbance in riparian wetlands adjacent to sensitive or large waterbodies • Limits vegetation disturbance to within the permanently maintained easement	• Slow construction and installation • Potential for inadvertent release of drilling fluids in unconsolidated gravel, coarse sand, and fractured bedrock and clays • Requires ATWS on both sides of the crossings to stage construction, fabricate the pipeline, and store materials • Some tree and brush clearing is necessary to install guide wires for monitoring and steering the drill bit • Requires obtaining water to formulate the drilling fluid as well as hydrostatic testing • Success depends on substrate • Requires specialized equipment • May require spread move around
Notes: ^a For all methods except auger bore and HDD, vegetation and trees within wetlands will be cut off at ground level, leaving existing root systems intact; clearing debris will generally be removed from the wetland for disposal. Hydro-axe debris or similar may be left in the wetland if spread evenly in the construction right-of-way to a depth that allows for normal revegetation as determined by the Environmental Inspector.				

3.0 PIPELINE CONSTRUCTION THROUGH WATERBODIES

Table 3-1 describes the waterbody crossing techniques Enbridge intends to utilize during construction. The routing and planning of large pipeline construction projects is an iterative process that is subject to change due to site-specific constraints, public and agency comments, and feasibility studies that may result in changes to the proposed waterbody crossing methods described below.

Refer to Sections 2.1 through 2.4 and 2.6 of the EPP for details regarding construction procedures and mitigative measures for each crossing method. The EPP also details procedures for temporary and permanent stabilization.

3.1 UNFORSEEN CONDITIONS

Enbridge may need to implement alternative crossing methods due to the followings situations, including but not specifically limited to:

- Significant fluctuation in water level (i.e., up or down) at the time of installation and/or significant changes to soil conditions at the time of installation (e.g., trench wall stability);
- Change in time of year of construction (winter construction vs. push-pull method or modified upland construction) due to delays in permit issuance (i.e., timing restrictions);
- Weather conditions at the time of installation;
- Unanticipated issues encountered during trenching or excavation; and
- Failure to install the pipe using the HDD method.

Enbridge identifies a primary and alternative crossing method for all waterbody crossings. In the case where an unforeseen condition makes the primary crossing method not practicable, Enbridge would proceed with the alternative crossing method per the conditions of regulatory approvals and permits.

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

TABLE 3-1
Pipeline Waterbody Installation Methods

Method	Description	Applicability	Advantages	Disadvantages
Wet Trench	Open-cut crossing technique that involves trenching through the waterbody while water continues to flow across the in-stream work area (refer to Figure 15 from the EPP provided in Appendix A).	Generally suitable for small, non-fishery streams, such as agricultural ditches and intermittent waterways, as well as larger waterbodies where other crossing methods are not practical. In Minnesota, these are primarily waterbodies located within large, saturated wetlands, and waterbodies with beaver dams.	• Rapid construction/installation • No need for specialized equipment • Compatible with granular substrates and some rock • Minimizes period of in-stream activity • Generally maintains streamflow • Maintains fish passage • Relatively short duration of sediment release (<24 hours)	• Requires implementation of erosion and sediment control devices to mitigate potentially high sediment release during excavation and backfilling • In-stream stockpiling of spoil on wide watercourses • May interrupt streamflow
Dry Crossing: Dam and Pump	Create a dry work area by damming the flow up- and downstream of the crossing and pumping water around. Dam materials may include but are not limited to: sand bags, aqua dams, sheet piling, or street plates (refer to Figure 16 from the EPP provided in Appendix A).	Generally suitable for streams with low flow and defined banks where fish passage is not of concern. Generally works best in non-permeable substrate and preferred for crossing meandering channels.	• Limited sediment release • Maintains streamflow • Minimal release and transport of sediment downstream that is not likely to result in negative effects on fish and fish habitat • Relatively dry working conditions • May be adapted for non-ideal conditions • Hose can be routed around area of construction • May reduce trench sloughing and trench width	• Minor sediment release during dam construction, dam removal and as water flushes over area of construction • Slow construction/installation resulting in extended period in-stream and prolonged sediment release • Fish salvage may be required from dried up reach • Short-term barrier to fish movement • Specialized equipment and materials • Slow construction/installation • Hose(s) may impede construction traffic • Seepage may occur in coarse, permeable substrate • Susceptible to mechanical failure of pumps

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

TABLE 3-1
Pipeline Waterbody Installation Methods

Method	Description	Applicability	Advantages	Disadvantages
Dry Crossing: Flume	Create a dry work area by damming the flow up- and downstream of the crossing and installing flume to convey water. Dam materials may include but are not limited to: sand bags, aqua dams, sheet piling, or street plates (refer to Figure 17 from the EPP provided in Appendix A).	Generally suitable for crossing relatively narrow streams that have straight channels and are relatively free of large rocks and bedrock at the point of crossing where fish passage is of concern. The waterbody should have defined banks and channel with solid, fine-textured substrate.	• Limited sediment release • Maintains streamflow • May allow fish passage • Minimal release and transport of sediment downstream that is not likely to result in negative effects on fish and fish habitat • Allows for flushing of substrates • Relatively dry or no flow working conditions • May be adapted for non-ideal conditions • May reduce trench sloughing and trench width	• Minor sediment release during dam construction, removal and as water flushes over area of construction • Slow construction/installation • Fish salvage may be required from dried up reach • Short-term barrier fish passage if water velocity in culvert is too high • Difficult to trench and lay pipe, especially large diameter pipe, under flume pipe • Work area may not stay dry in coarse, permeable substrate • Seepage may occur in coarse, permeable substrate
Auger Bore	Auger bore under watercourse from bell hole on one side to bell hole on the other side with or without casing.	Generally suitable for fine-textured impermeable soils and deep water table. Used most commonly for road and railroad crossings and can include adjacent ditches. Requires a slightly incised watercourse with approach slopes that are absent or slight. This method requires a minimum crossing length of 40 to 50 feet for 30-inch-diameter pipe and 45 to 60 feet for 36-inch-diameter pipe.	• No sediment release • No disturbance of streambed or banks • Maintains normal streamflow • Maintains fish passage • Maintains vegetative buffer on either side of watercourse	• Pump(s) may be required to drain seepage within the bell holes onto surrounding lands • Possibility of sump water causing sediment release in watercourse • Requires additional workspace for bell holes, spoil piles, and sump(s) • Potential for borehole cave-in and/or dewatering • Slower than wet trench or dry crossing techniques • Difficult with till or coarse material • Excessive borehole depth on deeply incised watercourses or watercourses with moderate or steeper slopes • Large excavations required both sides of the crossing

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

TABLE 3-1
Pipeline Waterbody Installation Methods

Method	Description	Applicability	Advantages	Disadvantages
HDD	Place a rig on one side of the waterbody and drill a small-diameter pilot hole under the waterbody along a prescribed profile. Upon completion of the pilot hole, the Contractor uses a combination of cutting and reaming tools to accommodate the desired pipeline diameter. Drilling mud is necessary to remove cuttings and maintain the integrity of the hole. The Contractor then pulls the pipe section through and welds the adjoining sections of pipe on each side of the waterbody (refer to Figure 18 from the EPP provided in Appendix A).	Generally suitable to cross sensitive or particularly deep, wide, or high-flow waterbodies and depends on site-specific topography and the local geologic substrate. Typically drilling is not feasible in areas of glacial till or outwash interspersed with boulder and cobbles, fractured bedrock, or non-cohesive coarse sands and gravels. This method requires a minimum crossing length of 1,280 feet for 30-inch-diameter pipe with 56 feet of depth and 90 feet bottom tangent. The minimum crossing length for a 36-inch-diameter pipe is 1,491 feet with 65 feet of depth and 90 feet bottom tangent. The minimum length assumes similar elevations on each side of the crossing.	• No sediment release unless an inadvertent return occurs • Minimal bank and approach slope disturbance • No streambed disturbance unless an inadvertent return occurs • Maintains normal streamflow • Maintains fish passage • Significantly reduces clean-up and restoration between entry and exit points • May be able to construct during restricted activity windows for sensitive fisheries	• Potential for inadvertent release of drilling fluids in unconsolidated gravel, coarse sand, and fractured bedrock and clays • Requires ATWS on both sides of the crossings to stage construction, fabricate the pipeline, and store materials • Tree and brush clearing is necessary to install guide wires for monitoring and steering the drill bit • Requires obtaining water to formulate the drilling fluid as well as hydrostatic testing • Success depends on substrate • Requires specialized equipment • Slow construction/installation • Limited drilling radius that is allowed for pilot hole • Pull string area along the alignment for the same length of the crossing to allow continuous pullback • Drill stem may get “stuck in the hole” and tools can be lost, especially on large diameter reams • No guarantees that drill will be successful • May damage coating or pipe during pullback

Source: Canadian Association of Petroleum Producers, Canadian Energy Pipeline Association, and Canadian Gas Association, 2005.

3.2 BRIDGES

Section 2.4 of the EPP provides details regarding the use of temporary bridges to facilitate equipment passage across waterbodies. Enbridge intends to utilize span (i.e., timber mat or railroad flat car) or rock flume bridges with in-stream support. Table 3-2 provides details regarding the applicability, advantages, and disadvantages of each technique.

SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES
FOR WETLAND AND WATERBODY CROSSINGS
ENBRIDGE

TABLE 3-2
Types of Bridges

Type	Description	Applicability	Advantages	Disadvantages
Typical Span Type Bridge (timber mats or railroad flat cars)	Construction of temporary bridge utilizing native timber mats or an imported portable bridge material such as railroad flat cars (refer to Figure 19 from the EPP provided in Appendix A).	Generally suitable for small- to medium-sized streams with stable banks. Multiple bridge spans and in-stream abutments. This bridge type can be used for large waterbodies. In-stream supports may be required. Regular bridge maintenance required. Preferred bridge type to provide safe crossing for heavy construction equipment.	• Strong, removable, and portable bridge that can be optimally located • Limited in-stream disturbance • Limited sediment release • Maintains streamflow • Maintains fish passage	• Specialized equipment/crew required • Substantial amount of work may be necessary to transport and/or construct • Limited span for timber bridges and cap may be required • Regular maintenance of erosion and sediment controls required • Possible sediment release from bank disturbance or if cap used over timber bridge • May cause interference on navigable waterways • In-stream disturbance and sediment mobilization if in-stream abutments used for multiple spans • Bridges need to be keyed into the banks
Rock Flume	Geotextile fabric would be placed over the stream bed. Non-galvanized steel culvert(s) would be laid perpendicular to the pipeline to divert the flow of water and a ramp would be built over the top of the culvert flumes using rock (refer to Figure 20 from the EPP included in Appendix A).	Primarily used in situations where there are heightened safety concerns with timber mat bridges. Generally suitable for medium- to large-sized streams with defined channel and banks where streamflow and fish passage are of concern.	• Limited sediment release • Maintains streamflow • Maintains fish passage	• Specialized materials may be required to construct • Heavy traffic can crush culverts • Icing in winter may block flow and fish passage • Sediment release during construction of the dam • May require bank grading • Susceptible to washout

Source: Canadian Association of Petroleum Producers, Canadian Energy Pipeline Association, and Canadian Gas Association, 2005.

4.0 REFERENCES

Canadian Association of Petroleum Producers, Canadian Energy Pipeline Association, and Canadian Gas Association. 2005. Pipeline Associated Watercourse Crossings. Prepared by TERA Environmental Consultants and Salmo Consulting Inc. Calgary, AB.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment station, Vicksburg, MS (on-line edition).

Minnesota Department of Natural Resources. 2015. Ecological Classification System. <http://www.dnr.state.mn.us/ecs/index.html>. Accessed May 1, 2015.

Appendix A

Construction Typical Drawings

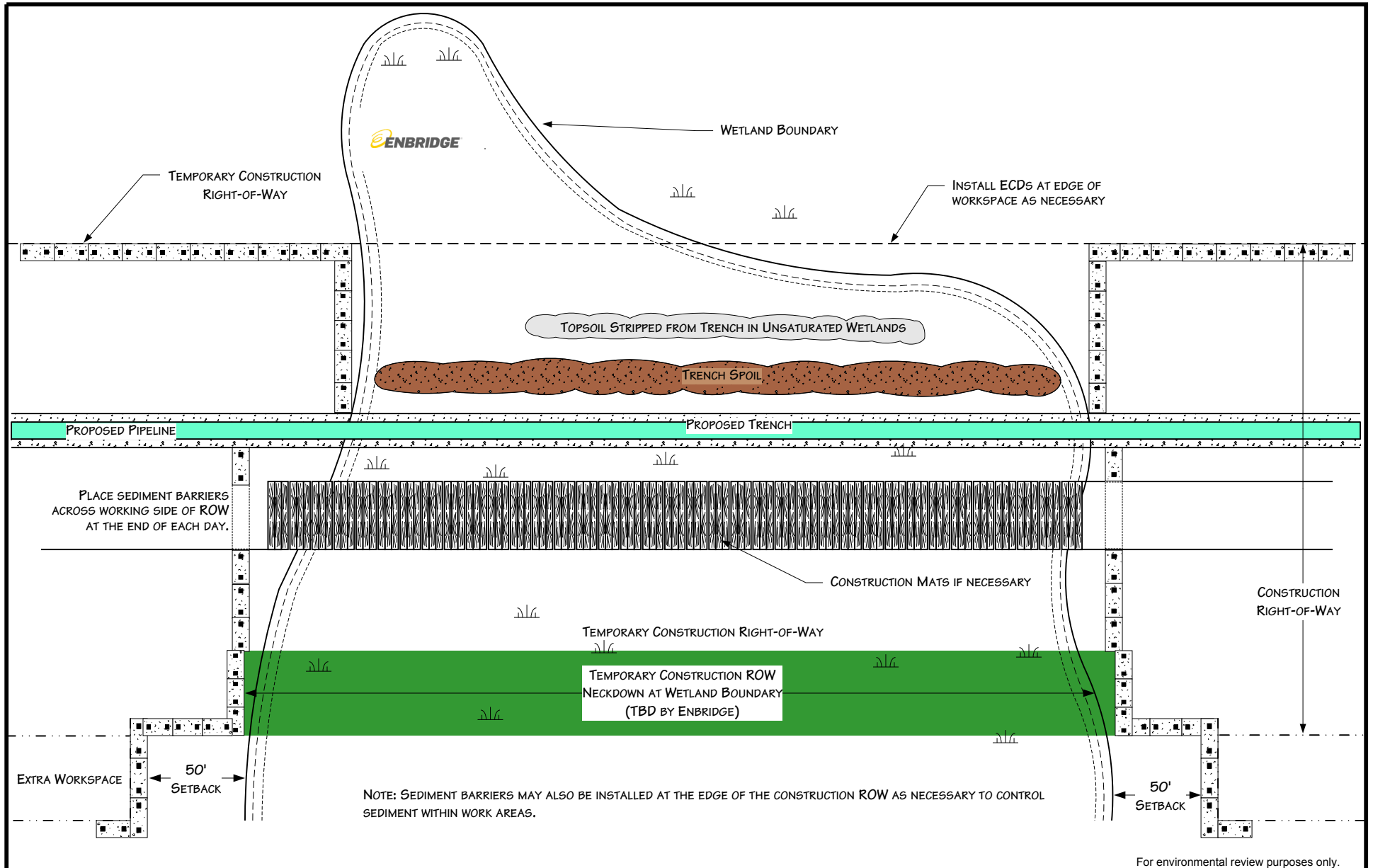
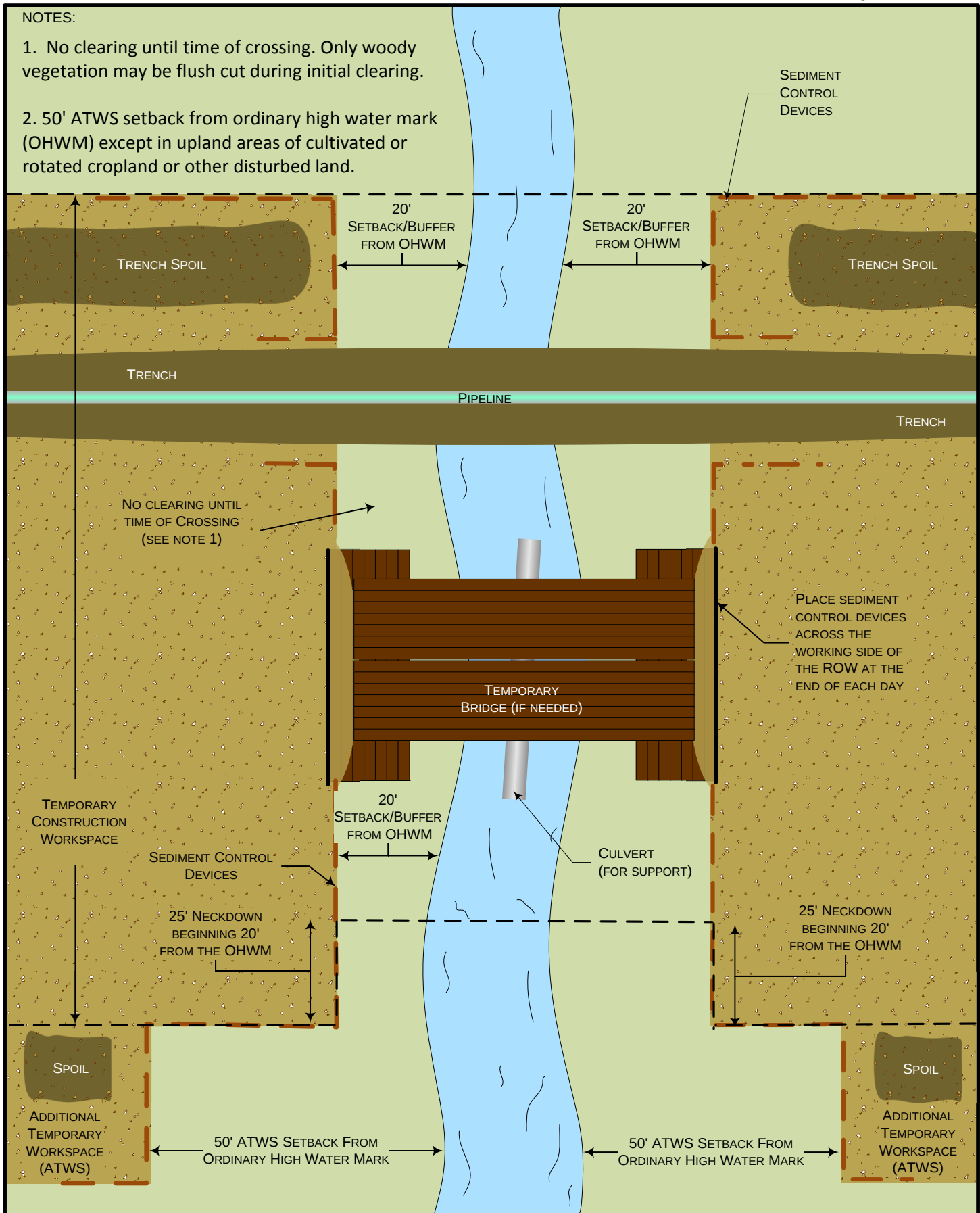
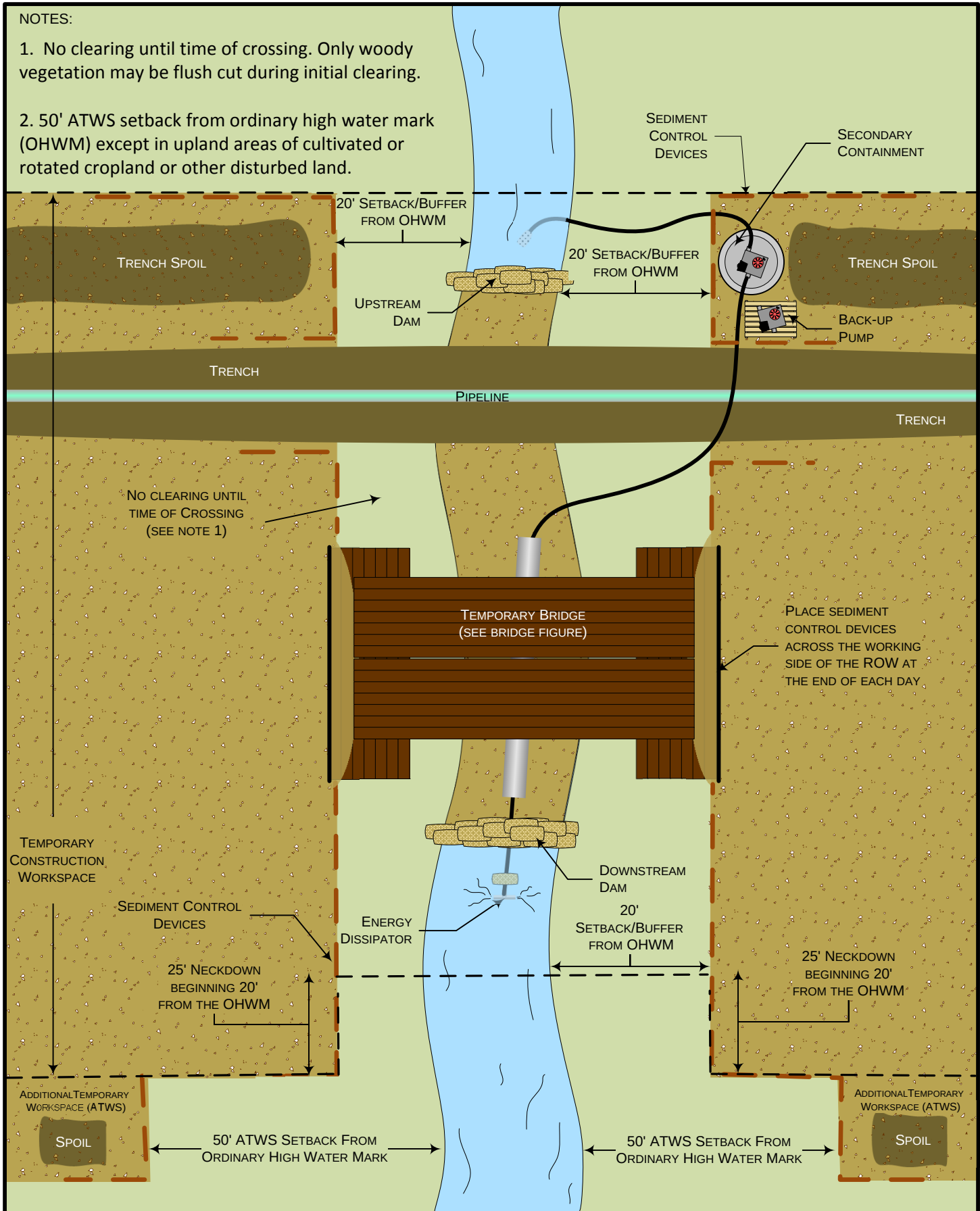


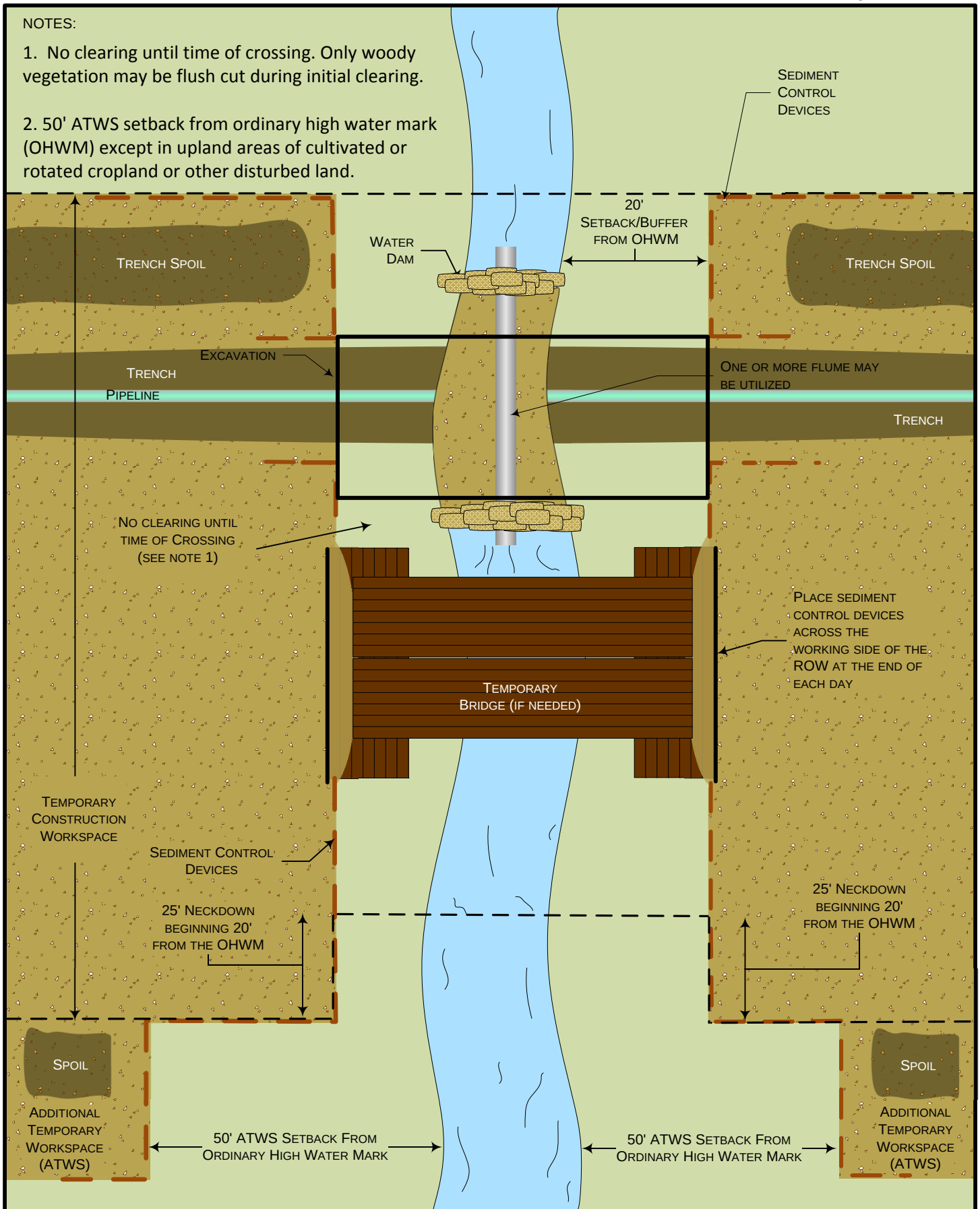
Figure 24
Environmental Protection Plan
Typical Wetland Crossing Method

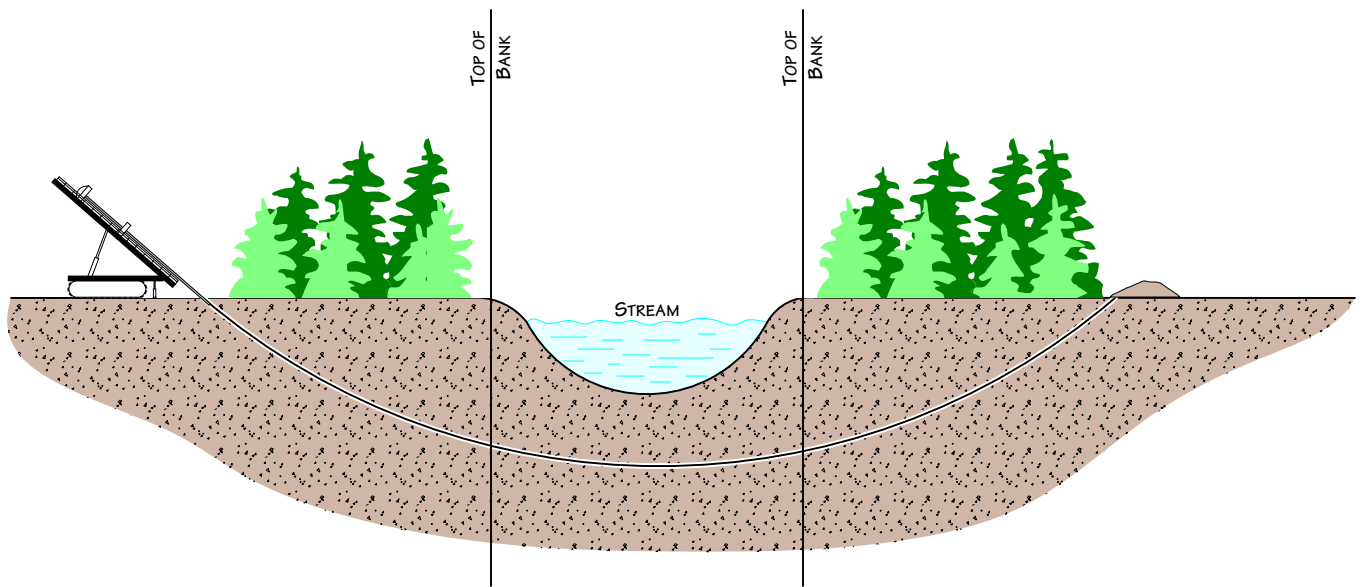
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REVISED: 3/14/11
SCALE: NTS
DRAWN BY: KMKENDALL
K:\CLIENT PROJECTS\SD-FEEL\2011-019\FIG_24_WETLAND_CROSSING_METHOD.VSD











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Figure 18
Environmental Protection Plan
Typical Waterbody Crossing
Directional Drill Method

DATE: 7/14/2000

REVISED: 3/11/11

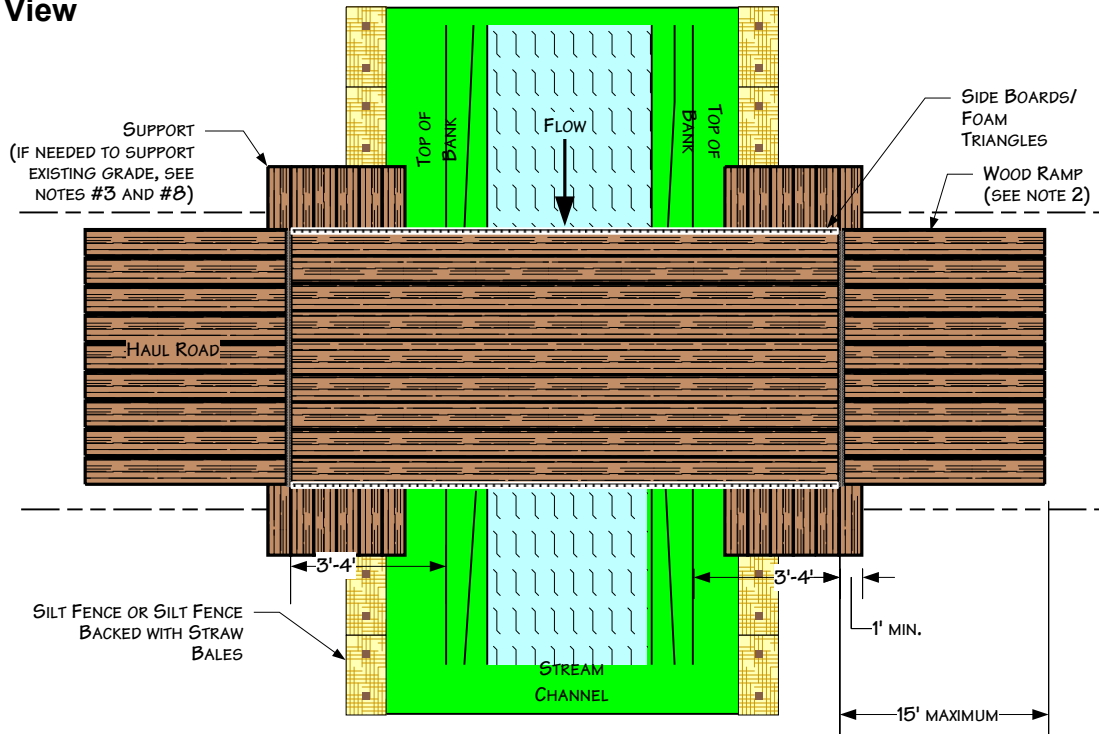
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DRAWN BY: KMKENDALL

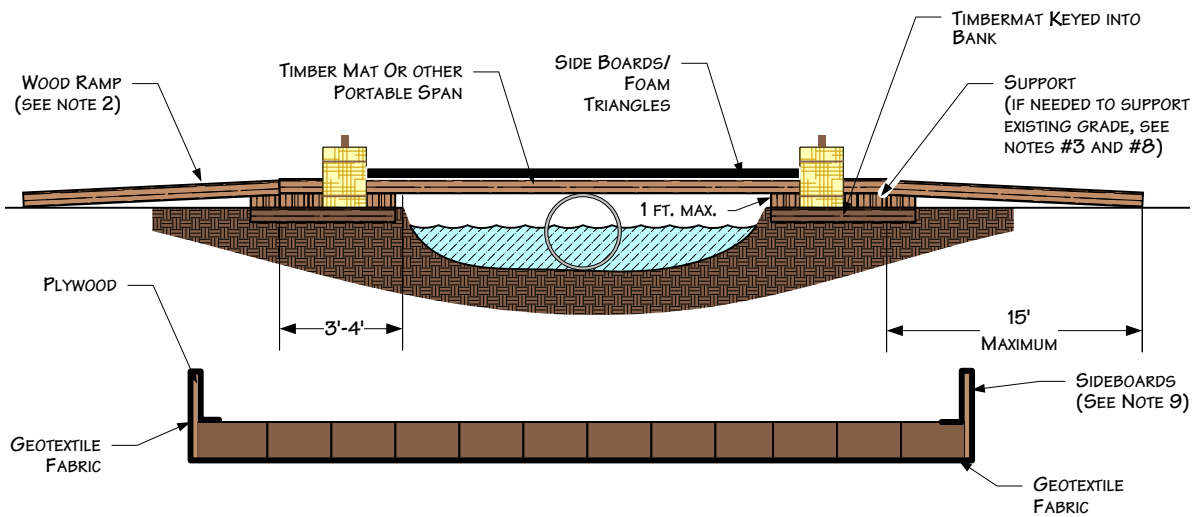
K:\CLIENT PROJECTS\ID-FEEL\2011-019\FIG_18_WATERBODY_DIRECTIONAL_DRILL_VSD



Plan View



Profile View



NOTES:

1. INSPECT BRIDGE OPENING PERIODICALLY AND FOLLOWING RAINFALLS OF OVER $\frac{1}{2}$ ". REMOVE ANY DEBRIS RESTRICTING FLOW AND DEPOSIT IT AT AN UPLAND SITE OUTSIDE OF FLOODPLAIN.
2. IF PHYSICAL CIRCUMSTANCES PROHIBIT WOOD OR METAL RAMPS, EARTHEN RAMPS MAY BE USED AS APPROVED.
3. INSPECT BRIDGE ELEVATION SO BRIDGE REMAINS SUPPORTED ABOVE OHWM.
4. THE CULVERT SUPPORT MUST BE ANCHORED TO THE STREAM BOTTOM AND MAY NOT BE SUPPORTED WITH FILL.
5. EARTHEN RAMP CANNOT BE TALLER THAN 1' AND CANNOT EXTEND FOR MORE THAN 15' ON EITHER SIDE OF THE CROSSING.
6. THE BRIDGE MUST SPAN ABOVE OHWM TO OHWM.
7. ADDITIONAL SUPPORT MUST BE ADDED ON TOP OF BANK AND UNDER SPAN IF INITIAL SUPPORT STARTS TO SETTLE.
8. EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE COMPANY'S ENVIRONMENTAL PROTECTION PLAN.
9. SIDEBARDS WILL BE INSTALLED ON TEMPORARY BRIDGES TO MINIMIZE THE POTENTIAL FOR SEDIMENT TRANSPORT. SIDEBARDS MAY BE CONSTRUCTED OUT OF PLYWOOD, OR EQUIVALENT, AND AFFIXED TO THE OUTER SIDES OF THE BRIDGE. GEO-TEXTILE FABRIC, OR EQUIVALENT, MUST ALSO BE ADEQUATELY SECURED TO THE UNDERSIDE OF THE BRIDGE TO PREVENT MATERIAL FROM FALLING THROUGH THE BRIDGE DECK. THE GEO-TEXTILE FABRIC OR AN EQUIVALENT SHOULD BE SECURED TO THE BOTTOM OF THE BRIDGE AND WRAPPED AROUND THE SIDEBARDS IN A CONTINUOUS FASHION.

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Figure 19
Environmental Protection Plan
Typical Span Type Bridge
With or Without Instream Support

DATE: 3/11/2003

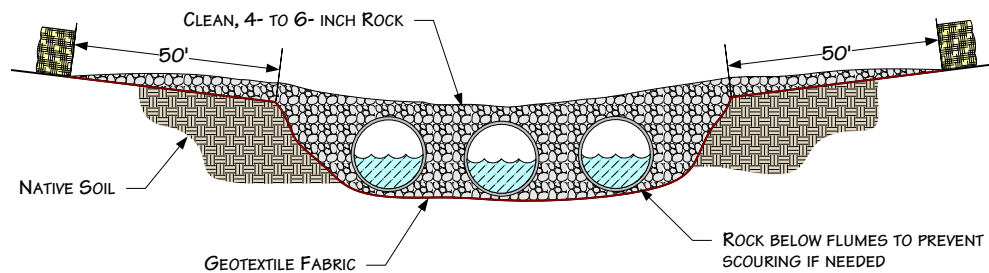
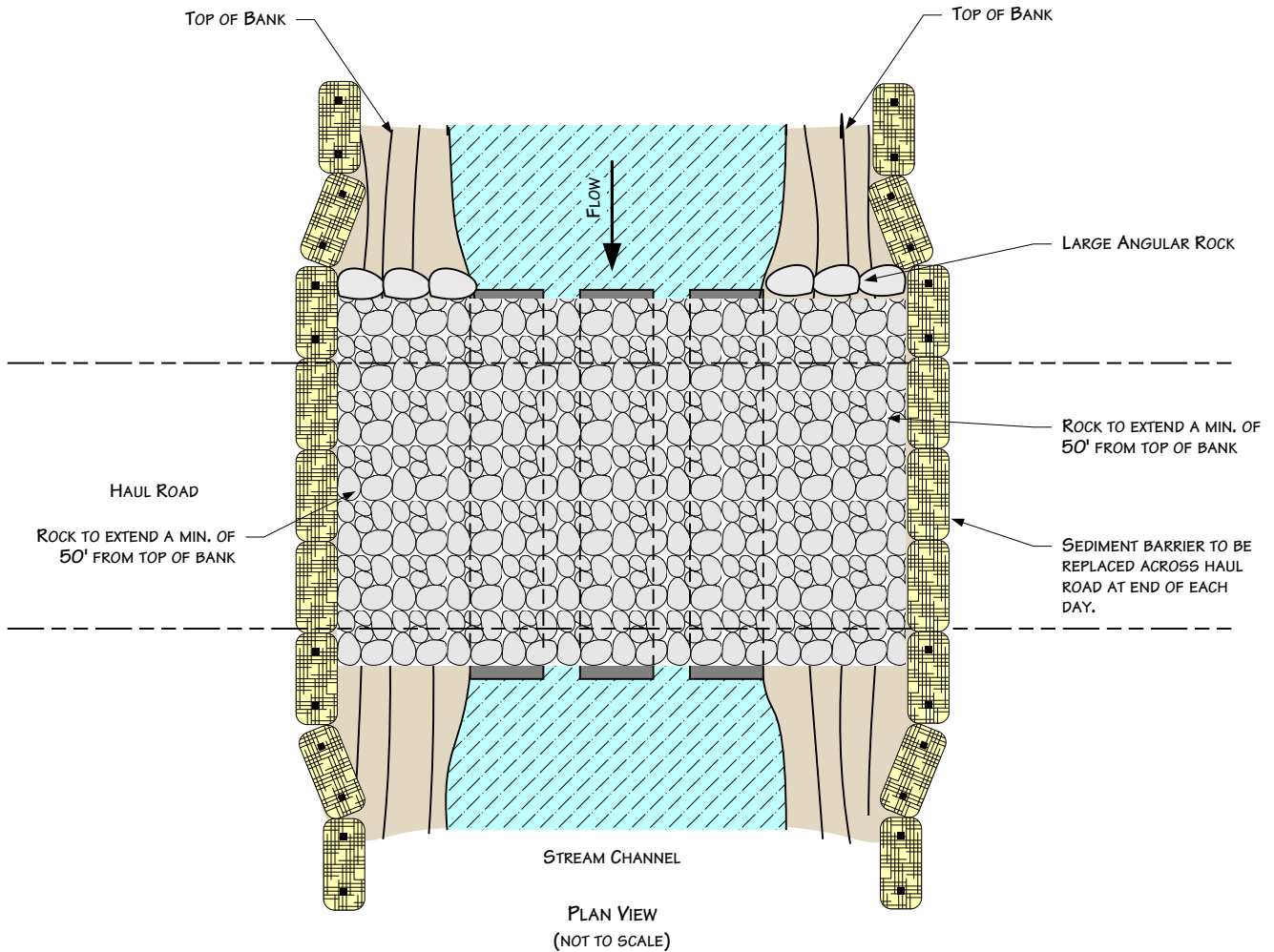
REVISED: 3/25/2011

SCALE: NTS

DRAWN BY: KMK6792

K:\CLIENT PROJECTS\SD-FEEL\2011-019\FIG_19_BRIDGE_SPAN.VSD





NOTES:

1. STEEL FLUME PIPE(S) SIZED TO ALLOW FOR STREAM FLOW AND EQUIPMENT LOAD.
2. STRAW BALES SHALL BE PLACED ACROSS BRIDGE ENTRANCE EVERY NIGHT.
3. ADDITIONAL INFORMATION INCLUDED ON OTHER DRAWINGS.

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Figure 20
Environmental Protection Plan
Typical Rock Flume Bridge

DATE: 5/25/2001

REVISED: 3/15/11

SCALE: NTS

DRAWN BY: KMKENDALL

K:\CLIENT PROJECTS\ID-PEEL\2011-019\FIG_20_ROCK_FLUME_BRIDGE.VSD

