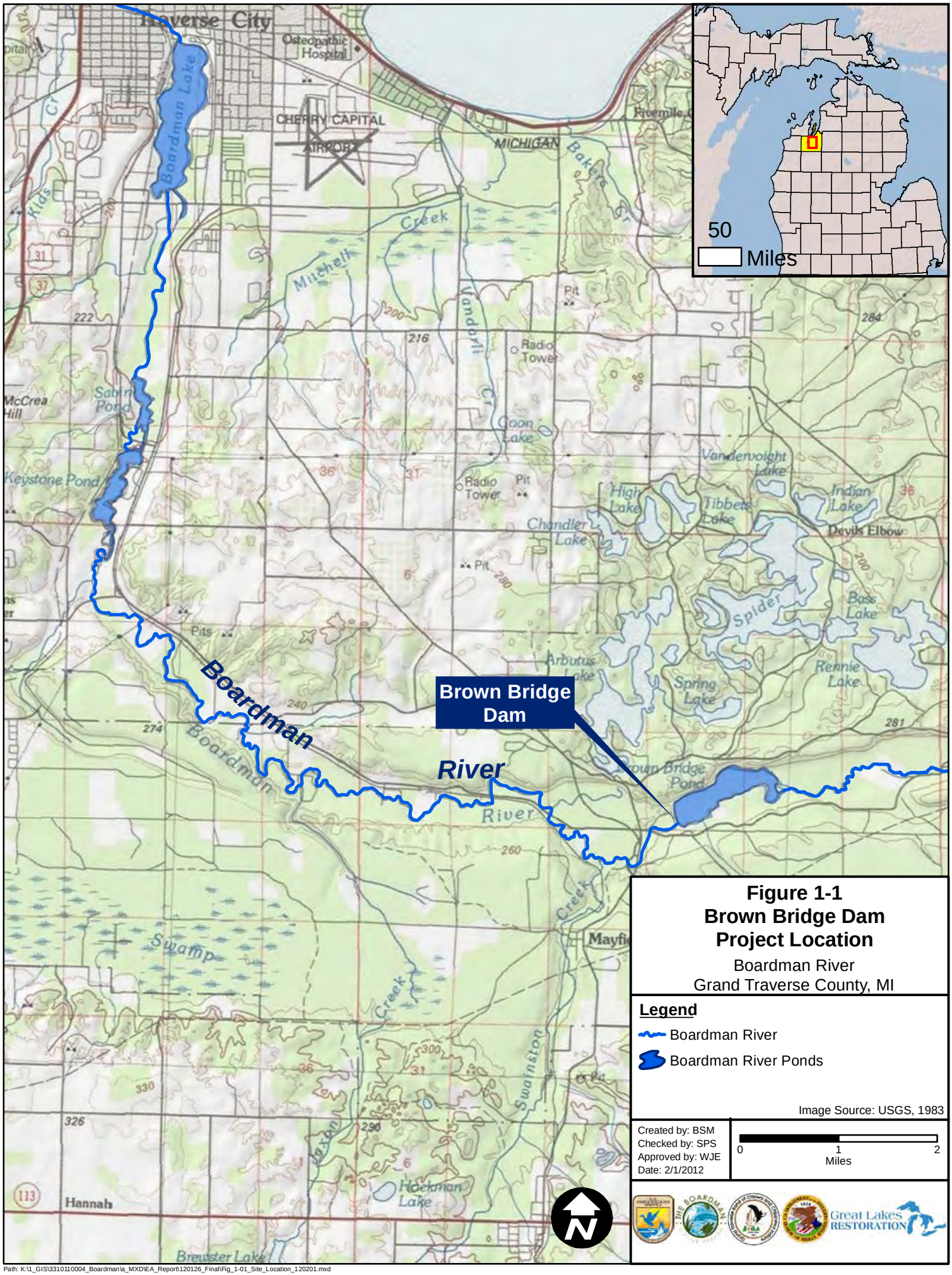


Figure 1-1
Brown Bridge Dam
Project Location

Boardman River
Grand Traverse County, MI

Legend

- Boardman River
- Boardman River Ponds

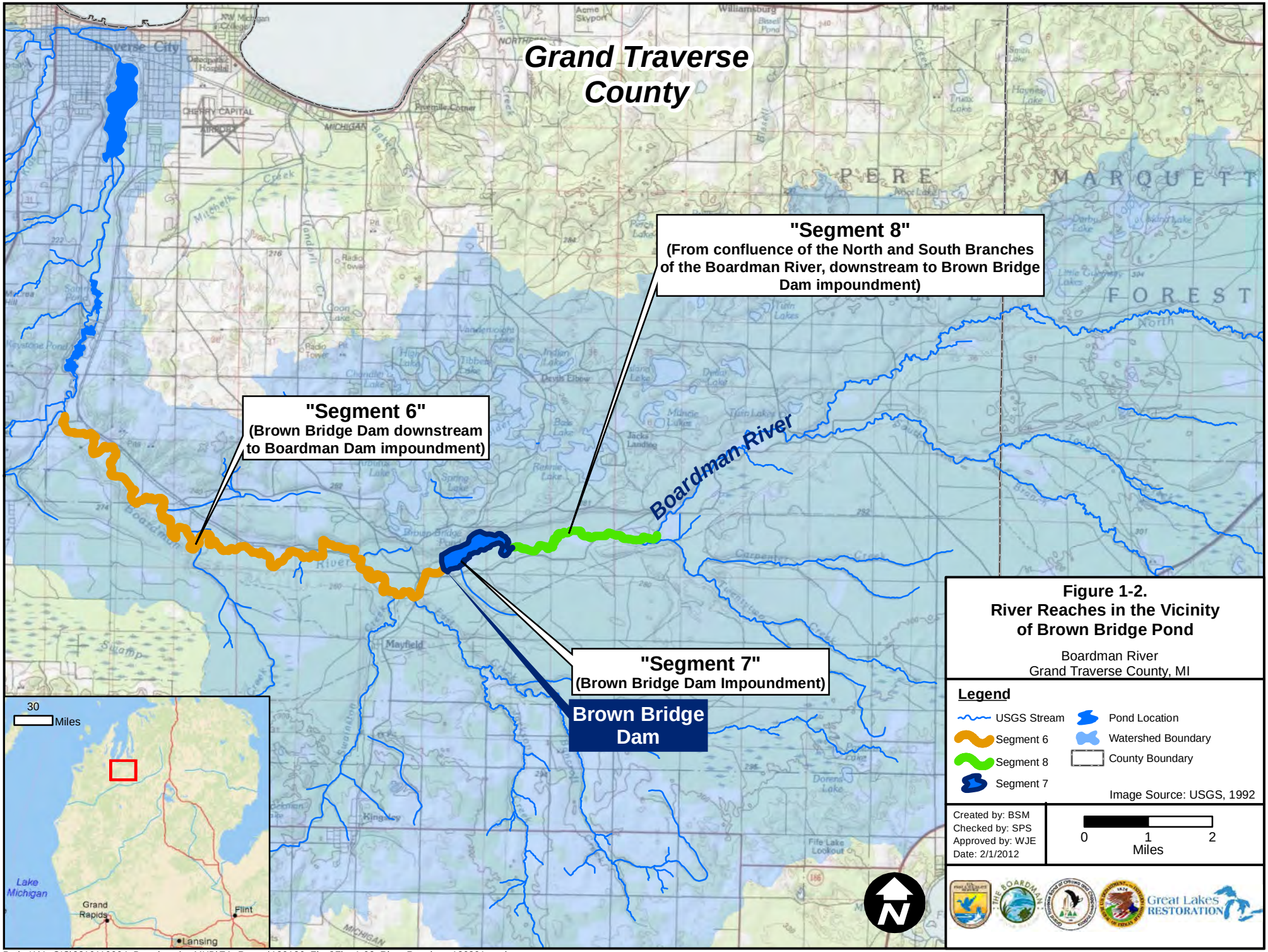
Image Source: USGS, 1983

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

0 1 2
Miles

Great Lakes RESTORATION

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_1-01_Site_Location_120201.mxd



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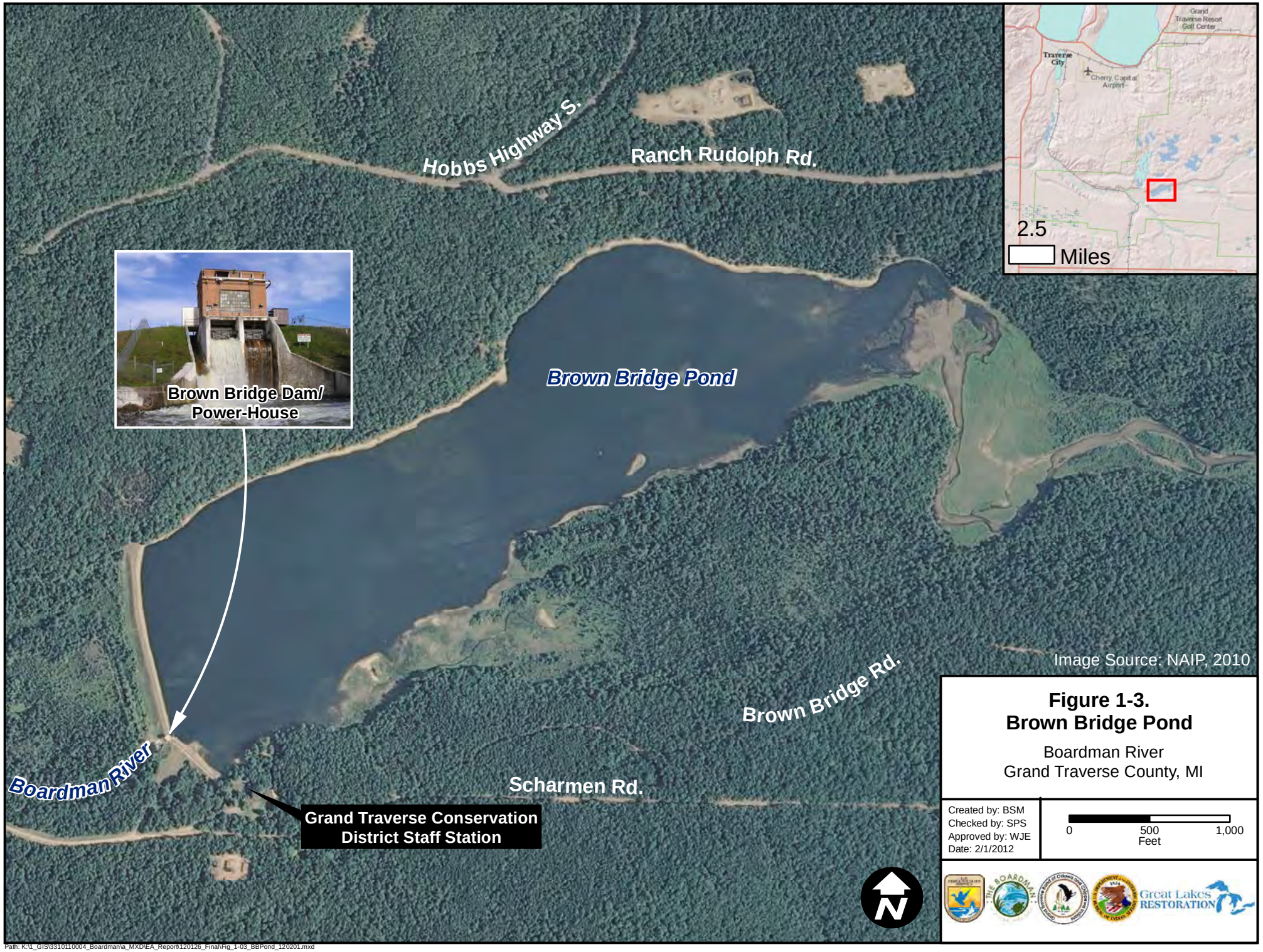


Figure 1-3.
Brown Bridge Pond

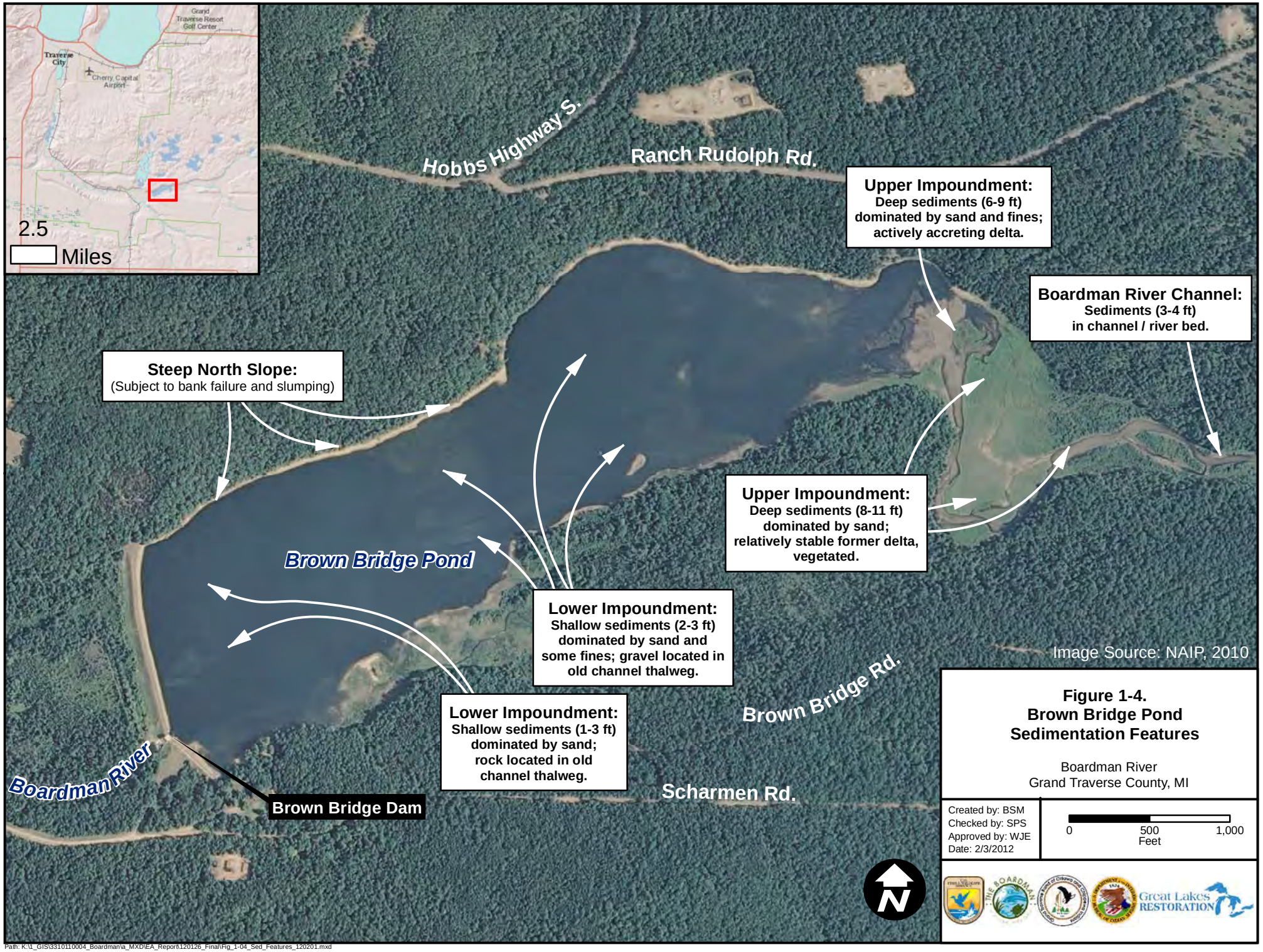
Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

0 500 1,000
Feet

Great Lakes RESTORATION

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_1-03_BBPond_120201.mxd



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Thermal Disruption:

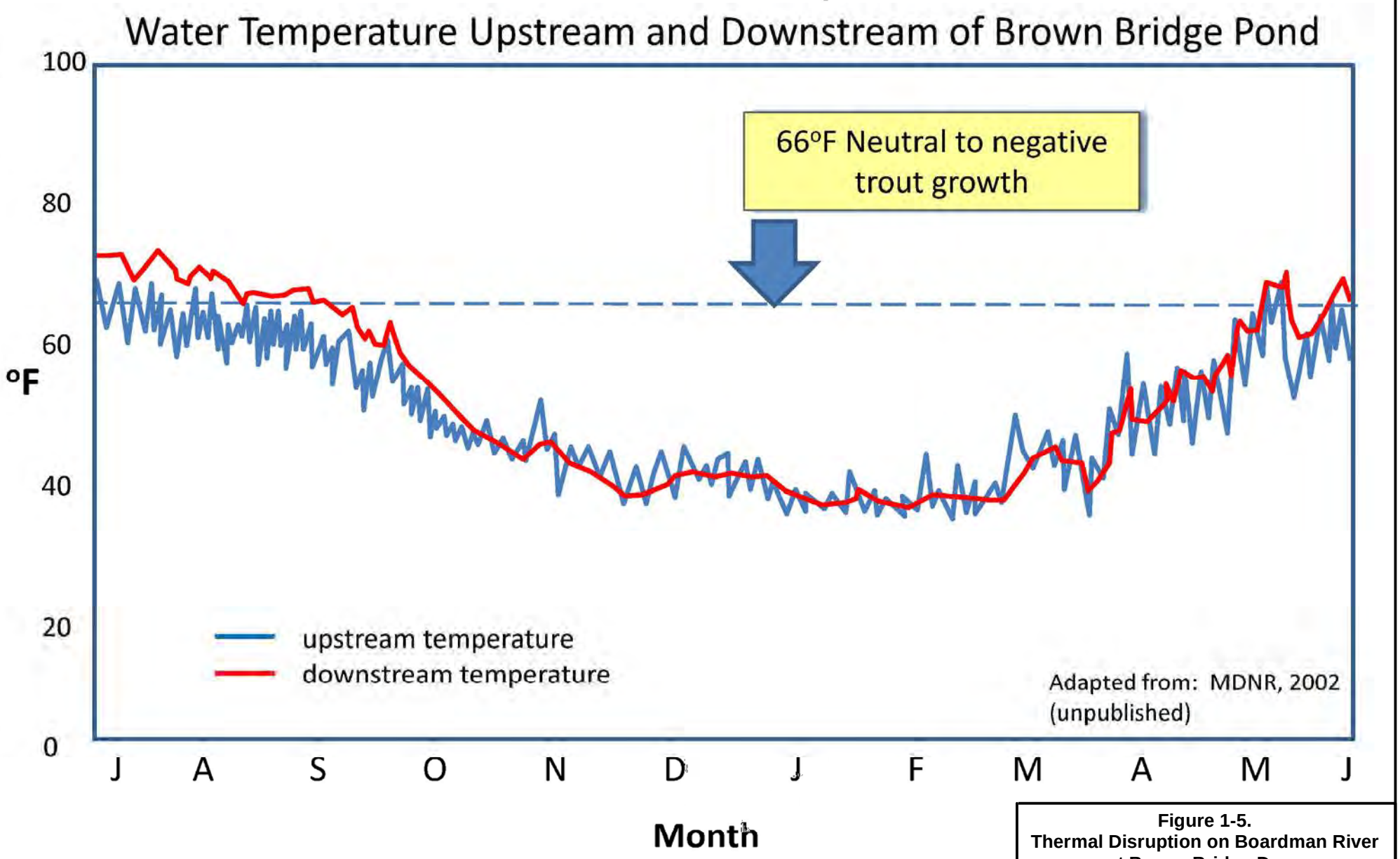
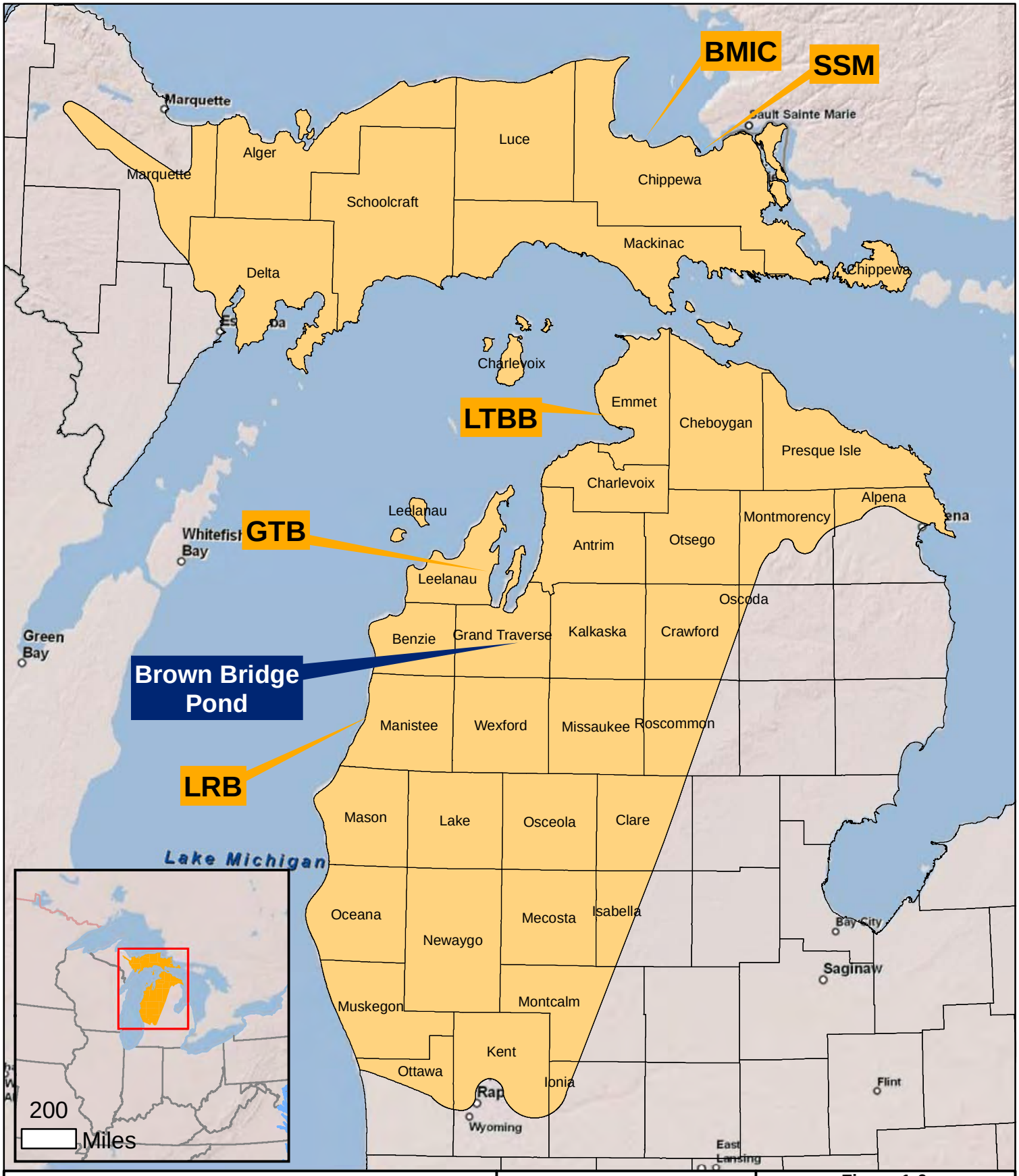


Figure 1-5.
Thermal Disruption on Boardman River at Brown Bridge Dam.

Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_1-05_Thermal_120201.mxd



Legend

- 1836 Treaty Ceded Territory
- BMIC — Bay Mills Indian Community
- GTB — Grand Traverse Band of Ottawa and Chippewa Indians
- LRB — Little River Band of Ottawa Indians
- LTBB — Little Traverse Bay Bands of Odawa Indians
- SSM — Sault Ste. Marie Tribe of Chippewa Indians

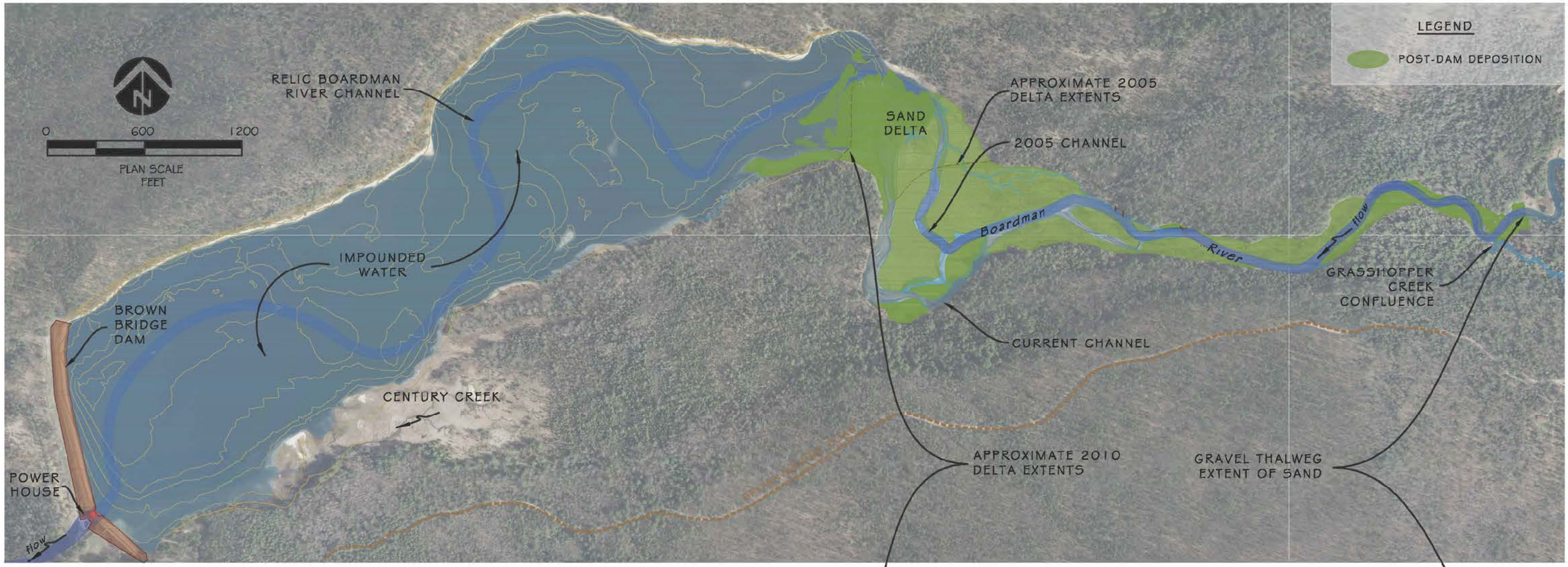
Figure 1-6.
Federally Recognized Indian Tribes within the 1836 Treaty Ceded Territory
Boardman River
Grand Traverse County, MI

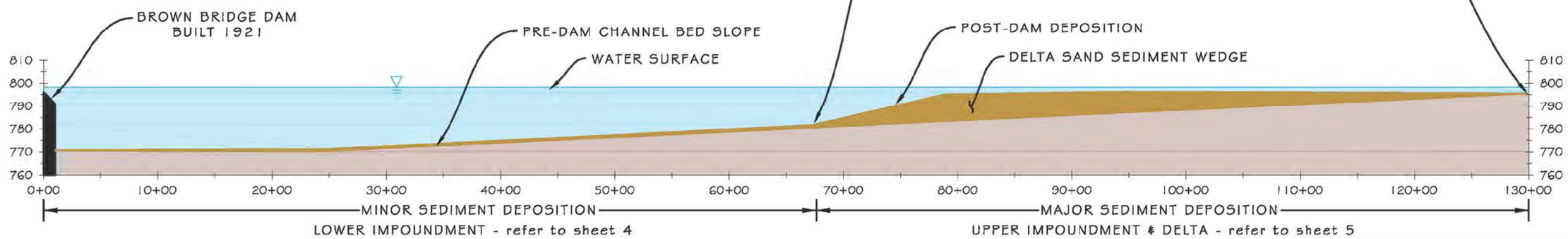
Created by: BSM Approved by: WJE
Checked by: SPS Date: 2/3/2012

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_1-06_Indian_Tribes-Ceded_120203.mxd

MINOR SEDIMENT DEPOSITION
LOWER IMPOUNDMENT - refer to sheet 4

MAJOR SEDIMENT DEPOSITION
UPPER IMPOUNDMENT & DELTA - refer to sheet 5





CONCEPTUAL PROFILE
not to scale

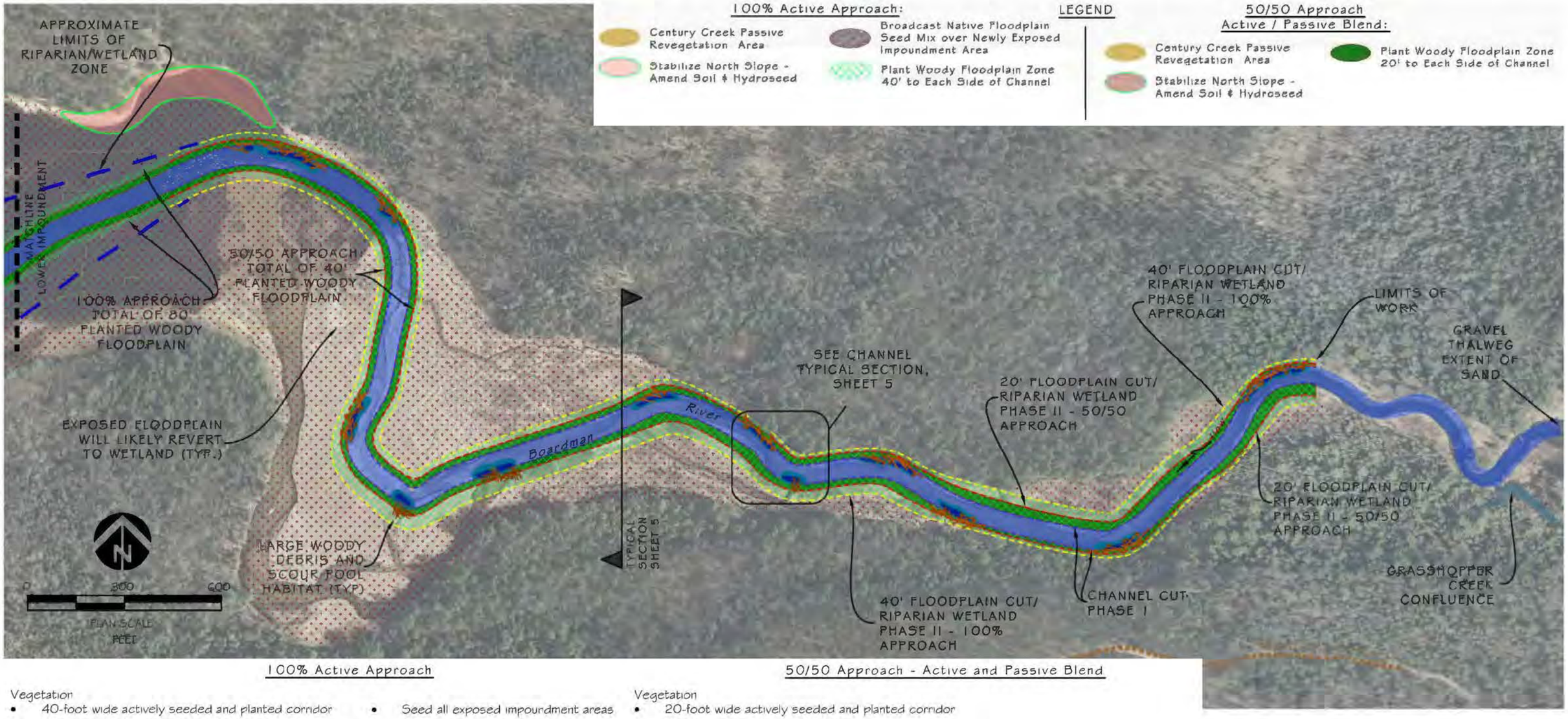
Figure 2-1
Brown Bridge Pond
Existing Conditions
Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/3/2012

Note: Elements in this figure are based on the "Concept Design Report" and have been subjected to further revision through the design process as presented in Figures 2-6 and 2-7

Source: Inter-Fluve, 2012

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_2-01_Existing_Conditions_120201.mxd



100% Active Approach

Vegetation
- 40-foot wide actively seeded and planted corridor
- Management of invasive plants throughout
- Seed all exposed impoundment areas
- Native grasses, shrubs and trees

In-channel Habitat
- Large wood installation (50 trees per 500 ft) in the form of small jams and placed key pieces
- Construct bedforms such as pools, riffles, and runs

Channel Banks
- Active stabilization using a variety of methods including grading, fabric placement, LWD

Excavation / Sediment Management
- Excavate channel volume and associated 40' floodplain bench on either side of channel
- Excavate microtopography and wetland features in floodplain

50/50 Approach - Active and Passive Blend

Vegetation
- 20-foot wide actively seeded and planted corridor
- Native grasses, shrubs and trees
- Management of invasive plants throughout

In-channel Habitat
- Large wood installation (50 trees per 500 ft) in the form of small jams and placed key pieces
- Bedforms such as pools, riffles, and runs will develop over several flood events

Channel Banks
- No bank treatment

Excavation / Sediment Management
- Excavate channel volume and 20-foot wide floodplain bench on either side of the channel
- Excavate microtopography and wetland features

Note: Elements in this figure are based on the "Concept Design Report" and have been subjected to further revision through the design process as presented in Figures 2-6 and 2-7

Figure 2-2
Preliminary Restoration Alternatives
(Sheet 1 of 2)

Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

Source: Inter-Fluve, 2012

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_2-02_Preliminary_Upper_Restoration_120201.mxd

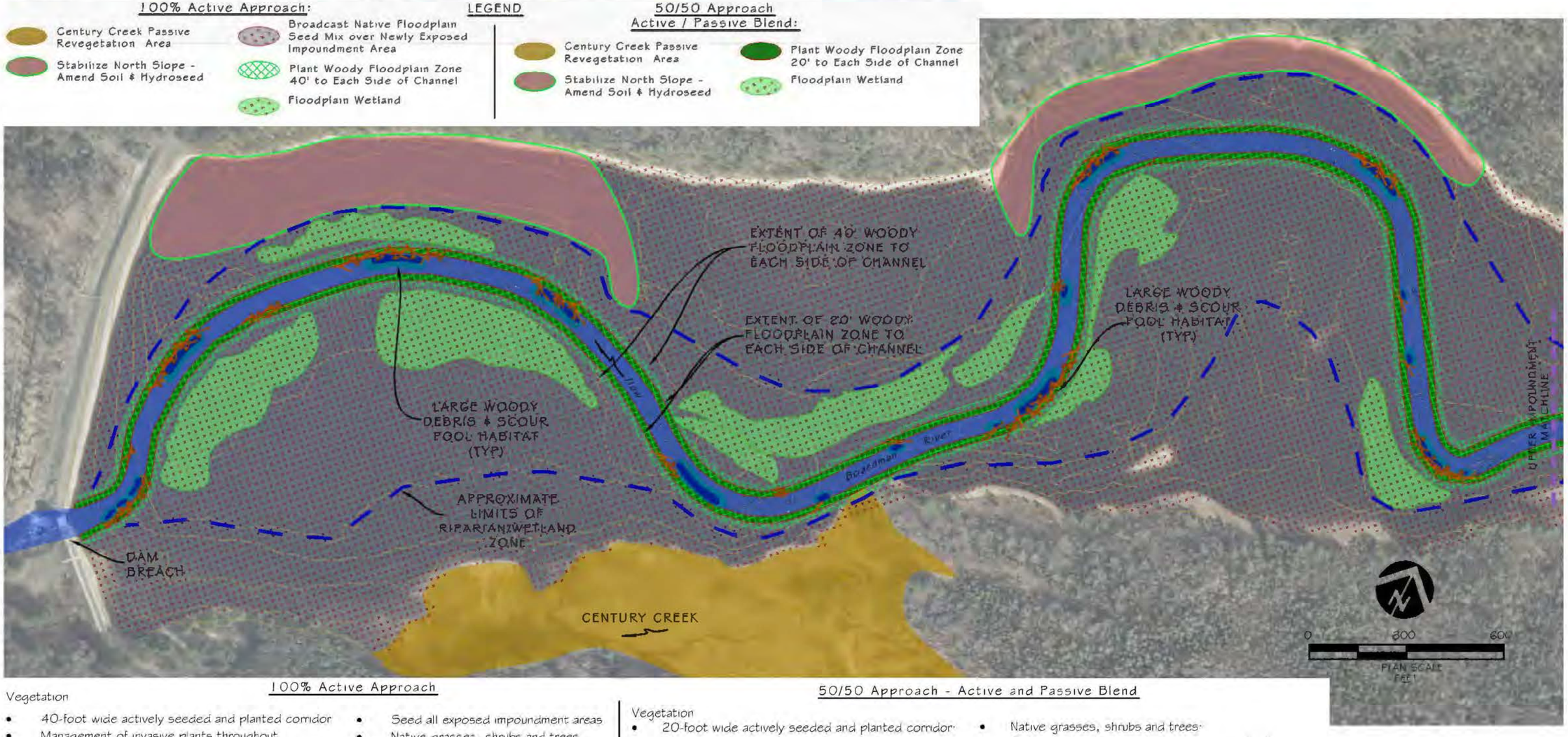
LEGEND

100% Active Approach:

- Century Creek Passive Revegetation Area
- Stabilize North Slope - Amend Soil & Hydroseed
- Broadcast Native Floodplain Seed Mix over Newly Exposed Impoundment Area
- Plant Woody Floodplain Zone 40' to Each Side of Channel
- Floodplain Wetland

50/50 Approach Active / Passive Blend:

- Century Creek Passive Revegetation Area
- Stabilize North Slope - Amend Soil & Hydroseed
- Plant Woody Floodplain Zone 20' to Each Side of Channel
- Floodplain Wetland



100% Active Approach

Vegetation

- 40-foot wide actively seeded and planted corridor
- Management of invasive plants throughout
- Soil amendment as needed on steep sandy slopes
- Seed all exposed impoundment areas
- Native grasses, shrubs and trees

In-channel Habitat

- Large wood installation (50 trees per 500 ft) in the form of small jams and placed key pieces
- Construct bedforms such as pools, riffles, and runs

Channel Banks

- Active stabilization using a variety of methods including grading, fabric placement, LWD

Excavation / Sediment Management

- Assumed to be minimal sediment below the delta in the Lower impoundment. No excavation required.
- Excavate wetland features

50/50 Approach - Active and Passive Blend

Vegetation

- 20-foot wide actively seeded and planted corridor.
- Management of invasive plants throughout.
- Native grasses, shrubs and trees.
- Soil amendment as needed on steep sandy slopes

In-channel Habitat

- Large wood installation (50 trees per 500 ft) in the form of small jams and placed key pieces
- Bedforms such as pools, riffles, and runs are assumed to persist in the Lower impoundment from pre-dam conditions.

Channel Banks

- No bank treatment

Excavation / Sediment Management

- Assumed to be minimal sediment below the delta in the Lower impoundment. No excavation required

Figure 2-2
Preliminary Restoration Alternatives
(Sheet 2 of 2)

Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

Note: Elements in this figure are based on the "Concept Design Report" and have been subjected to further revision through the design process as presented in Figures 2-6 and 2-7

Source: Inter-Fluve, 2012

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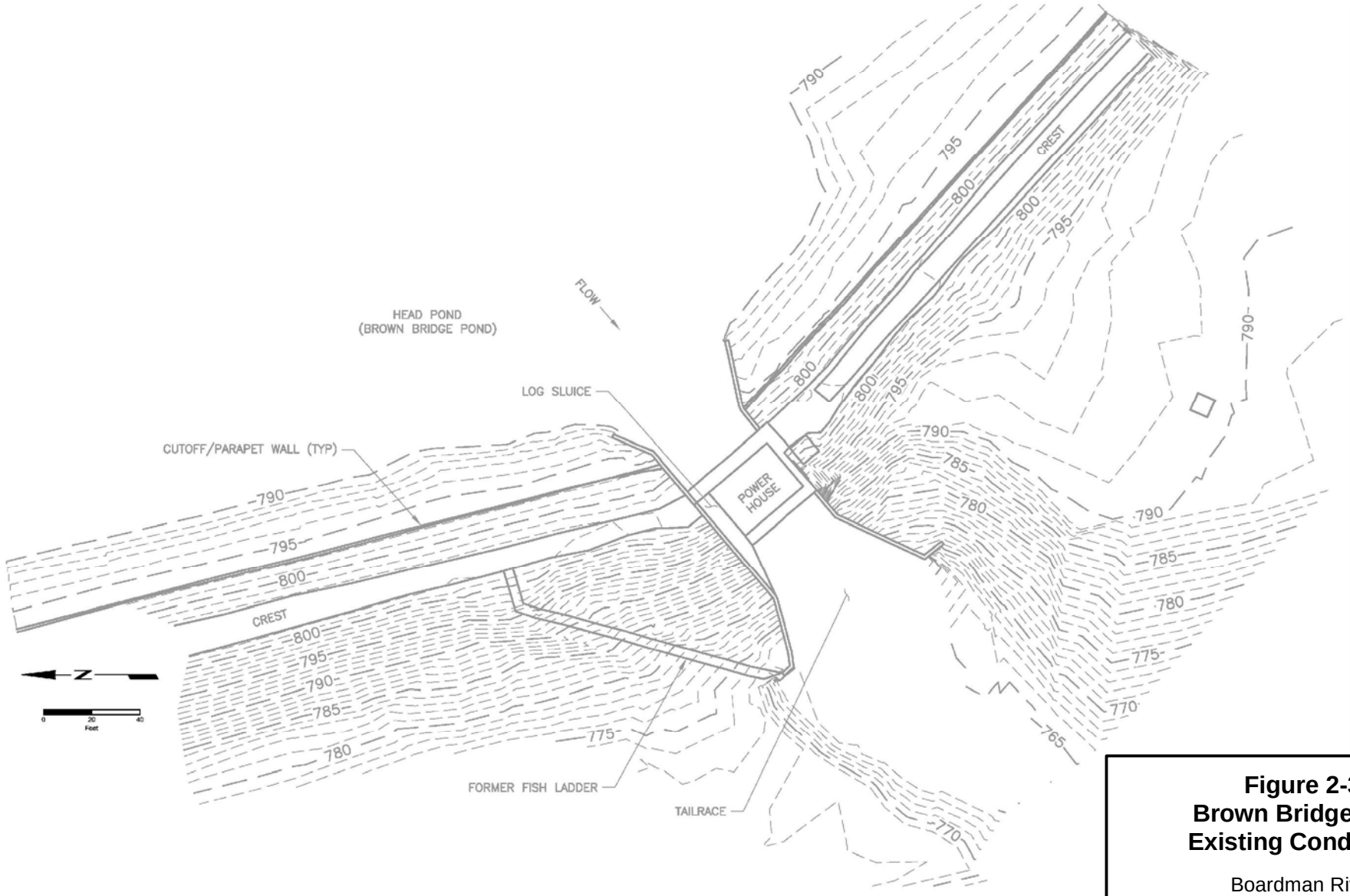


Figure 2-3
Brown Bridge Dam
Existing Conditions

Boardman River
Grand Traverse County, MI

Legend

Ground Surface Contour = 780

Created by: LNT
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

Great Lakes RESTORATION

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_2-03_Existing_Conditions_120201.mxd

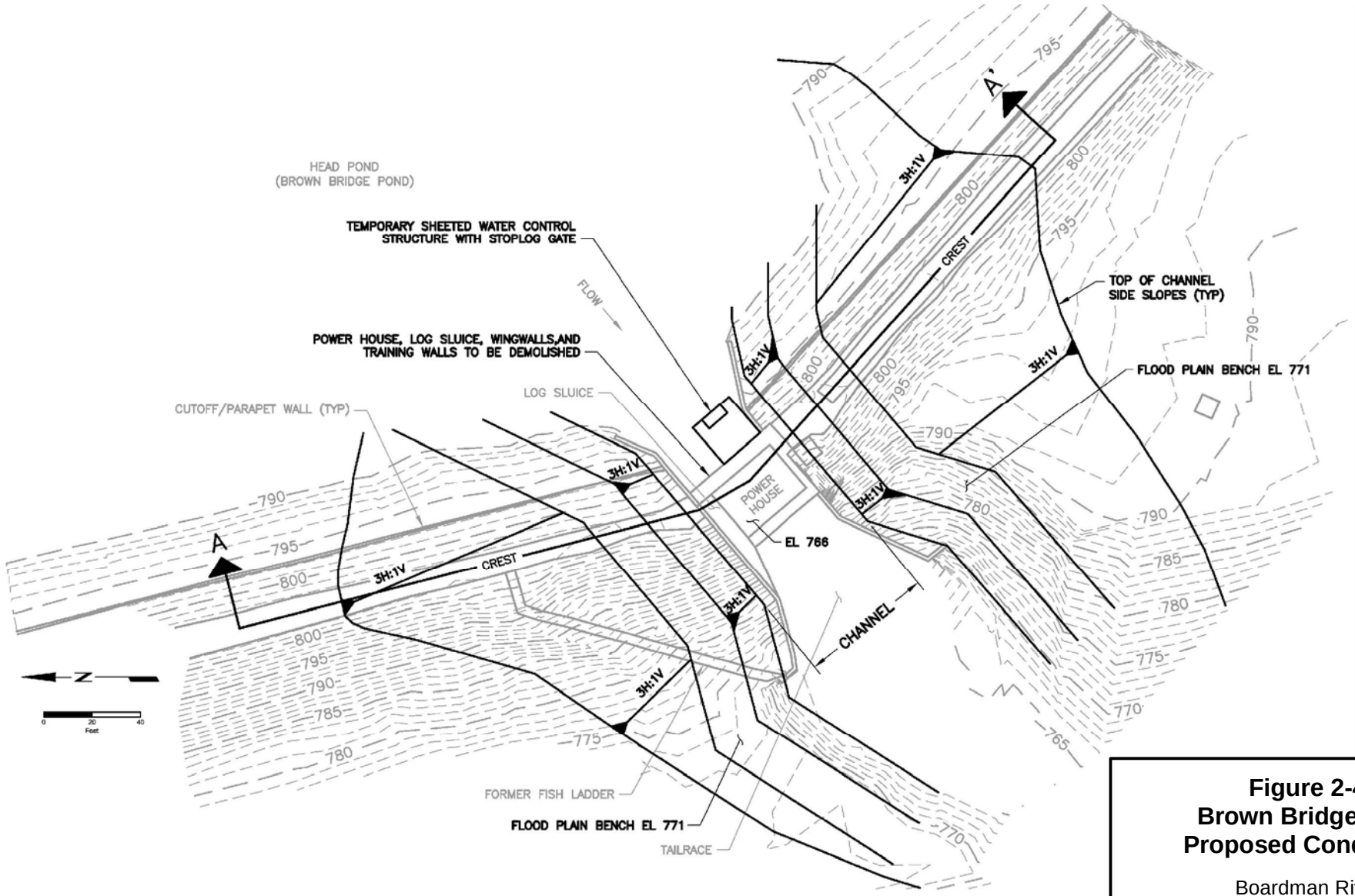


Figure 2-4
Brown Bridge Dam
Proposed Conditions

Boardman River
Grand Traverse County, MI

Legend

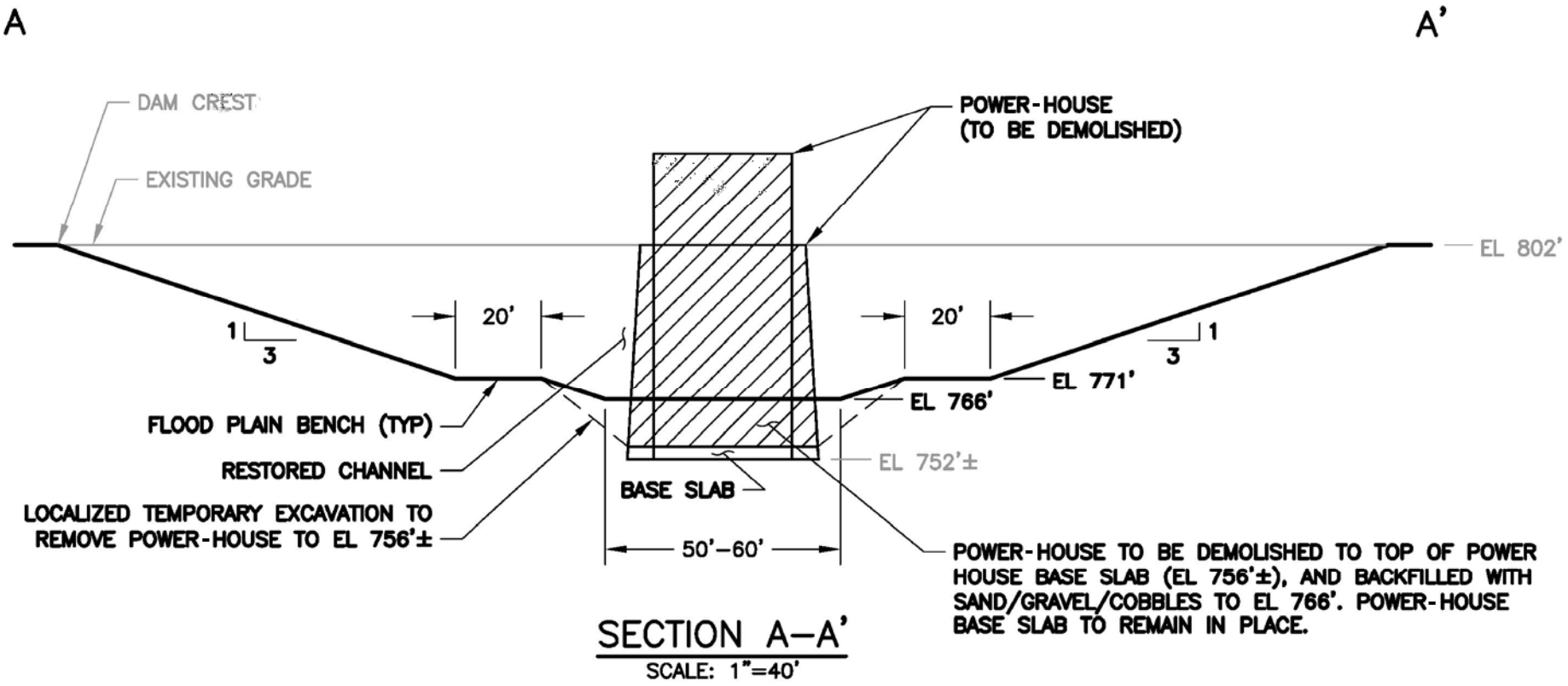
Ground Surface Contour = 780

Permanent Cut Slope

Created by: LNT
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

Great Lakes RESTORATION

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_2-04_Proposed_Conditions_120201.mxd



SECTION A–A'
SCALE: 1"=40'

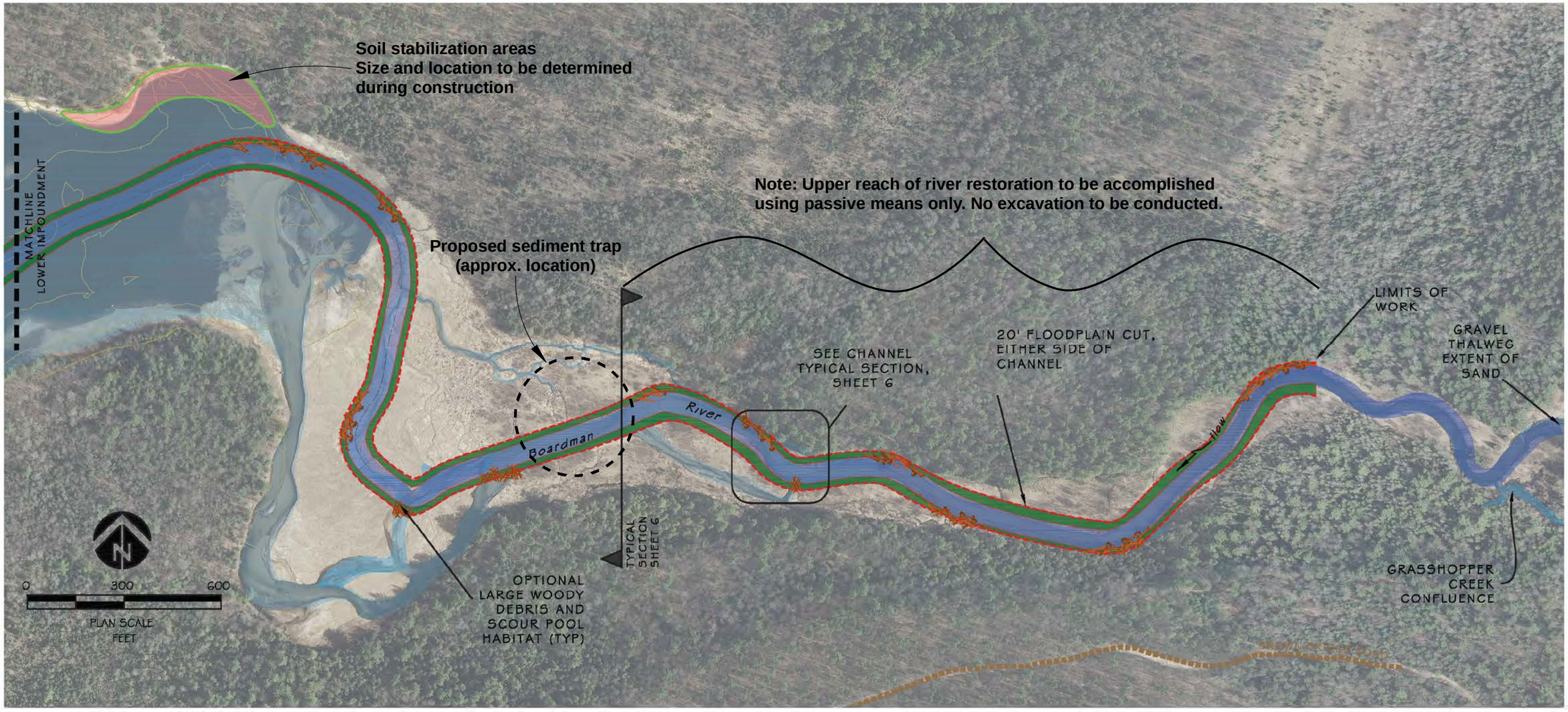
Figure 2-5
Brown Bridge Dam
Proposed Typical
Channel Section

Boardman River
Grand Traverse County, MI

Created by: LNT
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

Great Lakes RESTORATION

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_2-05_Typical_Section_120201.mxd



LEGEND

- Stabilize North Slope – Amend Soil & Hydroseed
- Seed Native Floodplain 20' to Each Side of Channel

Upper Impoundment Restoration Approach

Vegetation
- 20-foot wide actively seeded and planted corridor
- Native seed mix
- Management of invasive plants throughout

In-channel Habitat
- Optional: Large wood installation (50 trees per 500 ft) in the form of small jams and placed key pieces
- Bedforms such as pools, riffles, and runs will develop over several flood events

Channel Banks
- No bank treatment
  Excavation / Sediment Management
- Excavate channel volume and 20-foot wide floodplain bench on either side of the channel (see typical sheet 6)

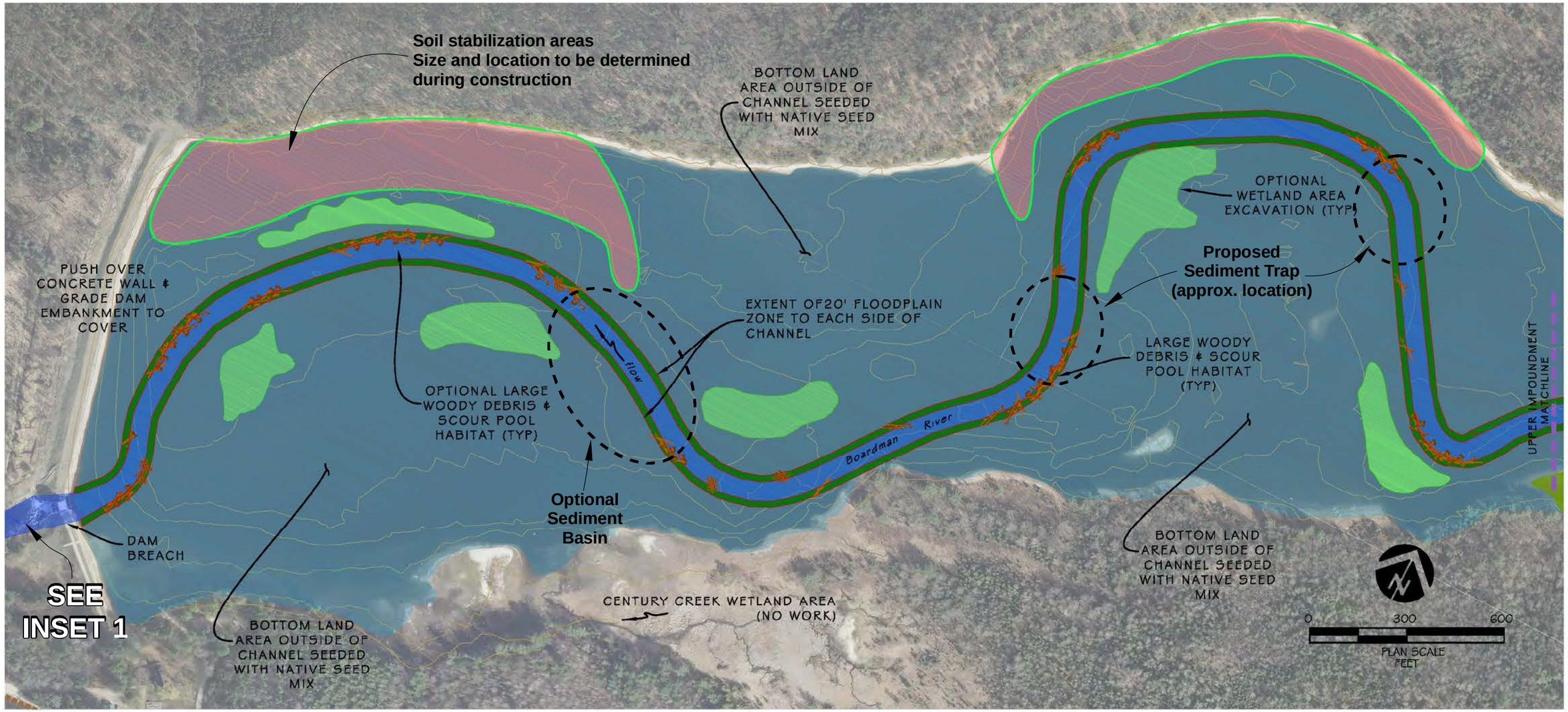
Figure 2-6
Alternative B: Brown Bridge Pond Restoration Approach (Sheet 1 of 2)

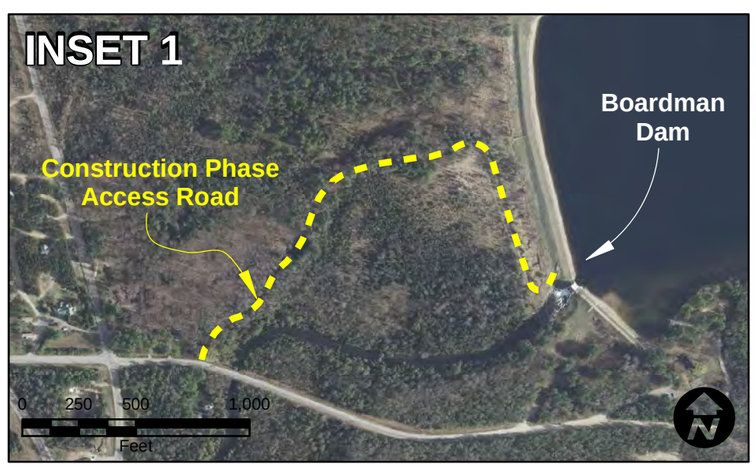
Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 3/12/2012

Source: Inter-Fluve, 2012

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_2-06_Upper_Restoration_120312.mxd





LEGEND

- Stabilize North Slope - Amend Soil & Hydroseed
- Seed Native Floodplain 20' to Each Side of Channel
- Floodplain Wetland (Optional Excavation)

Lower Impoundment Restoration Approach

Vegetation
- 20-foot wide actively seeded and planted corridor·
- Management of invasive plants throughout·
- Native grasses·
- Soil amendment as needed on steep sandy slopes

In-channel Habitat
- Optional: Large wood installation (50 trees per 500 ft) in the form of small jams and placed key pieces
- Bedforms such as pools, riffles, and runs are assumed to persist in the Lower impoundment from pre-dam conditions.

Channel Banks
- No bank treatment

Excavation / Sediment Management
- Assumed to be minimal sediment below the delta in the Lower impoundment. No excavation required
- Optional: Excavation for wetland enhancement

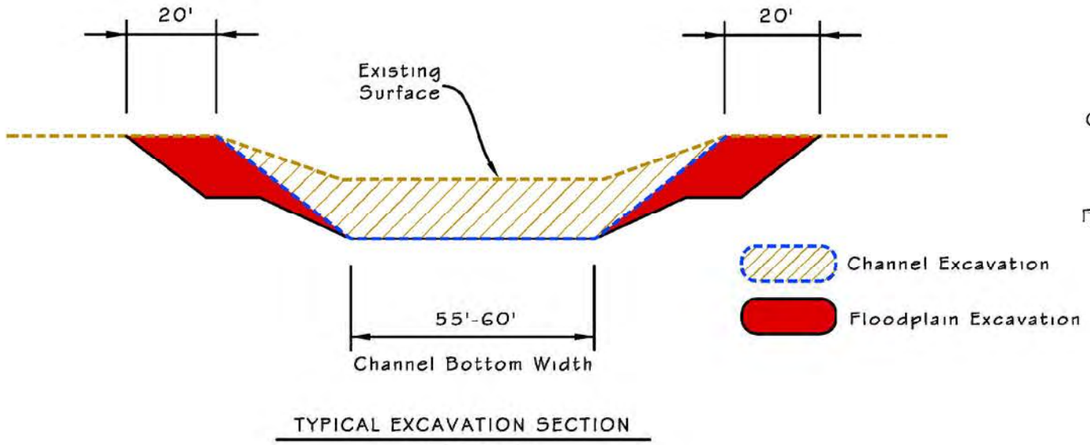
Source: Inter-Fluve, 2012

Figure 2-6
Alternative B: Brown Bridge Pond Restoration Approach (Sheet 2 of 2)

Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 3/12/2012

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_2-06_Lower_Restoration_120312.mxd



TYPICAL EXCAVATION SECTION
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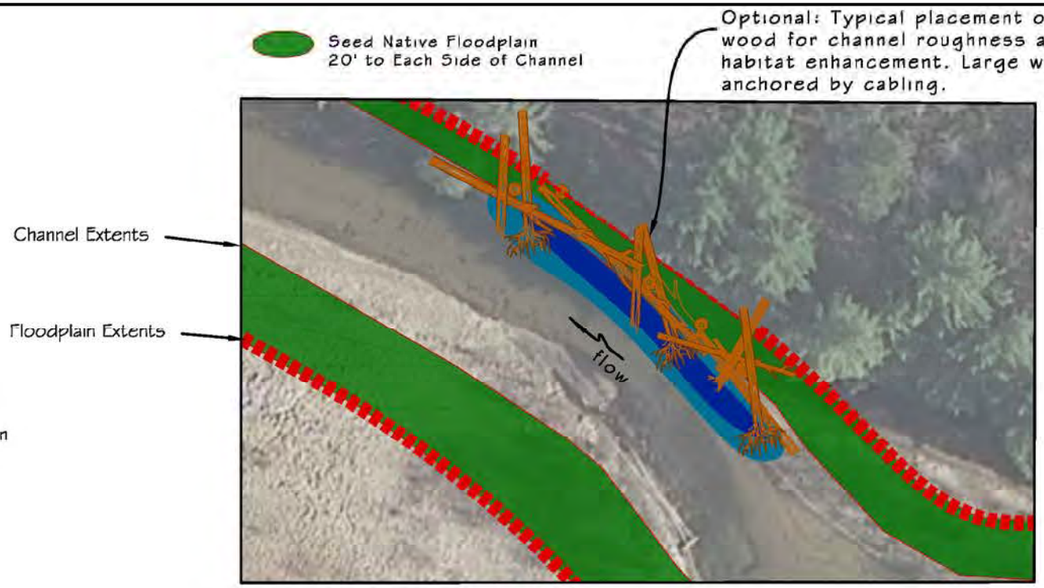
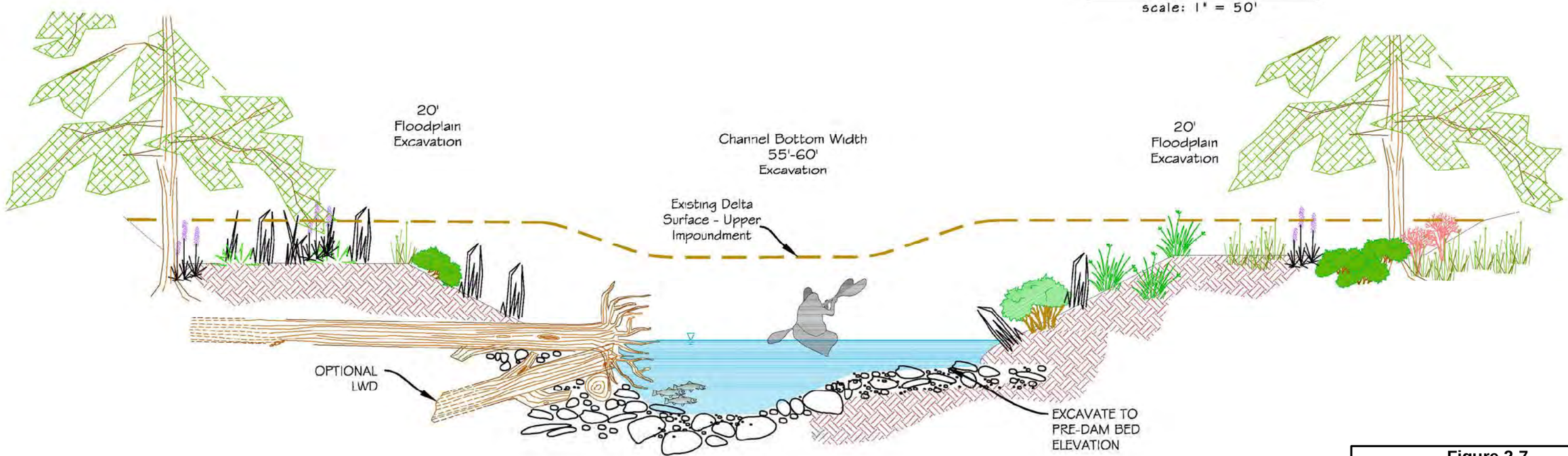


TYPICAL CHANNEL WOOD PLACEMENT DETAIL
scale: 1" = 50'



TYPICAL SECTION
not to scale

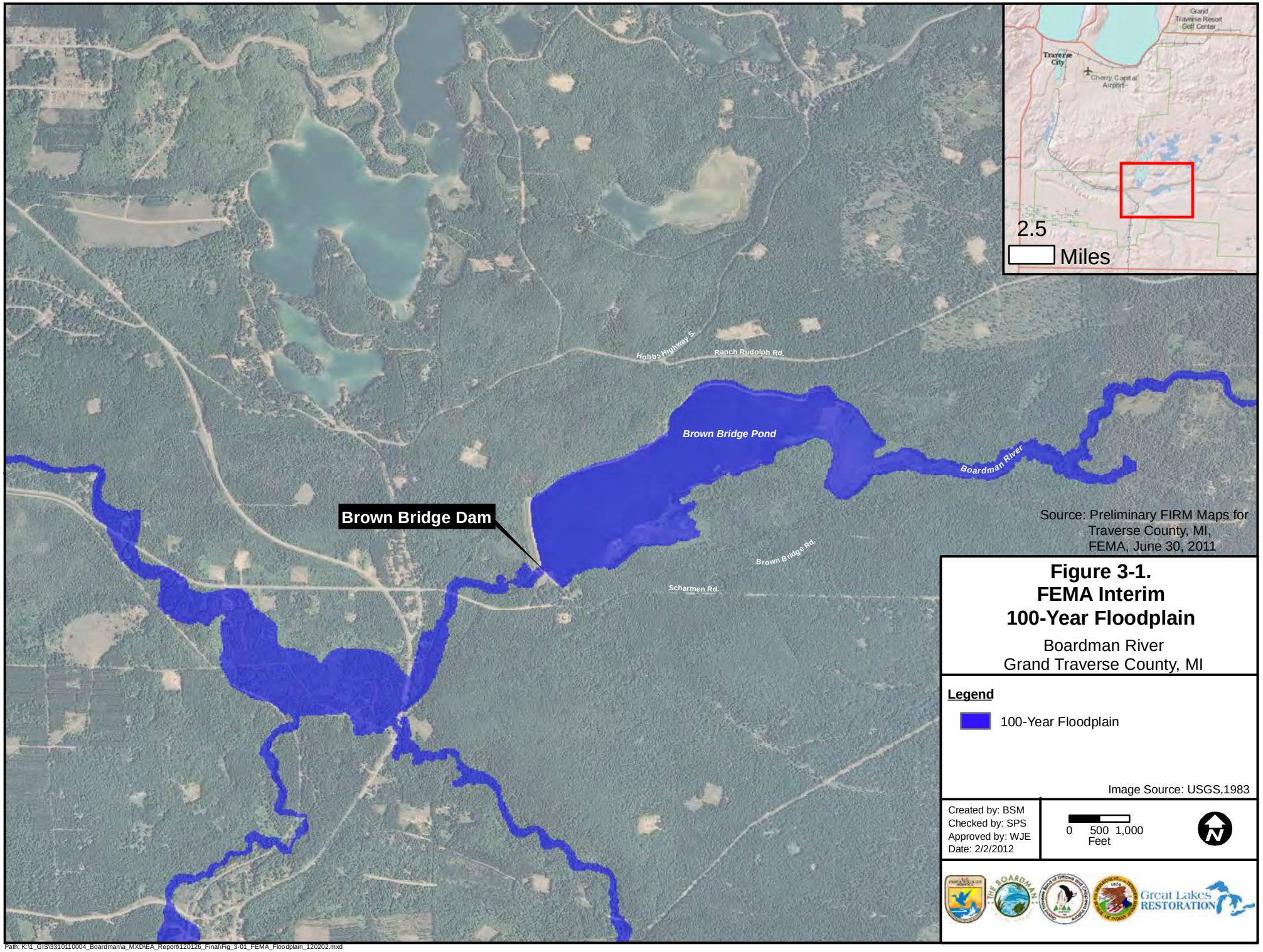
Figure 2-7
Alternative B:
Upper Impoundment Typicals

Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

Source: Inter-Fluve, 2012

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_2-07_Upper_Typicals_120201.mxd



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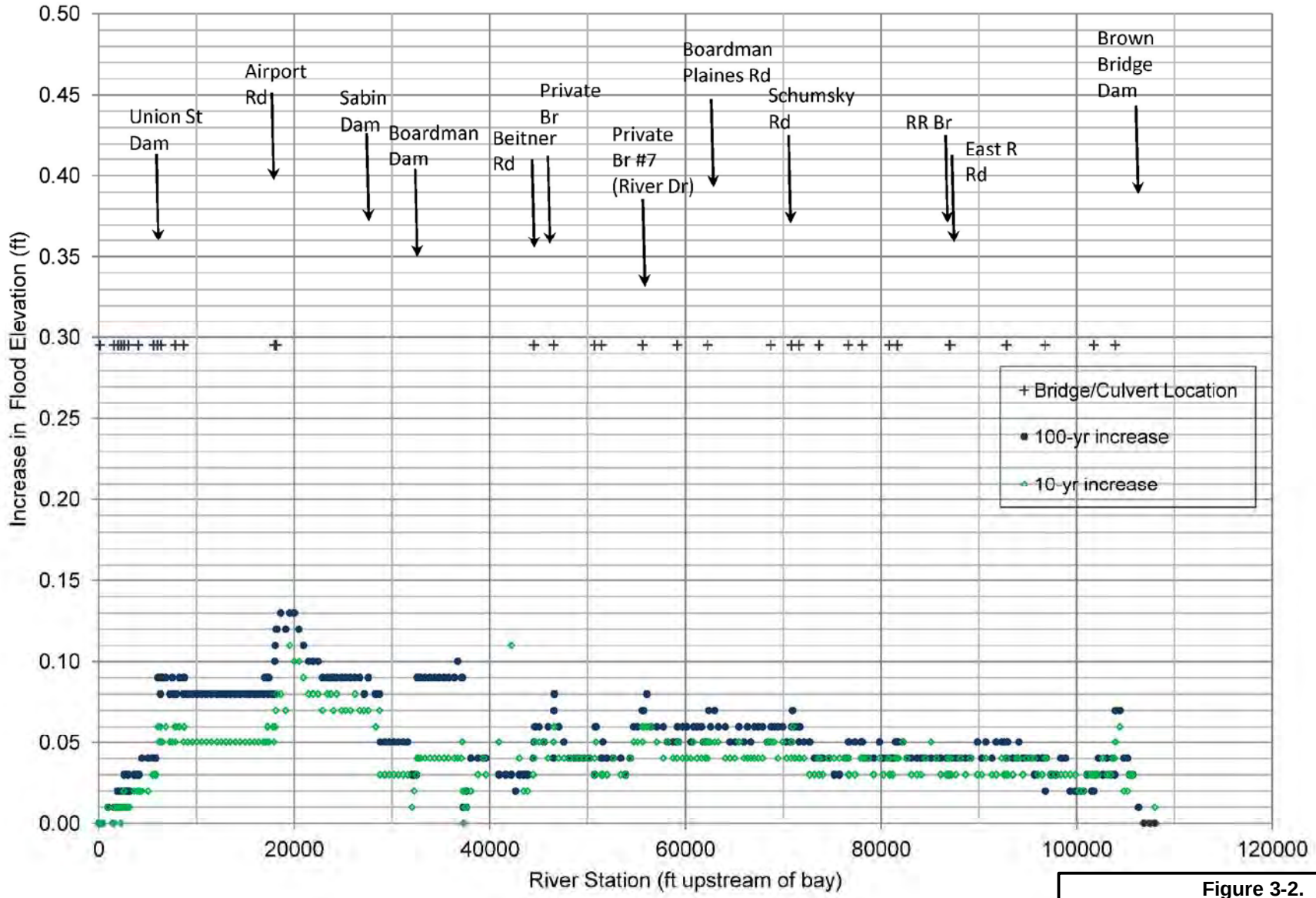


Figure 3-2.
Flood Elevation Increases Based on Flood Discharge Changes with Brown Bridge Dam Removal (USGS Regional Regression Equations)
Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: DWI
Approved by: WJE
Date: 2/1/2012

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_3-02_Flood_Elev_120201.mxd

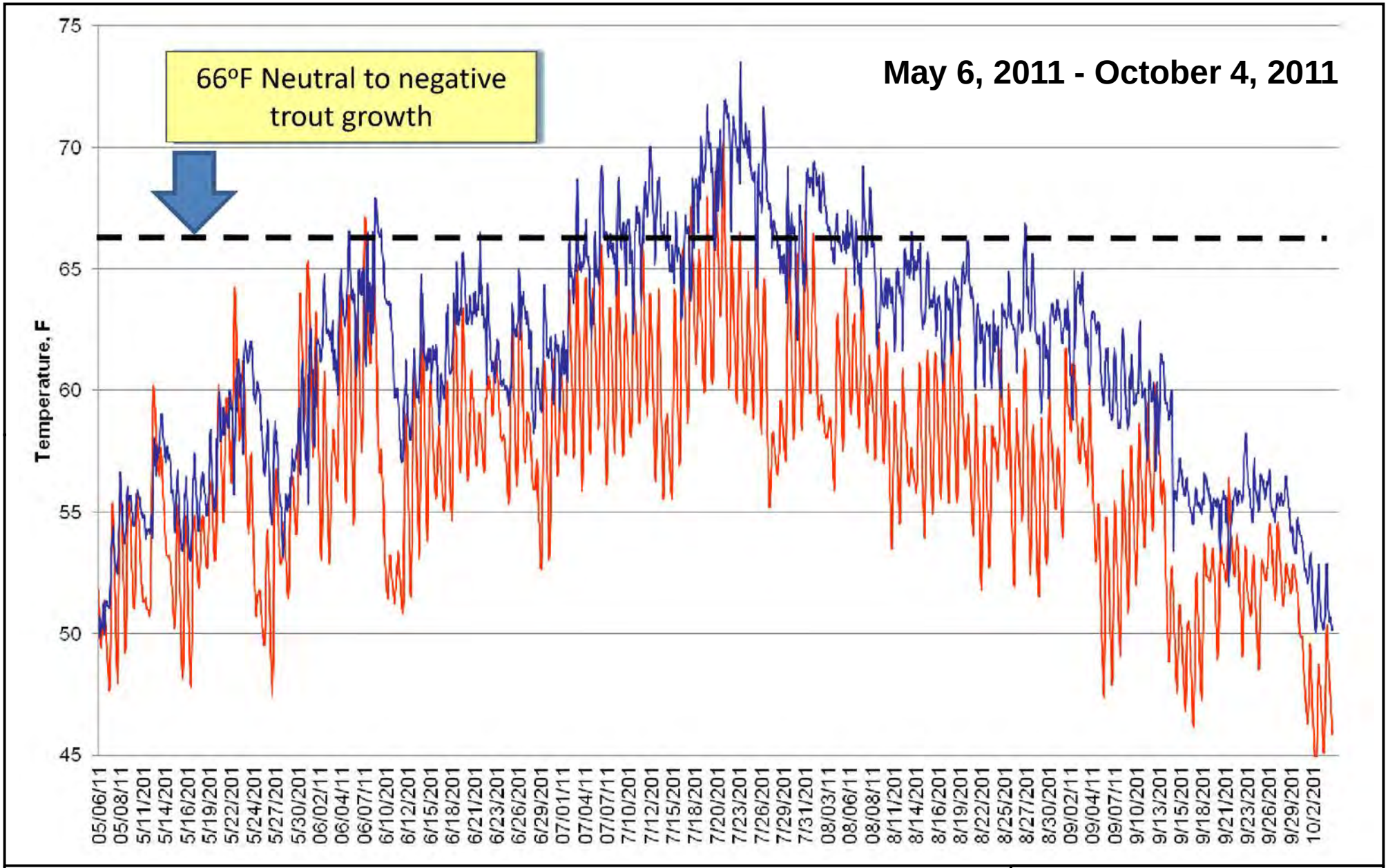


Figure 3-3.
Differences in Boardman River Water Temperature near Brown Bridge Pond

Boardman River
Grand Traverse County, MI

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/3/2012

Source: Steve Largent, GTCD

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_3-03_Water_Temp_120201.mxd

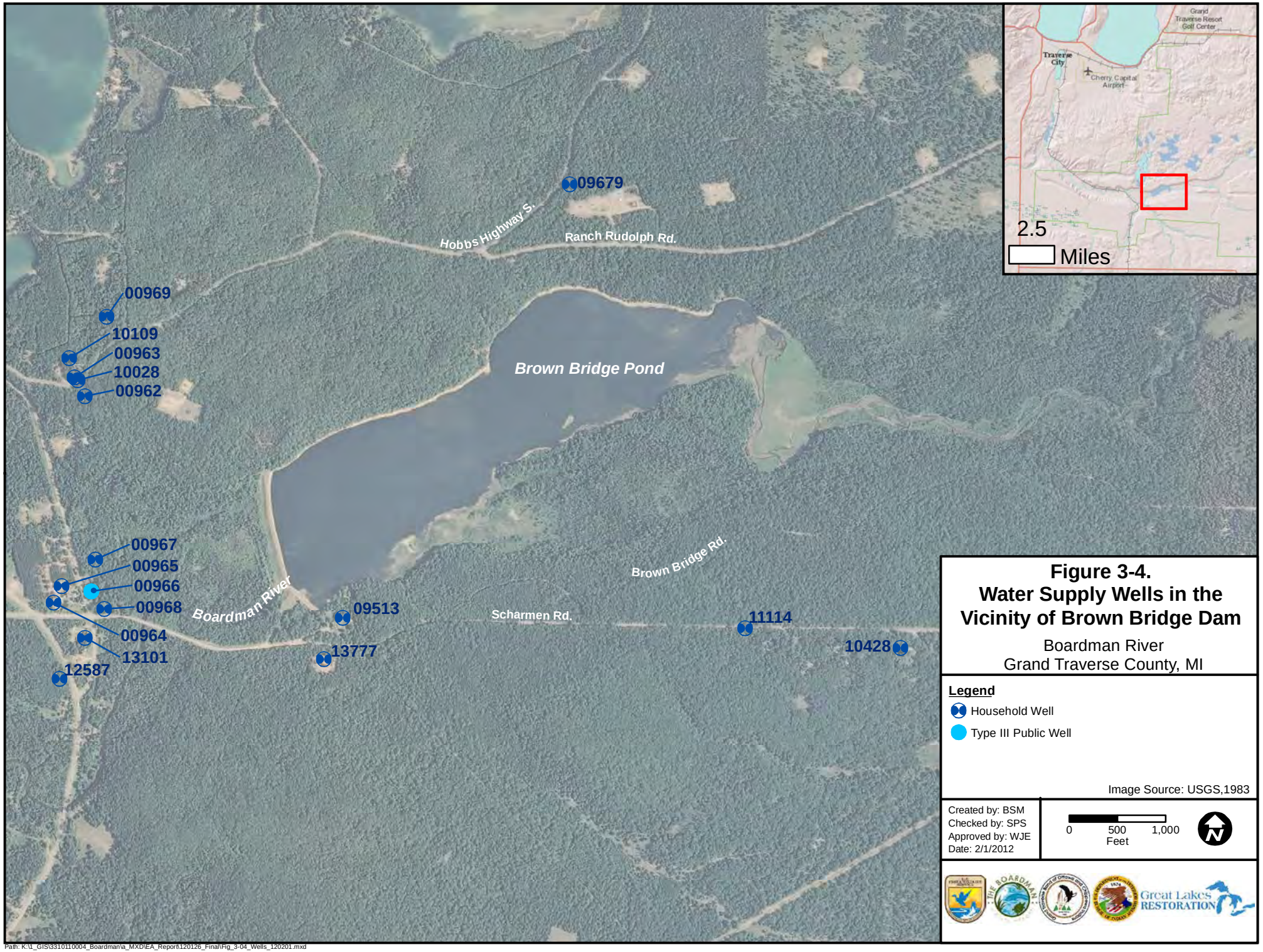


Figure 3-4.
Water Supply Wells in the Vicinity of Brown Bridge Dam

Boardman River
Grand Traverse County, MI

Legend

- Household Well
- Type III Public Well

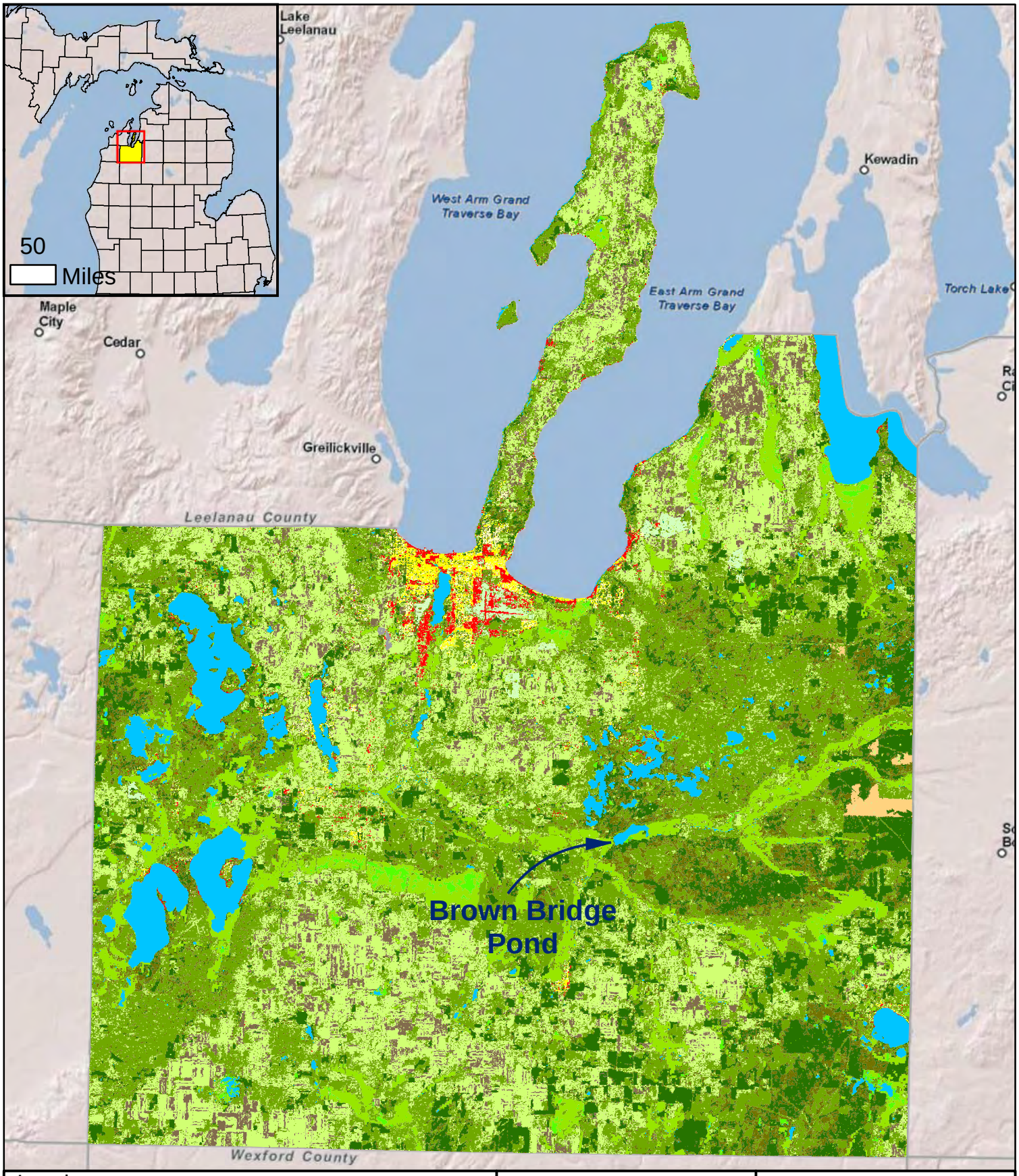
Image Source: USGS,1983

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

0 500 1,000
Feet

Great Lakes RESTORATION

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_3-04_Wells_120201.mxd



Legend

- Bare Rock/Sand/Clay
- Commercial/Industrial/Transportation
- Deciduous Forest
- Emergent Herbaceous Wetlands
- Evergreen Forest
- Grasslands/Herbaceous
- High Intensity Residential
- Low Intensity Residential
- Mixed Forest
- Open Water
- Pasture/Hay
- Quarries/Strip Mines/Gravel Pits
- Row Crops
- Transitional
- Urban/Recreational Grasses
- Wooded Wetland

0 2 4 Miles

Image Source: USGS, 1985

Created by: BSM Approved by: WJE

Checked by: SPS Date: 2/3/2012

Figure 3-5.
Land Use/Land Cover of Grand Traverse County

Boardman River
Grand Traverse County, MI

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_3-05_LULC_120203.mxd

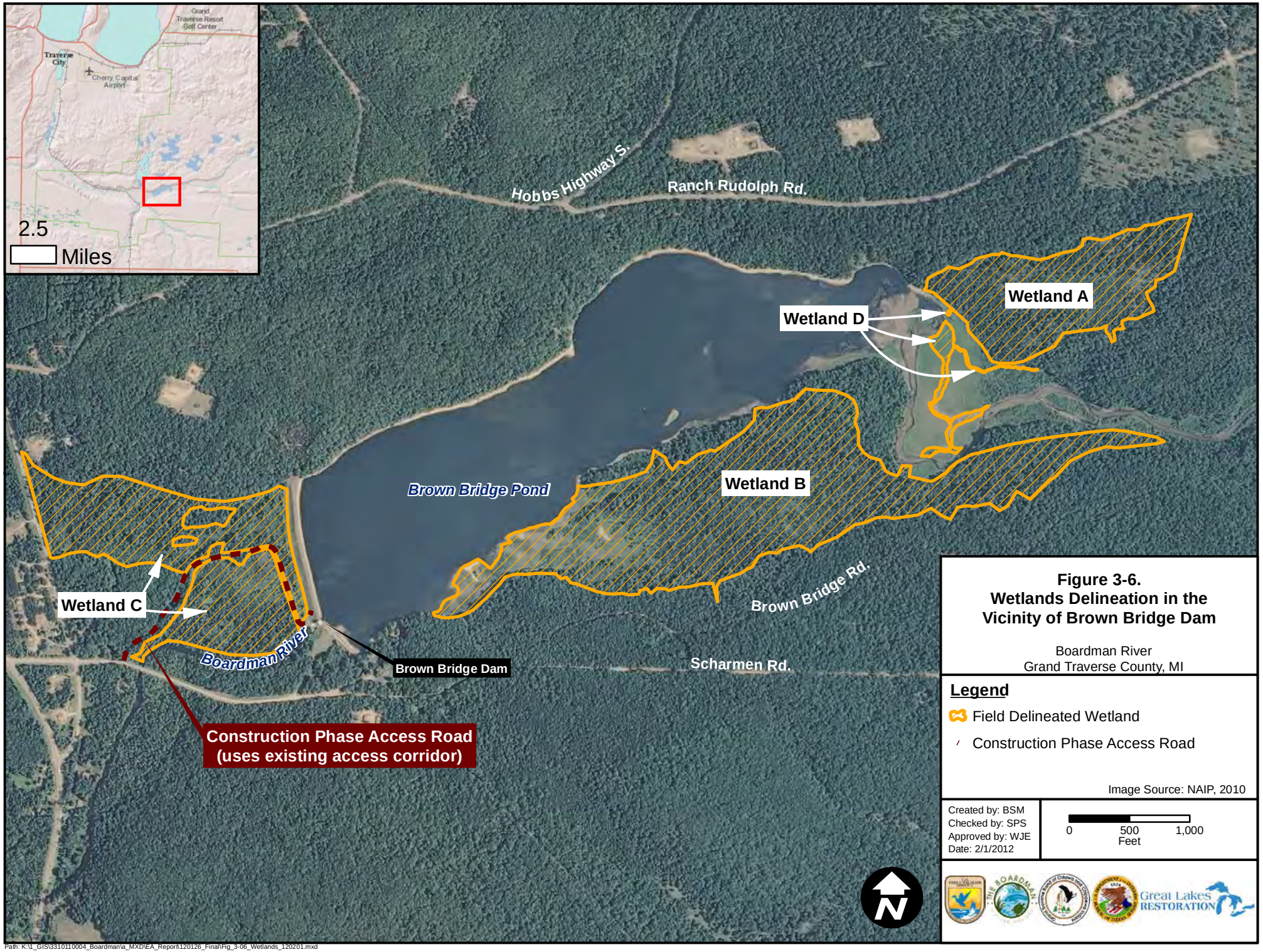


Figure 3-6.
Wetlands Delineation in the Vicinity of Brown Bridge Dam

Boardman River
Grand Traverse County, MI

Legend

- Field Delineated Wetland
- Construction Phase Access Road

Image Source: NAIP, 2010

Created by: BSM
Checked by: SPS
Approved by: WJE
Date: 2/1/2012

0 500 1,000
Feet

Great Lakes RESTORATION

Path: K:\1_GIS\3310110004_Boardman\a_MXD\EA_Report\120126_Final\Fig_3-06_Wetlands_120201.mxd