Issued To:

Grand Traverse County
c/o Ms. Vicki Uppal, Administrator
400 Boardman Avenue
Traverse City, MI 49684

Permit No.: WRP009806 v.1
Submission No.: 2NO-KJ6T-Q1QY
Site Name: Sabin Dam
Issued: January 8, 2018
Revised: January 8, 2020
Expires: January 8, 2020

This permit is being issued by the Michigan Department of Environmental Quality (MDEQ), Water Resources Division, under the provisions of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); specifically:

- Part 301, Inland Lakes and Streams
- Part 303, Wetlands Protection
- Part 315, Dam Safety
- Part 31, Water Resources Protection (Floodplain Regulatory Authority)

Permission is hereby granted, based on permittee assurance of adherence to State of Michigan requirements and permit conditions, to:

Authorized Activity:

Permanently drawdown the Sabin Dam impoundment by a maximum of 14.5 vertical feet, remove the Sabin Dam structure, and restore approximately 4,000 linear feet of Boardman River channel to its natural pre-dammed alignment and configuration. Install in-stream structures including constructed riffles and large wood debris bank stabilization and habitat structures to provide stability and enhanced habitat within the restored channel reach. Excavate approximately 103,106 cubic yards of material, including 57,067 cubic yards below the Ordinary High Water Mark (OHWM) and within the 100-year floodplain of the Boardman River; and place approximately 77,866 cubic yards of material, including 4,000 cubic yards below the OHWM and 16,415 cubic yards within the 100-year floodplain of the Boardman River. Dredge approximately 57,420 cubic yards of material and placement of approximately 77,886 cubic yards of fill in wetland areas, impacting approximately 10.99 acres of exiting wetlands. Stream flows shall be maintained throughout construction.

Waterbody Affected: Boardman River
Property Location: Grand Traverse County, City of Traverse City, Town/Range/Section 27N11W27,
Authority granted by this permit is subject to the following limitations:

A. Initiation of any work on the permitted project confirms the permittee's acceptance and agreement to comply with all terms and conditions of this permit.

B. The permittee, in exercising the authority granted by this permit, shall not cause unlawful pollution as defined by Part 31 of the NREPA.

C. This permit shall be kept at the site of the work and available for inspection at all times during the duration of the project or until its date of expiration.

D. All work shall be completed in accordance with the approved plans and specifications submitted with the application and/or plans and specifications attached to this permit.

E. No attempt shall be made by the permittee to forbid the full and free use by the public of public waters at or adjacent to the structure or work approved.

F. It is made a requirement of this permit that the permittee give notice to public utilities in accordance with 2013 PA 174 (Act 174) and comply with each of the requirements of Act 174.

G. This permit does not convey property rights in either real estate or material, nor does it authorize any injury to private property or invasion of public or private rights, nor does it waive the necessity of seeking federal assent, all local permits, or complying with other state statutes.

H. This permit does not prejudice or limit the right of a riparian owner or other person to institute proceedings in any circuit court of this state when necessary to protect his rights.

I. This permit shall not be assigned or transferred without the written approval of the MDEQ.

J. Failure to comply with conditions of this permit may subject the permittee to revocation of permit and criminal and/or civil action as cited by the specific state act, federal act, and/or rule under which this permit is granted.

K. All dredged or excavated materials shall be disposed of in an upland site (outside of floodplains, unless exempt under Part 31 of the NREPA, and wetlands).

L. In issuing this permit, the MDEQ has relied on the information and data that the permittee has provided in connection with the submitted application for permit. If, subsequent to the issuance of a permit, such information and data prove to be false, incomplete, or inaccurate, the MDEQ may modify, revoke, or suspend the permit, in whole or in part, in accordance with the new information.

M. The permittee shall indemnify and hold harmless the State of Michigan and its departments, agencies, officials, employees, agents, and representatives for any and all claims or causes of action arising from acts or omissions of the permittee, or employees, agents, or representative of the permittee, undertaken in connection with this permit. The permittee's obligation to indemnify the State of Michigan applies only if the state: (1) provides the permittee or its designated representative written notice of the claim or cause of action within 30 days after it is received by the state, and (2) consents to the permittee's participation in the proceeding on the claim or cause of action. It does not apply to contested case proceedings under the Administrative Procedures Act, 1969 PA 306, as amended, challenging the permit. This shall not be construed as an indemnity by the State of Michigan for the benefit of the permittee or any other person.

N. Noncompliance with these terms and conditions and/or the initiation of other regulated activities not specifically authorized shall be cause for the modification, suspension, or revocation of this permit, in whole or in part. Further, the MDEQ may initiate criminal and/or civil proceedings as may be deemed necessary to correct project deficiencies, protect natural resource values, and secure compliance with statutes.

O. If any change or deviation from the permitted activity becomes necessary, the permittee shall request, in writing, a revision of the permitted activity from the MDEQ. Such revision request shall include complete documentation supporting the modification and revised plans detailing the proposed modification. Proposed modifications must be approved, in writing, by the MDEQ prior to being implemented.

P. This permit may be transferred to another person upon written approval of the MDEQ. The permittee must submit a written request to the MDEQ to transfer the permit to the new owner. The new owner must also submit a written request to the MDEQ to accept transfer. The new owner must agree, in writing, to accept all conditions of the permit. A single letter signed by both parties that includes all of the above information may be provided to the MDEQ. The MDEQ will review the request and, if approved, will provide written notification to the new owner.

Q. Prior to initiating permitted construction, the permittee is required to provide a copy of the permit to the contractor(s) for review. The property owner, contractor(s), and any agent involved in exercising the permit are held responsible to ensure that the project is constructed in accordance with all drawings and
specifications. The contractor is required to provide a copy of the permit to all subcontractors doing work authorized by the permit.

R. Construction must be undertaken and completed during the dry period of the wetland. If the area does not dry out, construction shall be done on equipment mats to prevent compaction of the soil.

S. Authority granted by this permit does not waive permit requirements under Part 91, Soil Erosion and Sedimentation Control, of the NREPA, or the need to acquire applicable permits from the County Enforcing Agent (CEA).

T. Authority granted by this permit does not waive permit requirements under the authority of Part 305, Natural Rivers, of the NREPA. A Natural Rivers Zoning Permit may be required for construction, land alteration, streambank stabilization, or vegetation removal along or near a natural river.

U. The permittee is cautioned that grade changes resulting in increased runoff onto adjacent property is subject to civil damage litigation.

V. Unless specifically stated in this permit, construction pads, haul roads, temporary structures, or other structural appurtenances to be placed in a wetland or on bottomland of the water body are not authorized and shall not be constructed unless authorized by a separate permit or permit revision granted in accordance with the applicable law.

W. For projects with potential impacts to fish spawning or migration, no work shall occur within fish spawning or migration timelines (i.e., windows) unless otherwise approved in writing by the Michigan Department of Natural Resources (MDNR), Fisheries Division.

X. Work to be done under authority of this permit is further subject to the following special instructions and specifications:

1. All dam construction shall be completed in accordance with the design plans prepared by AECOM and Inter-Fluve, Incorporated, dated May 11, 2017.

2. All dam construction activities must be conducted under the knowledge and supervision of a licensed professional engineer.

3. If any change or deviation from the permitted activity becomes necessary, the permittee shall request, in writing, a revision of the permitted activity and/or mitigation plan from the MDEQ. Such revision requests shall include complete documentation supporting the modification and revised plans detailing the proposed modification. Proposed modifications must be approved, in writing, by the MDEQ prior to being implemented.

4. This permit may be transferred to another person upon written approval of the MDEQ. The permittee must submit a written request to the MDEQ to transfer the permit to the new owner. The new owner must also submit a written request to accept transfer of the permit. The new owner must agree, in writing, to accept all conditions of the permit. A single letter signed by both parties which includes all the above information may be provided to the MDEQ. The MDEQ will review the request and if approved, will provide written notification to the new owner.

5. A permit may be extended for cause, however, the life of this permit may not exceed five (5) years. To request an extension of a permit, a written request must be submitted to the MDEQ before the expiration date of the permit. The request must indicate the reasons for the extension. The MDEQ will review the request and, if approved, provide written notification to the permittee.

6. Any modification or revision to the approved design plans and/or specifications must be approved, in writing, by the WRD, MDEQ.

7. The permittee shall furnish notification of the start of construction to the WRD, MDEQ, five (5) days prior to commencement of construction. Contact Mr. Lucas Trumble, P.E., at 517-420-8923 or trumblel@michigan.gov.

8. A final Monitoring and Maintenance Plan for the restored river channel, including in-stream structures, shall be submitted to, and approved by, the MDEQ prior to commencement of construction.
9. Prior to initiating construction, authorized by this permit, the permittee is required to provide a copy of
the permit to the contractor(s) for review.

10. Prior to initiation of construction, a pre-construction meeting shall be held with the contractor, permittee
or her/his representative(s), and representatives of the MDEQ. To arrange the required meeting,
please contact Mr. Lucas Trumble, P.E. at 517-420-8923 or by e-mail at trumblel@michigan.gov.

11. It is advised that proper caution signs and/or buoys be placed at the upstream end of the project
and near the dam to prevent endangerment of recreational users.

12. Prior to the initiation of any permitted construction activities, a siltation barrier shall be constructed
immediately downstream of the construction site. Siltation barriers shall be specifically designed to
handle the sediment type, load, water depth, and flow conditions of each construction site throughout
the anticipated time of construction and unstable site conditions. The siltation barrier shall be
maintained in good working order throughout the project's duration. Upon project completion, the
accumulated materials shall be removed and disposed of at an upland (non-wetland, non-floodplain)
site. The siltation barrier shall then be removed in its entirety and the area restored to its original
configuration and cover.

13. Prior to the initiation of any permitted construction activities, a "fabric" erosion control fence (straw bales
are not acceptable) shall be installed immediately adjacent to the wetland boundary along the entire
length of the wetland area within the construction site. This erosion barrier shall be maintained in good
working order throughout the duration of the project. Upon project completion, the accumulated
materials shall be removed and disposed of at an upland site. The erosion barrier shall then be
removed in its entirety and the area restored to its original configuration and cover.

14. Prior to the commencement of any demolition authorized by this permit, the work areas shall be
isolated by a downstream turbidity curtain to prevent off-site siltation. The turbidity curtain shall be
installed to extend from the bed of the waterbody to a point above the existing water's surface. The
turbidity curtain shall be maintained for the duration of the project and shall be left in place after the
completion of dredging until all disturbed sediments have settled.

15. The use of explosives for removal of the structure over the waterbody, including any abutments or
piers, is strictly prohibited.

16. All slurry resulting from any dewatering operation shall be discharged through a filter bag or pumped to
a sump located away from wetlands and surface waters and allowed to filter through natural upland
vegetation, gravel filters, or other engineered devices for a sufficient distance and/or period of time
necessary to remove sediment or suspended particles. The discharge of slurry water resulting from the
hydro-demolition of concrete is not allowed to enter a lake, stream, or wetland.

17. Historic artifacts could occur on or near this project site and may be impacted by your activities. If
during the course of construction, artifacts are encountered, immediately contact the Office of the State
Archaeologist, at 517-373-6358.

18. Except as provided for in this permit, all dredge/excavated spoils, including organic and inorganic soils,
vegetation, and other material removed shall be placed on upland (non-wetland, non-floodplain or non-
bottomland) areas, prepared for stabilization, and stabilized with sod and/or seed and mulch in such a
manner to prevent and ensure against erosion of any material into any waterbody, wetland, or
floodplain.

19. All raw areas within 100 feet of a lake, stream, or wetland that is not brought to final stabilization by the
end of the active growing season shall be temporarily stabilized with mulch blankets in accordance with
the following dates: September 20th for the Upper Peninsula, October 1st for the Lower Peninsula
20. Drawdown of the impoundment shall not exceed 1.0 vertical foot of elevation in a 24-hour period.

21. The permittee shall provide passage of flow during and after construction. During periods of low flow, the permittee shall provide a minimum flow release approximately equivalent to the stream flow into the impoundment.

22. The permittee is hereby cautioned that any unlawful discharge of sediment into waters of the state is a violation of Part 31 of the NREPA. Any sedimentation caused by construction or use of the permitted structures subjects the permittee to provisions of Part 31.

23. All raw areas in uplands resulting from the permitted construction activity shall be promptly and effectively stabilized with sod and/or seed and mulch (or other technology specified by this permit or project plans) in a sufficient quantity and manner so as to prevent erosion and any potential siltation to surface waters or wetlands. Temporary stabilization measures shall be installed before or upon commencement of the permitted activity, and shall be maintained until permanent measures are in place. Permanent measures shall be in place within five (5) days of achieving final grade.

24. If the project, or any portion of the project, is stopped and lies incomplete for any length of time other than that encountered in a normal work week, every precaution shall be taken to protect the incomplete work from erosion, including the placement of temporary gravel bag riprap or other acceptable temporary protection.

25. No fill, excess soil, or other material shall be placed within the 100-year floodplain, any wetland, or surface water area not specifically authorized by this permit, its plans, and specifications.

26. Unless specifically stated under the “Permitted Activity” of this permit, construction pads, haul roads, temporary structures, or other structural appurtenances to be placed in a wetland or on bottomland of the waterbody are not authorized and shall not be constructed unless authorized by a separate permit or permit revision granted in accordance with the applicable law.

27. The pre-construction design flood or 100-year floodplain elevation on the Boardman is 615.69 feet NAVD88 at the downstream end of Cass Road bridge and is 596.88 feet NAVD88 at the downstream limits of the proposed work area. The proposed post-construction design flood or 100-year floodplain elevation on the Boardman River is 616.40 feet NAVD88 at the downstream end of Cass Road bridge and 596.88 feet NAVD88 at the downstream limits of the proposed work area. The proposed floodplain area is contained within the permittee's property boundaries. The 100-year floodplain elevation determination was based on the hydraulic analysis provided with the permit application and using MDEQ approved flow discharges.

28. During removal of the existing structures, every precaution shall be taken to prevent debris from entering any watercourse. Any debris reaching the watercourse during the removal and/or reconstruction of the structure shall be immediately retrieved from the water. All material shall be disposed of in an acceptable manner consistent with local, state, and federal regulations.

29. All fill/backfill shall consist of clean inert material which will not cause siltation nor contain soluble chemicals, organic matter, pollutants, or contaminants. All fill shall be CONTAINED in such a manner so as not to erode into any surface water, floodplain, or wetland. All raw areas with high erosion potential associated with the permitted activity shall be STABILIZED with sod and/or seed and mulch, riprap, or technology specified by this permit or project plans as necessary to prevent erosion and in compliance with Part 91 of the NREPA.
30. Wetland fill shall consist of inert materials, which will not cause siltation nor contain soluble chemicals or organic matter, which is biodegradable. All fill shall be contained in such a manner as not to erode into any watercourse and/or wetland. All raw banks shall be stabilized with native wetland seed and lightly mulched (maximum 4-inches deep) as necessary to prevent erosion.

31. Side-slopes adjacent to wetland areas shall be 3:1 or gentler; 2:1 side-slopes adjacent to wetland areas are not acceptable under any circumstances.

32. Equalization and temporary culverts shall be a minimum of 18 inches in diameter, installed at the proper elevation for the purpose of water level equalization and must be buried 20 percent of the culvert diameter. The culvert shall provide for the free flow of surface water or the movement of organisms between portions of a wetland system. The culvert shall not increase drainage of any existing wetland areas.

33. Excess soil materials from the project shall not be deposited in wetlands or surface water without first securing a permit under the NREPA, Part 303, Wetlands Protection, or other applicable statute. All excess soil material shall be placed on upland site, mulched, and/or seeced to prevent erosion into waters or wetlands.

34. All riprap shall be properly sized and graded based on wave action and velocity, and shall consist of natural field stone or rock (free of paint, soil, or other fines, asphalt, soluble chemicals, or organic material). Broken concrete is not allowed.

35. All dredge/excavated spoils including organic and inorganic soils, vegetation, and other material removed shall be placed in such a manner so as to prevent and ensure against erosion of any material into any waterbody, wetland, or floodplain, see permit plans.

36. Exposed streambanks resulting from this construction shall be stabilized with temporary measures in accordance with appropriate Best Management Practices based on site conditions and, if necessary, may be riprapped extending above the OHWM to provide adequate erosion protection. Temporary stabilization measures shall be maintained until permanent measures are in place.

37. All other exposed slopes, ditches, and other raw areas draining directly to the stream may be protected with riprap, sod, and/or seed and mulch as may be necessary to provide effective erosion protection. The placement of riprap shall be limited to the minimum necessary to ensure proper stabilization of side slopes and fill in the immediate vicinity of the structure.

38. All natural and engineered stabilization materials shall be firmly staked and otherwise secured using biodegradable materials to prevent movement due to wind, waves, high water, or ice. Vegetation, including plantings and other potentially viable material such as live stakes, brush bundles, or other gathered woody material, shall be comprised only of plant species native to Michigan according to the Floristic Quality Assessment for the State of Michigan and appropriate to the site. Engineered plant material such as jute and coconut fabric, shall be comprised of inert plant fiber that may be nonnative.

39. Any temporary fill placed within the 100-year floodplain shall be promptly removed upon completion of the project and pre-existing grades shall be restored.

40. The temporary easement access road fill and culverts shall be removed by the end of the easement period and the wetland restored to original grade and with native wetland seed and lightly mulched (maximum 4-inches deep) as necessary to prevent erosion.

41. The permittee is responsible for acquiring all necessary easements or rights-of-way before commencing any work authorized by this permit. All construction operations relating to or part of this project shall be confined to the existing right-of-way limits or other acquired easements.
42. The permittee is cautioned that grade changes resulting in increased runoff onto adjacent property is subject to civil damage litigation.

43. Fill shall not be placed to prevent surface water drainage across the site. Site runoff shall be directed to public or natural drainage ways and not unnaturally discharged onto adjacent properties.

44. No work shall be done in the stream during periods of above-normal flows except as necessary to prevent erosion.

45. Habitat structures shall not extend more than 25 percent of the width of the stream.

46. Structures shall be anchored securely to prevent the creation of navigational hazards.

47. Vegetation, including plantings and other potentially viable material such as live stakes, brush bundles or other gathered woody material, shall be comprised only of plant species that are considered native to Michigan according to the Floristic Quality Assessment for the State of Michigan.

48. Engineered plant material, such as jute, wattles, coconut fabric or logs, shall be comprised of inert plant fiber that may be non-native.

49. Immediately prior to beginning the project the contractor shall pressure wash or steam clean any wheeled or tracked vehicles that will be used to work in the water.

50. Immediately prior to beginning the project the contractor shall evaluate wheeled and tracked vehicles that will be used to work in the water for gas or oil leaks and/or other defects and shall rectify any leaks or defects identified prior to bringing any vehicles into the water.

51. Use or placement of the spoils shall be done in such a manner to prevent nuisance conditions and control the release of fugitive dust or visible emissions as required by Part 55, Air Pollution Control, of the NREPA, or the rules promulgated under this Act.

52. The spoils shall not be mixed with other waste or materials that are not inert as defined in Part 115, Solid Waste Management, of the NREPA.

53. The provisions of this permit do not preclude the permittee from disposal of the spoils in accordance with Part 115 at a properly licensed Type II solid waste disposal facility or at an out-of-state facility in accordance with the State's solid waste disposal regulations.

54. The permittee shall control invasive plant species in all exposed previously submerged bottomland areas planted with native plant species, using appropriate techniques and in accordance with all applicable local, state, and federal regulations, for a period of three years from the project completion. Permittee shall submit annual photo documentation of these restored bottomland areas to the MDEQ's Cadillac District Office.

55. This stream falls under the authority of Part 305, Natural Rivers, of the NREPA. Authority granted by this permit does not waive permit requirements under the authority of Part 305. A Natural Rivers Zoning Permit may be required for construction, land alteration, streambank stabilization, or vegetation removal along or near the river. Authorization under Part 305 must be obtained prior to beginning the work authorized by this permit. For information regarding a Natural River Zoning Permit, please contact Mr. Patrick Ertel, MDNR, Fisheries Division, Gaylord Operations Service Center, 1732 West M-32, Gaylord, Michigan 49735-8177, at 989-732-3541, ext. 5047.

56. The permittee shall furnish a written statement from a professional engineer, certifying that he has supervised the removal of the dam and that it was removed in accordance with the plans and specifications approved by the WRD, MDEQ.
57. The permittee shall submit a final engineering report to the Dam Safety Program, WRD, which shall include, but not be limited to, documentation of the extent of construction, results of construction material testing, soil boring logs, test pit data collection, summaries of instrumentation monitoring for the construction, and other pertinent project information. The report shall also include a set of final project drawings documenting the extent of construction, signed and sealed by a professional engineer licensed in the State of Michigan.

58. Final approval of the dam removal will not be granted until a site inspection by the MDEQ has confirmed that the dam has been removed in accordance with the approved plans and specifications.

59. For projects within the known range of Eastern Massasauga Rattlesnake (EMR), but outside of Tier 1 and Tier 2 habitat:

To help ensure your project is unlikely to affect EMR:

a) Project applies the General Best Management Practices:

(1) Use wildlife-safe materials for erosion control and site restoration (See Erosion Control Resources side panel, page 4). By January 1, 2019, eliminate the use of erosion control products containing plastic mesh netting or other similar material that could ensnare EMR (within the known range but outside of Tier 1 or Tier 2 habitat).

(2) To increase human safety and awareness of EMR, those implementing the project should first watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video (available at https://youtu.be/-PFnXe_e02w), or review the EMR factsheet (available at https://www.fws.gov/midwest/endangered/reptiles/eama/pdf/EMRfactsheetSept2016.pdf or by calling 517-351-2555.

(3) Require reporting of any EMR observations, or observation of any other listed threatened or endangered species, during project implementation to the Service within 24 hours.

b) Project will not have significant impacts to dispersal, connectivity, or hydrology of existing EMR potential habitat, i.e., filling less than 1 acre of wetland habitat or converting less than 20 acres of uplands of potential EMR habitat (uplands associated with high quality wetland habitat) to other land uses.

60. Noncompliance with these terms and conditions, and/or the initiation of other regulated activities not specifically authorized by this permit shall be cause for the modification, suspension, or revocation of this permit, in whole or in part. Further, the MDEQ may initiate criminal and/or civil proceedings as may
be deemed necessary to correct project deficiencies, protect natural resource values, and secure compliance with statutes.

61. In issuing this permit, the MDEQ has relied on the information and data, which the permittee has provided in connection with the permit application. If, subsequent to the issuance of this permit, such information and data prove to be false, incomplete or inaccurate, or additional information demonstrates that the spoils are causing environmental contamination or that new State or Federal regulations are promulgated which cause this disposal to be inappropriate, the MDEQ may modify, revoke, or suspend the permit, in whole or in part, in accordance with the new information.

62. The permittee shall indemnify and hold harmless the State of Michigan and its departments, agencies, officials, employees, agents and representatives for any and all claims or causes of action arising from acts or omissions of the permittee, or employees, agents, or representatives of the permittee, undertaken in connection with this permit. This permit shall not be construed as an indemnity by the State of Michigan for the benefit of the permittee or any other person.

63. Authority granted by this permit does not waive permit requirements under the Natural Resource and Environmental Protection Act, Part 91 - Soil Erosion and Sedimentation Control at (231) 995-6042.

64. The authority to conduct the activity as authorized by this permit is granted solely under the provisions of the governing act as identified above. This permit does not convey, provide, or otherwise imply approval of any other governing act, ordinance, or regulation, nor does it waive the permittee's obligation to acquire any local, county, state, or federal approval or authorization necessary to conduct the activity.

65. This permit does not authorize or sanction work that has been completed in violation of applicable federal, state, or local statutes.

66. The permit placard shall be kept posted at the work site, in a prominent location at all times for the duration of the project, or until permit expiration.

This permit shall become effective on the date of the MDEQ representative's signature. Upon signing by the permittee named herein, this permit must be returned to the MDEQ's, WRD, Hydrologic Studies and Dam Safety Unit, for final execution.
Permittee hereby accepts and agrees to comply with the terms and conditions of this permit.

X Vicki Uppal 1-5-18
Permittee Date

X Vicki, Uppal, County Administrator
Printed Name and Title of Permittee

Issued By: Lucas A. Trumble, P.E.
Hydrologic Studies and Dam Safety Unit
Water Resources Division
517-420-8923

cc: City of Traverse City Clerk
Grand Traverse County Drain Commissioner
Grand Traverse County CEA
Mr. Dan DeVau, P.E., AECOM
Ms. Susan Conrason, P.E., MDEQ
Ms. Robyn Schmidt, MDEQ
3. PROJECT DESCRIPTION

The figures below are included to provide a better understanding of the dam breaching operation and sequencing. The dam breaching sequence consists of the following:

1. Remove spillway concrete structure down to WSE at time of construction (~609’). Excavate sediment out from in front of spillway inlet to facilitate river flow. Install sediment trap upstream of spillway. [Stage 1]

2. Continue demolition of spillway concrete at 1’ increments to draw down pond. Construct downstream river access to the west of the powerhouse. [Stage 2]

3. Once pond is drawn down below powerhouse intake sill, install stop logs at intake gates to isolate flow to the spillway. Install flow diversion berm downstream between the powerhouse and spillway outlet to isolate downstream river flow to the east side of the river channel. Begin construction of restored river channel downstream of the powerhouse. [Stage 3]

4. During this time flow will be exclusively passing through the spillway. Upon reaching elevation 598.5’ at the spillway, stop demolition at the spillway. Install bulk bag diversion berm upstream of the powerhouse. Demolish powerhouse 4-6 feet below proposed river channel grades and construct restored river channel through former powerhouse. [Stage4]

5. Once restored river channel has been fully constructed through the powerhouse, begin final draw down by incrementally lowering the cofferdam upstream of the powerhouse. [Stage 5]

6. Once flow is fully diverted to restored river channel, demolish any remaining spillway structures at least 2 feet below final grade and fill to match the design plans and complete site restoration activities. [Stage 6]
Steps 1 and 2: Remove spillway concrete structure and continue incremental demolition of spillway.
Steps 1 and 2 Profile view:

SECTION A-A
EXISTING PROFILE THROUGH THE DAM POWERHOUSE AND SPILLWAY
(REFER TO P.2 FOR PLAN VIEW)
HYDRAULIC RATIO = 4:1

SECTION B-B
EXISTING PROFILE THROUGH SPILLWAY
(REFER TO P.2 FOR PLAN VIEW)
HYDRAULIC RATIO = 4:1

LEGEND:
- Existing Finished Surface
- Concrete Boundaries
- Initial Construction to Elevation of Stage 1
- Deconstruction to Dam Stage 0 (Stage 0)
Step 3: Install flow diversion berm downstream.
**Step 4 and 5:** Install bulk bag cofferdam upstream of powerhouse and upon completion of restored river channel through powerhouse, complete remaining drawdown through the incremental lowering and removal of the bulk bags.
Step 4 and 5 Profile Views:
Step 6: remove any remaining concrete structures to 2 feet below finish grade and fill to match design plans:
6. EASEMENTS AND OTHER PERMITS

Summary of Environmental Permitting Requirements

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<td>Grand Traverse County Soil Erosion – Sedimentation Control Department</td>
<td>Act 451, Part 91 Soil Erosion and Sedimentation Control (SESC)</td>
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</tbody>
</table>
County Resolution for the land surrounding Sabin Dam.
RESOLUTION No. 3-74

WHEREAS, the County of Grand Traverse is the owner of a certain parcel of real property, the full legal description of which is attached hereto and made a part hereof, which property is hereinafter known as the "Boardman River Property," and;

WHEREAS said Boardman River Property represents some land within the County which still remains in an unimproved state and adjoins a watercourse, and;

WHEREAS said Boardman River Property contains certain fragile, unique features which are being destroyed throughout the state by development of watershed land, and;

WHEREAS the Grand Traverse County Board of Commissioners believes the Boardman River Property represents a public trust which should be preserved and protected for future generations;

NOW, THEREFORE BE IT RESOLVED that the Grand Traverse County Board of Commissioners hereby dedicates the Boardman River Property as a natural education reserve. The terms of this dedication are as follows:

1. The Board of Commissioners reserves the right to make rules and regulations respecting the use of such land as a natural education reserve which regulations shall be calculated to preserve and enhance the natural character of the Boardman River Property in keeping with its public use for that purpose.

2. The Board of Commissioners reserves the right to alter, maintain, repair, remove and relocate any or all of the improvements located on such land providing the natural character of the land is improved or not impaired.

3. The Board of Commissioners by its chair may appoint an advisory commission to assist the Board
of Commissioners under this dedication.

4. In its discretion, the Board of Commissioners may permit the erection of one or more structures upon the property for use in nature education.

5. Fishing, hunting, swimming and boating may be permitted by rule so long as such uses shall not impair the use of the property in nature education.

6. The Board of Commissioners reserves the right to exchange portions of the property for contiguous parcels if the result will be to preserve or enhance the natural character of the resulting tract.

7. The Board of Commissioners reserves the right to change the use of not more than five percent (5%) of the total area to ancillary public recreational uses if said uses do not detract or impair the use of the remainder.

8. No use shall hereafter be made of this land except as provided herein. If a future Board of Commissioners wishes to depart from this Dedication, it may submit the proposed change to the voters of the County at a special or general election. If two-thirds of the votes cast shall support the new use, the use may be changed and not otherwise.

GRAND TRAVERSE COUNTY BOARD OF COMMISSIONERS

By:

JACKSON BENSLEY
Chairman

I, Anita Kucera, Clerk of the Board of Commissioners, hereby certify that the foregoing Resolution was introduced and adopted at a session of said Board convened in the City of Traverse City on __________, 1974, by a __________ vote of the members.

Dated: __________

ANITA KUCERA
County Clerk
8. ADJOINING PROPERTY OWNERS

<table>
<thead>
<tr>
<th>Map ID</th>
<th>Parcel ID Number</th>
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10. PROJECTS IMPACTING INLAND LAKES, STREAMS, GREAT LAKES, WETLANDS OR FLOODPLAINS

The figures below depict locations of cross sections in plan view as well as a cross section view of the river alignment including the existing grade and proposed grade. The table below shows the cut or fill volume at each cross section as well as the cumulative cut and fill volume from the furthest upstream section of the river to the cross section location. Additionally, a net volume is calculated for the project at each cross section location.

The Ordinary High Water Mark (OHWM) for this project has been assumed to mean the high water level of the restored river through the restored river channel. For permitting purposes pertaining to fill and cut volumes, we have assumed the OHWM to be at the top of bank of the proposed river channel.

10A. Projects Requiring Fill

There are a few cross sections of the proposed restored river channel, primarily downstream of the existing dam, that require fill to build up the restored channel and transition the restored channel through the impoundment to the existing river channel downstream of the dam. These fill areas are within the proposed river channel and floodplain and will total 16,417 cu yds. These fill areas are detailed in the cross section views and table presented at the end of section 10B.

Additionally, other areas of fill will occur within the former impoundment for spoils placement. The material excavated in order to place the restored river channel at the elevation of the historic river bed material, as determined through depth of refusal studies, will be placed on site within the project area. These areas of fill will vary greatly in area and volume, as determined by topography, wetlands, and construction access. Spoils fill areas will be located outside of the 100yr floodplain. The table and associated figures presented below represent the anticipated placement, area, and volume of each proposed spoils area.

<table>
<thead>
<tr>
<th>Spoils Area #</th>
<th>Maximum Length (ft)</th>
<th>Average Width (ft)</th>
<th>Average Depth (ft)</th>
<th>Calculated Volume from Dimensions (CYD)</th>
<th>Total Volume (CYD) (Based on comparison of fill surfaces and underlying existing survey-LiDAR surface in AutoCAD)</th>
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<tr>
<td>SA - A</td>
<td>492</td>
<td>182</td>
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<td>SA - F</td>
<td>598</td>
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Project Name: Sabin Dam Removal and Boardman River Restoration
Owner: Grand Traverse County
January 20, 2017
Final
Cross Section 6
Spoils Area F
In addition to spoils fill areas, large wood is proposed for the river restoration aspect of this project. The large wood structures will be contained within the river channel and associated river bank. These structures are designed to increase the bank stability of the river along bends in the river and prevent excessive bank erosion.

**Background for Large Wood Enhancement**

The pre-dam channel through the Sabin impoundment is covered with sediment and will be generally exhumed by the project exposing the pre-dam gravel bed. Complex bedforms such as riffles, pools, runs, and chutes present at the time of dam construction were obscured and are generally not discernable or present afterward. These features will redevelop over time if the appropriate forcing elements are present. This process will be jump-started during construction with selective grading of the channel bed to augment point bars, pools and riffle features.

In addition to bedforms, in-channel habitat and hydraulic complexity is propagated by large wood in the Boardman River. Upon removal of the dam, some relict wood will be exhumed in the channel. Based on observations in the Brown Bridge impoundment, large wood was most likely removed from much of the expected inundation area and channel prior to dam construction in an effort to avoid transport and deposition of this material on the spillway of the new dam. The remaining wood exposed after dam removal will be generally small and sparse, unable to substantially induce the processes that create and sustain high quality instream habitat.

In this way, the immediate post-excavation instream habitat condition will be at an early successional stage. Since the newly exhumed floodplain will also be at an early successional stage leading to many years before substantial large woody material is recruited to the channel, and the hydrology and sediment regimes of the Boardman River are such that large disturbance events are rare, the time lag between impoundment excavation and development of self-sustaining mature instream habitat will likely require decades or centuries.

For this reason, large wood supplementation is proposed for the exhumed river channel. In the base project design that was fit in scope to the funding level that was known at the time of dam removal design preparation, large wood was included at one key location where it will be necessary to maintain a substantial planform redirection with a very stable feature. A log crib will be installed at this location (approximate stations 121+50 to 120+00). As additional funding becomes available, additional large wood will be added to the newly exhumed and shaped channel to accelerate the development of instream habitat along the successional trajectory, so that the restored river is able, at an earlier date, to provide the level of habitat quality and complexity that is the underpinning of the restoration initiative.

To summarize, the large wood that naturally inhabited the historic channel helped to define the geomorphic characteristics of the channel and floodplain. By adding large wood habitat structures to the

---

1 Instream structure (such as large wood), planform redirection, and sediment caliber/load that is in-tune with hydrology of the system.

2 The concept of “late-successional habitat” refers to an area which has been shaped by channel and riparian processes (vegetative growth and large wood recruitment) to provide mature, complex, high quality habitat for native fauna. Maturation of habitat in a newly disturbed area of a river system to a late-successional condition often requires many decades.

3 Primarily herbaceous cover for the first years following excavation, followed by progressive establishment and growth of woody shrubs and trees over several years to decades.
exhumed channel the project will jump-start the process of redeveloping the natural large wood features in advance of reforestation and wood recruitment. With that being stated, it is also important to understand that the Boardman River is an extremely steady river with muted flood flows and elongated hydrographs. As such, the inclusion of large wood structures on the project will have immense ecological benefits, but should have negligible effects on the system-scale hydraulic function of the river and the frequency of overbank events.

The proposed large wood enhancement is shown on figures at the end of this section, which includes typical details for the enhancement types which could be placed at various locations along the banks of the restored river channel. The different types of large wood enhancement are described in greater detail below. The final locations for large wood installation will be determined based on assessment of the conditions following dam removal and trend in evolution when resources are available for subsequent large wood installation.

Typical Large Wood/Log Jam Descriptions

The following sections describe three typical configurations of large wood that will be installed for the project. Each of these configurations will be placed in more than one location, but the structure of each will vary to more closely mimic natural woody jams. This will require a fit in the field approach that relies on field engineering. The approximate size, location, ballast, and function of each are described.

**Habitat Jams**

1. **Number of logs**: approximately 0.3 logs per foot of channel bank length treated plus slash
2. **Spatial location**: Along the banks of straighter reaches in riffles/runs, or in outside bends.
3. **Function**: Placements will provide cover habitat in shallower areas for juvenile fish close to feeding areas, and holding habitat, velocity refuge and cover for both juvenile and adult fish in a variety of locations.
4. **Typical ballast**: Log piles and soil ballast. Log piles may be utilized to allow logs to protrude into the flow more than if soil ballast alone was used.
5. **Description**: The top log elevations will be below bankfull elevation to ensure sufficient soil ballast. The bottom elevation of the logs will be at or just below the stream bed to provide cover if local scour occurs. Depending on location, a small scour pool may be pre-excavated to enhance pool habitat local to the structure. The geometry of potential scour pool excavation is shown in the typical detail. Projection of the structure into the channel will be 20% of the channel width or less.
6. **Geomorphic Analogy**: These jams will replicate (1) a tree toppling into the river from the bank and accumulating additional wood that is transported down the river, or (2) mobile large wood snagging on existing trees along banks and accumulating additional woody material.

**Flow Deflector Jams**

1. **Number of logs**: 10-15 logs per jam plus slash
2. **Spatial location**: Outside meander bends.
3. **Function**: These jams induce a local scour pool adjacent to the structure, providing relatively deeper water.
4. **Typical ballast:** Primarily log piles so that more of the logs can protrude into the river further and extend up to the floodplain elevation to intercept flow and develop a larger pool. Some soil ballast will enhance stability but the structure will be designed to be stable with piles alone. Fully threaded rod will be required at log-log intersections.

5. **Description:** Logs will extend from the bed up to a minimum of the bankfull elevation to interact with flows during small and large events to maximize pool development. The bottom elevation of the logs will be at or just below the stream bed to provide cover if local scour occurs. Depending on location, a small scour pool may be pre-excavated to enhance pool habitat local to the structure. The geometry of potential scour pool excavation is shown in the typical detail. Projection of the structure into the channel will be 20% of the channel width or less.

6. **Geomorphic analogy:** This jam type will mimic the snagging or deposition of a larger log at the downstream end of a meander that cannot make it around the bend due to its size and length, and the subsequent racking of additional pieces during flood flows.

---

**Log Crib**

1. **Number of logs:** approximately 0.5-0.7 logs per foot of channel bank length treated plus slash

2. **Spatial location:** In sharp meander bands where substantial planform redirection must be reinforced, or in locations where structural bank stabilization is required. For this project, the only location identified for this treatment is the upstream most meander bend (253+00 to 256+40). This location is intended to protect unconsolidated sediments that will be placed in the existing cutoff channel.

3. **Function:** These structures create highly stable channel margins that resist bank migration, while also enhancing instream habitat and velocity breaks local to the structure.

4. **Typical ballast:** Log piles and soil ballast, with coarse substrate zone at the front of the structure to resist piping of potentially finer retained bank soils. Fully threaded rod will be required at log-log intersections.

5. **Description:** Logs will extend from the bed up to a minimum of the 25-year return period flood level. The bottom elevation of the logs will be at or just below the stream bed to provide cover if local scour occurs. Projection of the structure into the channel will be 20% of the channel width or less.

6. **Geomorphic analogy:** This structure type mimics large wood buried in a floodplain that is exhumed by channel migration and recruits additional logs transported by the river, or a large accumulation of logs that may be deposited by a mass-wasting event near a valley wall. In both instances, the large wood features act as a forcing element causing a redirection in the channel planform.

---

**Large Wood Quantities:**

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<th>Structure Type</th>
<th>Avg Depth (ft)</th>
<th>Width (ft)</th>
<th>Length (ft)</th>
<th>Volume (CYD)</th>
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<td>Large Wood - Habitat Jams</td>
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<td>Large Wood - Flow Deflector</td>
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<td>40</td>
<td>666</td>
<td>4,933</td>
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<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td><strong>27,157</strong></td>
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</table>
Placement of woody structures will be within the locations shown on the following plans and covering up to 50% of the total bank length in those areas as deemed necessary by the Engineer in the field and with concurrence from the Michigan DEQ.
NOTE: POTENTIAL LARGE WOOD LOCATIONS ARE SHOWN.
Large wood, typ. excavated scour pool (not in all locations)

Slash excavated scour pool (not in all locations)

Native material

Large wood with root wad, typ. 10 ft (min.) below subgrade

Typical plan habitat jam

Typical section habitat jam

Typical section flow deflector jam

TYPICAL SHEETS

PROPERTY OWNER: GRAND TRAVERSE COUNTY

PREPARED BY: INTER-FLUVE, INC.

PURPOSE: RIVER RESTORATION

IN: BOARDMAN RIVER

NEAR: SABIN DAM

COUNTY: GRAND TRAVERSE

STATE: MI

DATE: SEPTEMBER 22, 2017

SHEET P-2.1

SABIN DAM REMOVAL AND BOARDMAN RIVER RESTORATION LARGE WOOD ENHANCEMENT

TRaverse CiTY, Mi

1320 Traverse City Highway

Suite 3365

(231) 932-7592

PH (231) 932-7592

301 South Livingston Street

Suite 200

Madison, WI 53703

608.441.0342

010850 Traverse City Highway

Suite 3365

Ph (231) 932-7592

301 South Livingston Street

Suite 200

Madison, WI 53703

608.441.0342

SCOUR POOL EXCAVATION DEPTH VARIES BY SITE, AND WILL BE DETERMINED BY ENGINEER AT TIME OF CONSTRUCTION.

NOTE: SCOUR POOL EXCAVATION DEPTH VARIES BY SITE, AND WILL BE DETERMINED BY ENGINEER AT TIME OF CONSTRUCTION.

NOTES:

Large wood is a field set item, to be installed with assistance of engineer. At each location, engineer may adjust orientation, number of large wood pieces, depth of installation, number of connections, and ballast requirements at the time of construction.

1 cu. yd. of loose packed volume slash required per large wood or large wood-root wad piece installed (max.).

Cumulative dam removal and Boardman river restoration

Purpose: river restoration

Property owner: grand traverse county

Prepared by: inter-fluve, inc.

In: boardman river

Near: sabin dam

County: grand traverse

State: mi

Date: september 22, 2017

Sheet p-2.1
2-YR FLOOD WATER SURFACE
ORDINARY LOW WATER SURFACE
EXISTING GRADE
1 FT (MIN.)
CONNECTIONS AT ALL LOGS, SEE DETAILS:
10 FT (MIN.)
PACK SLASH BETWEEN LOG LAYERS
EMBED 2/3 LOG LENGTH (MIN.)
SALVAGED FILL
SET LOGS PARALLEL TO CHANNEL AT OR BEHIND BANK TOP

TYPICAL PLAN
P-2.2
LARGE WOOD CRIB WALL
NOT TO SCALE

TYPICAL SECTION & PLAN
P-2.2
LOG-LOG CONNECTIONS
NOT TO SCALE

TYPICAL SECTION
P-2.2
LARGE WOOD CRIB WALL
NOT TO SCALE

BOLTED CONNECTION NOTES
PIN LOGS TO LOGS:
1. DRILL 7/8" DIA HOLE THROUGH LOGS.
2. INSERT 7/8" IN. THREADED ROD.
3. INSTALL STEEL PLATES AND HEAVY HEX NUTS.
4. SECURE NUTS BY CHISELING THREADS OR MUSHROOMING EXPOSED ENDS OF ROD.
5. FILE OR GRIND OFF SHARP EDGES

PROPERTY OWNER: GRAND TRAVERSE COUNTY
PREPARED BY: INTER-FLuve, INC.
PURPOSE: RIVER RESTORATION
IN: BOARDMAN RIVER
NEAR: SABIN DAM
COUNTY: GRAND TRAVERSE
STATE: MI
DATE: SEPTEMBER 22, 2017
SHEET P-2.2

301 South Livingston Street
Suite 200
Madison, WI 53703
608.441.0342
10B. Projects Requiring Dredging or Excavation

As this is a river restoration project through an impoundment, which has collected thousands of tons of sediment, there will be a great amount of excavation and dredging required to restore the Boardman River to its historical placement and bed elevation within the impoundment. In total, we are expecting 103,106 cu yds of excavation and dredging. This volume will include a 60ft wide river channel and floodplains ranging from 0-40ft on either side of the river. Depth of excavation will vary throughout the impoundment based on the historic river channel location and the amount of deposited sediment to be removed in order to expose the historic river bed. Of the total 103,106 cu yds excavation volume 57,067 cu yds is anticipated to be located below the OHWM of the river. This is the volume of material anticipated to be excavated in order to create the restored river channel. The remaining proposed excavation amount will be located in the floodplains and required to bring the project even with the site topography.

The dredged material will be placed in on-site spoil areas, which are discussed in Section 12.

Sediment sampling data presented in Attachment D indicate concentrations of arsenic and some other metals in some sediment samples exceed residential soil cleanup criteria developed pursuant to Part 201 (Environmental Remediation) of Public Act 451. These sediments will be exposed after impoundment levels are lowered and the river channel is dredged and will become soil. MDEQ Remediation and Redevelopment Division staff (Steve Kitler and Christine Flaga) recommended sampling of the new soils after water levels are lowered and the channel is constructed. Grand Traverse County, as a non-liable owner of the property will have “due care” obligations pursuant to Section 201297a of Part 201 if the new soils are found to have concentrations of metals that exceed the applicable residential cleanup criteria.

Appropriate due care measures to protect human health will be identified and implemented after the new soils are sampled and the data are evaluated. Such measures may include administrative controls to limit the use of the affected areas or engineered controls to prevent people from being exposed to hazardous substance concentrations that exceed applicable cleanup criteria.
VEGETATION SALVAGE AREA

DETAILED GRADING OF THE CHANNEL BED IS NOT REFLECTED IN THE DESIGN CONTOURS & TO BE LIMITS OF DISTURBANCE

SPOIL AREA 'E' TOP ELEV. 614 FT

APPROXIMATE LOCATION OF UNDERGROUND FIBER OPTIC CABLE AT 610-611

APPROXIMATE ELEVATION OF 591.1 FT (NAVD88)

VEGETATION SALVAGE AREA

HABITAT JAM

HISTORICAL CHANNEL BED ELEVATION AT DAM REMOVAL PROJECT GRADING BLEND FINISH GRADE TO MATCH THE DOWNSTREAM END OF THE BOARDMAN CHANNEL BANKS

BOARDMAN DAM PILOT CHANNEL

1. EXCAVATION QUANTITIES AND APPROXIMATE VOLUME DISTRIBUTION MAY VARY BASED ON CONDITIONS AT TIME OF CONSTRUCTION AND EFFECT OF CIVILWORK.

2. FINE GRADING OF CHANNEL BED THROUGH DIG AND PITCH ACTIVITY ESTIMATED TO RESULT IN BALANCED CUT AND FILL. AFTER EXCAVATION OF CHANNEL AND SPOIL, MODIFIED GRADE LINE SHOWS DISTRIBUTION OF PRE-DAM CHANNEL WITH ASSISTANCE OF GOVERNMENT REPRESENTATIVE. ALSO SEE SPECIFICATIONS.

3. CONTRACTOR SHOULD EXERCISE CAUTION WHEN EXCAVATING "EXISTING GRADE" TO AVOID CONSTRUCTION FIELD ENSUING IN EXCAVATING TO M ridicule RIGHT SIDE OF THE FIBER OPTIC CABLE LINE.

4. APPROXIMATE LOCATION OF UNDERGROUND FIBER OPTIC CABLE AT 591.1 FT (NAVD88)

NOTE: CONTRACTOR SHOULD NOT IMPLEMENT EXCAVATION ACTIVITY OR التWO

5. FINE GRADING OF CHANNEL BED THROUGH DIG AND PITCH ACTIVITY ESTIMATED TO RESULT IN BALANCED CUT AND FILL. AFTER EXCAVATION OF CHANNEL AND SPOIL, MODIFIED GRADE LINE SHOWS DISTRIBUTION OF PRE-DAM CHANNEL WITH ASSISTANCE OF GOVERNMENT REPRESENTATIVE. ALSO SEE SPECIFICATIONS.

6. CONTRACTOR SHOULD EXERCISE CAUTION WHEN EXCAVATING "EXISTING GRADE" TO AVOID CONSTRUCTION FIELD ENSUING IN EXCAVATING TO M ridicule RIGHT SIDE OF THE FIBER OPTIC CABLE LINE.

7. APPROXIMATE LOCATION OF UNDERGROUND FIBER OPTIC CABLE AT 591.1 FT (NAVD88)

NOTE: CONTRACTOR SHOULD NOT IMPLEMENT EXCAVATION ACTIVITY OR التWO
EXCAVATION QUANTITIES ARE APPROXIMATE. VOLUME DISTRIBUTION MAY VARY BASED ON CONDITIONS AT TIME OF CONSTRUCTION AND EFFECT OF DRAINAGE.

FINE GRADING OF CHANNEL BED THROUGH DIG AND PITCH ACTIVITY ESTIMATED TO RESULT IN BALANCED CUT AND FILL AFTER EXCAVATION OF CHANNEL AND PITCH ACTIVITY. DETAILED GRADING OF THE CHANNEL BED IS NOT REFLECTED IN THE DESIGN CONTOURS AND IS TO BE CONSTRUCTED WITH ASSISTANCE OF THE GOVERNMENT REPRESENTATIVE. ALSO SEE INDICATORS OF PRE-DAM CHANNEL WITH ASSISTANCE OF GOVERNMENT REPRESENTATIVE. ALSO SEE DETAILED GRADING OF THE CHANNEL BED. FLOODPLAIN TO LINES AND GRADES SHOWN ON DRAWINGS, MODIFIED AS REQUIRED PER INDICATORS OF PRE-DAM CHANNEL WITH ASSISTANCE OF GOVERNMENT REPRESENTATIVE. ALSO SEE CONDITIONS AT TIME OF CONSTRUCTION AND EFFECT OF DRAINAGE.

R-1.1 - CHANNEL GRADING & PROFILE 1 OF 2

R-1.2 - CHANNEL GRADING & PROFILE 2 OF 2
### Excavation/Fill Volume Calculations by Proposed River Channel Station

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10C. Project Requiring Riprap

There is one location where the use of rip rap material will be needed in order to create and stabilize the restored river channel at the correct grade to transition the restored river channel through the impoundment to the existing river channel downstream. This location is through the existing powerhouse structure and downstream of the dam to where the restored river channel will meet the existing river channel. This portion of the existing Boardman River channel was dredged when the dam was constructed, and requires significant fill to meet the design profile of the restored river channel. Due to the fill required, rip rap material will be used to stabilize the channel bed and banks. All remaining concrete and steel from the powerhouse will be removed 4-6 feet below the proposed restored river channel invert and rip rap will be placed over this area for a distance upstream and downstream of this area. This will provide the necessary armoring to ensure any remaining structure will not be exposed after years of changes within the river channel.

Rip rap as referred to in this section will consist of river rock in varying dimensions from 21 inches at the base of the fill to sand/silt sizes to form the river channel bottom. It is preferred that the material come from onsite, found during excavation of the river channel and used at the proposed locations described above. However, if the necessary material cannot be found on-site, clean river rock from off-site will be brought on-site and used to build up and stabilize the river channel. The figure below shows the approximate dimensions of the proposed rip rap placement within the Boardman River and typical cross sections of the designed feature in those locations.
Constructed Riffle Plan View and Details:

- 58 feet wide
- 600 feet long
Project Name: Sabin Dam Removal and Boardman River Restoration
Owner: Grand Traverse County
January 20, 2017
Final
12. ACTIVITIES THAT MAY IMPACT WETLANDS

Wetland delineations were performed within the Sabin impoundment in 2008, 2012, and 2016. Upon the lowering of Sabin Pond in 2011, additional wetlands have formed within the impoundment. The wetland delineations show wetland acreage and location changes over time due to variations in impoundment water levels. The impoundment was kept at its normal pool elevation until 2011 when the Sabin Dam impoundment was lowered 4 feet. Wetland delineations were performed soon after drawdown and again at a later date.

The figures below show the wetland areas delineated during 2008, 2012, and 2016. The delineated wetland areas near Sabin Impoundment are:

- 17.58 acres near Sabin Dam in 2008.
- 25.10 acres near Sabin Dam in 2012.
- 40.11 acres near Sabin Dam in 2016.

The figures demonstrate that wetland areas are influenced by the water level in the impoundment and input from groundwater sources. These figures also suggest that wetland areas will change in response to water levels over time. Observations between the delineations provide some insight into what may occur once the dams are fully removed.

The Sabin impoundment area, as presented in the 2016 wetland delineations, has wetlands forming in the upper reaches following the 2012 drawdown and the resultant exposure of bottomlands. These areas are primarily sandy materials that are saturated due to close proximity to the river. The remaining areas were formed from groundwater inputs and exposed areas that formerly were under water before the drawdown. The 2016 delineation further confirms the location of groundwater seeps along the valley walls.

Upon removal of the dam and further lowering of the water surface elevation within the impoundment it is expected that wetlands will form along the river in the riparian corridor and adjacent to groundwater seeps. Exposed areas with sandy soil material may form temporary wetlands but are expected to convert to uplands over time, because of the lower groundwater table, the lack of groundwater inputs, and the well-drained nature of the material.
From the most recent wetland delineation conducted in 2016 combined with depth of refusal data collected between 2012 - present it is apparent that many of the wetlands that have formed within the impoundment possess only 2 of the 3 characteristics required for wetland classification, hydrology and vegetation. The soils in these areas consist of impounded sediment, primarily sand, and hydric soils have not developed in most exposed areas since the drawdown in 2011. With the removal of Sabin Dam and further lowering of the water surface elevation throughout the impoundment, it is expected that these "interim" wetlands will lose the hydrology characteristic, thus turning into upland areas. With this in mind, the placement of fill areas was limited to areas within the impoundment where uplands are expected to form, including those areas where "interim" wetlands exist now, or are currently upland areas. The 2016 Wetland Delineation Report is in Attachment C. The field notes and representative photographs are also provided within that report.

Net wetland loss adjacent to (or near) the impoundment resulting from lowering of water elevations is expected to be minimal, given that the majority of existing wetlands outside of the impoundment are sustained by groundwater inputs (i.e., seeps) within the Boardman River Valley.

Rather than loss of wetland habitat, alternatives proposing the reduction of water elevation within an impoundment are expected to result in 1) a gain in wetland acreage with the conversion of open water areas to wetlands; and 2) an increase in species and structural diversity with the conversion of deep aquatic habitats to emergent and ultimately forested/scrub-shrub systems. Such a shift in wetland type and extent would improve the quality and quantity of wildlife habitat available along the Boardman River.

Wetlands are anticipated to form in areas near existing seeps and along the restored river corridor. Further, they are more likely to form in deeper areas of the impoundments, as these areas are more likely to receive groundwater inputs. Since much of the area that may form into wetlands is submerged, limited information is available to develop a detailed map of anticipated wetlands. Therefore, some uncertainty is associated with the extent of anticipated wetland acreage.

Alternatives were assessed during the plan preparation of this project. The wetlands, in particular, were assessed for their viability after the water level within the impoundment is lowered and Sabin Dam is removed. Additionally, tributaries were identified. Areas where it was determined that wetlands would be likely to remain or form were protected by avoiding the placement of spoils areas in those locations; additionally tributaries and seeps will be left a path to drain to the Boardman River.

Spoils areas are locations where material moved as part of the restoration project will be placed during project implementation. Per previous discussions with the Michigan Department of Environmental Quality (MDEQ), the sediment will be placed in uplands or areas where wetlands are not anticipated to form after the dams are removed. Spoils placement areas are in locations where wetlands are not expected to remain or occur post-project due to lowered water levels (i.e. an indirect impact). Spoils areas have been designed to reduce impacts to existing wetlands even if these wetlands are not anticipated to remain once the dam is removed.

The spoils areas have been designed to provide approximately 20 percent greater volume than is expected to be needed. This contingency provides for potential variances between estimated and actual volumes of material that will result from changes to channel alignment and sediment quantities developed during the design phase.

The proposed plan results in both cut and fill impacts on the interim wetlands in the dewatered impoundment. These impacts will have an immediate effect on wetlands. The construction design plans shows that there will be 4.59 acres of existing wetlands directly impacted by the project, all due to river
and floodplain excavation. The remaining impacts consist of fill from spoils placement of 5.3 acres of existing wetlands. These impacts are broken out by impact area in the table below and the figures located at the end of this section.

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¹ Cut impact due to historic river channel and floodplain excavation.
² Fill impact due to spoils placement.
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**LEGEND**

- **WETLAND AREA**
- **PROPOSED SPOILS AREA**
- **PROPOSED RIVER CHANNEL**
15. STREAM, RIVER, OR DRAIN CONSTRUCTION, RELOCATION AND ENCLOSURE ACTIVITIES

Since the initial drawdown of Sabin Pond in 2011, the Boardman River has already eroded through part of the sediment deposited within the upper reaches of the impoundment. This reach of the Boardman River is approximately 100 feet wide, 2 feet deep, and 1,000 feet long. The remaining impounded area measures 1,500 feet long, 515 feet wide, and 6 feet deep.

The proposed restored river channel will be 4,000 feet long, 60 feet wide, and 3 feet deep.
Project Name: Sabin Dam Removal and Boardman River Restoration
Owner: Grand Traverse County

January 20, 2017
Final

Sabin Pond

515 feet wide

Proposed river channel; 60 feet wide 4,000 feet long

1,500 feet long

Interim Channel; 100 feet wide 1,000 feet long
16. DRAWDOWN OF AN IMPOUNDMENT

From the available bathymetry data it appears that there is only about 2-3 feet of sediment immediately upstream of the dam structure, where the dewatering is proposed.