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Chapter 1 – Planning the Return of the River
June 2014 – On the search for the relic river channel in Boardman Pond.
Surveyors & engineers complete field work during the design phase.

Boardman Dam Impoundment with proposed river alignment in blue.

- Sediment wedge.
- New Cass Road Bridge location.
- Core wall of dam.
- Powerhouse & one-lane bridge.
Chapter 2 – History

1894 – The initial Boardman Dam being built for the Boardman River Light and Power Company, where the new Cass Road Bridge now sets. This was the first hydro-electric dam constructed on the river. Photo provided by the Traverse Area Historical Society.

1931 – Boardman Dam was rebuilt 500 feet to the east to increase capacity for multiple owners. Meanwhile, Keystone Dam was in operation only 1.5 miles upstream from 1909 to 1961 when it flooded out. Photo provided by the Traverse Area Historical Society.
August 2015 – The Boardman River flows fast just before the impoundment Boardman Dam. This is partly why it was dammed so much. The gradient or slope of the river as it gets closer to Lake Michigan is a bit steep & was seen as an opportunity to create energy. But water-wise the Boardman River is “small” in that on average the river flows around 250 cfs, as compared to the Colorado River that flows 21,900 cfs & has the Hoover Dam.

A snapshot. The Boardman River has been riddled with multiple dams over the last 170 years.

<table>
<thead>
<tr>
<th>LOCALE</th>
<th>EVENT</th>
<th>YEAR</th>
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<tbody>
<tr>
<td>Union St.</td>
<td>Various mills utilize water wheels on the river</td>
<td>1850s</td>
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<tr>
<td>Union St.</td>
<td>Dam constructed</td>
<td>1867</td>
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<tr>
<td>Union St.</td>
<td>Major overhaul to original dam</td>
<td>1885</td>
</tr>
<tr>
<td>Boardman Dam (1)</td>
<td>Dam operational 200 yards below modern location</td>
<td>1894</td>
</tr>
<tr>
<td>Sabin Dam</td>
<td>Dam operational below Boardman Dam</td>
<td>1906</td>
</tr>
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<td>Keystone Dam</td>
<td>Dam operational above Boardman Dam</td>
<td>1909</td>
</tr>
<tr>
<td>Sabin Dam</td>
<td>Original structure enlarged, same location (Fargo Inc)</td>
<td>1914</td>
</tr>
<tr>
<td>Keystone Dam</td>
<td>Major repairs for log damage</td>
<td>1919</td>
</tr>
<tr>
<td>Brown Bridge Dam</td>
<td>Dam operational in the Upper Boardman River</td>
<td>1922</td>
</tr>
<tr>
<td>Union St Dam</td>
<td>Mill destroyed by fire-never rebuilt, dam remains</td>
<td>1926</td>
</tr>
<tr>
<td>Sabin Dam</td>
<td>2nd time enlarged and repaired, (Harza Inc)</td>
<td>1930</td>
</tr>
<tr>
<td>Boardman Dam (2)</td>
<td>New Boardman Dam operational, in modern location</td>
<td>1931</td>
</tr>
<tr>
<td>Boardman Dam (1)</td>
<td>Dam is dismantled below modern Boardman location</td>
<td>1931</td>
</tr>
<tr>
<td>Keystone Dam</td>
<td>Dam fails during major flood, never rebuilt</td>
<td>1961</td>
</tr>
<tr>
<td>Boardman Dam (1)</td>
<td>Cass Rd narrowed to 1 lane, substation moves to east</td>
<td>1983</td>
</tr>
<tr>
<td>Sabin Dam</td>
<td>Upgraded and repaired (Mead and Hunt Inc)</td>
<td>1986</td>
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<tr>
<td>Boardman Dam</td>
<td>Deemed safety hazard, pond lowered 16’</td>
<td>2007</td>
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<tr>
<td>Brown Bridge Dam</td>
<td>Deemed safety hazard, pond lowered 3’</td>
<td>2008</td>
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<tr>
<td>Brown Bridge Dam</td>
<td>Pond lowered about 6’ in preparation for removal</td>
<td>2011</td>
</tr>
<tr>
<td>Sabin Dam</td>
<td>Pond lowered to minimum level with existing control</td>
<td>2011</td>
</tr>
<tr>
<td>Brown Bridge Dam</td>
<td>Removed</td>
<td>2012</td>
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Chapter 3 - Building a Bridge

June 2016 - Cass Road Bridge project underway with five 137’ center beams (weighing 64 tons each) being set. Adjacent beams measured 53’ (weighing 25 tons each) & 63’ long (weighing 30 tons each).

October 2016 – Cass Road Bridge construction complete with a 254’ span, two vehicle lanes, 6’ shoulders & 54” high railing safe for both vehicles & pedestrians. The site is ready for returning river to original location.
November 2014 – Before. Looking upstream at the future location for the new Cass Road Bridge. This is called the “beaver pond” where beavers had dammed seeps from the native river channel. This is actually where the first Boardman Dam was built in 1894.

May 2016 – During. An estimated 26,000 cubic yards of fill were removed from the roadway to create an opening for the new bridge & return of the river channel. Steel piles are being driven into the ground on the right. Earthwork for the bridge uncovered some of the old concrete fish ladder structure.
August 2016 – Bridge deck built & forms poured for side rails & wing walls.

October 2016 – After! The beaver pond area will be returned to a river in 2017 when Boardman Dam is removed.
March 2016 – Trees cut for constructing Cass Road Bridge were stockpiled for later placement at instream fish/wildlife habitat sites & on the floodplain for amphibian/reptile habitat during the Boardman Dam removal in 2017.

June 2016 – Beam day! The five 137’ long concrete I-beams were trucked individually from Grand Rapids where they were cast. Parts of US-31 were closed so that semi-trucks could make the turn down to Cass Road. Photo provided by Jim Johnson.
June 2016 – Semis had to back 1.2 miles down to the site because there wasn’t enough room to turn around. Two cranes grabbed on to the end of each beam to set them because of their size.

Workers were harnessed & they guided placement at either end of the beams. Photo provided by Tessa Lighty.
August 2016 – Plywood & lumber forms were built to pour the base of the railings & wing walls.

September 2016 – Nearby landowner & farmer, Jack Robinson, was the first one to drive over the new bridge at the ribbon cutting event. Jack grew up on his farm on the neighboring property & stayed to raise his family.
March 2016 – Before. Standing on the core wall of the dam looking downstream to the future Cass Road Bridge site. Pooling water forms from the seeps of the original river channel.

June 2016 – Getting started. We can see the crane setting Cass Road Bridge concrete beams through the trees. Below, a film of algae grows on the standing water in sunny conditions.
April 2017 – Getting ready to return the river to its original streambed; building the channel.

June 2017 – Siphons to drain the impoundment are being tested & auxiliary channel to the right is being built.
September 2017 – Siphons removed, river flowing through temporary auxiliary channel on the far right, & earthwork underway to re-create original river channel location downstream of the sand berm.

November 2017 - River is in its native location. Workers spread topsoil & place rock at the base of new streambanks.
December 2017 – Stone placed along the river’s edge where former dam wall used to set. Note addition of root wads for habitat on the left outside river bend.

January 2018 – After! Winter sets in. Black line snaking on the right is staked silt fencing that will prevent runoff from entering the river during spring rains & snowmelt events. Photo provided by Jason Plum.
2016 – Before. Drone shot of looking upstream at the core wall (earthen embankment built around a concrete & sheet pile wall) that makes up Boardman Dam with the 78-acre impoundment behind it.

April 2016 – Before. Looking at the core wall as nearby clearing of trees takes place to build the new bridge.
April 2017 – During. The core wall is starting to be removed & a river channel created below.

June 2017 – Siphons are in full operation draining the impoundment as the auxiliary channel is being constructed. Once the gravity fed siphons have drained the pond as far as they can go, the rest of the impoundment will be drained by the auxiliary channel while the siphons are removed & the river channel is finished being built in their place.
July 2017 – River is now flowing through the auxiliary channel. Siphons are offline & being hauled away now that they are no longer needed.

September 2017 – River continues to flow through the auxiliary channel as the new channel is being built on the right.
October 2017 – The river is now flowing through its original channel at the far right & the auxiliary channel is offline.

November 2017 - Auxiliary channel has been created into floodplain. The new streambanks are being graded out & placed with topsoil.
December 2017 – Installing fabric encapsulated soil (FES) lifts to secure the river bend & ensures it stays in place as it approaches Cass Road Bridge. Topsoil/seed work is wrapping up for the winter. Photo provided by Greg Orum.

January 2018 – After! Winter sets in as the river flows much as it once did for thousands of years before 1894.
September 2016 – Before. Downstream of the new Cass Road Bridge, this ponded area was a result of beavers damming the natural seeps from the original riverbed that continued to flow in spite of Boardman & Sabin Dams.

April 2017 – Getting ready to return the river; an access road is built on the left bank.
May 2017 – During. In the thick of it, earthwork to return what once was. A sediment trap & the Sabin Dam impoundment downstream will catch mobilized sediment.

September 2017 – River channel is established. Sediment removal is done repeatedly as dewatering continues, & a combination of muck & sand washes downstream from the former pond area.
October 2017 – This stretch of river proved to be an effective sediment trap. Bulk bags (filled with sand) were used to guide flow & cause sediment to build up in certain reaches so that it could be dug out. This picture was taken after several days of heavy rains when the river was flowing about 5 times higher than normal.

December 2017 – After! Digging more sediment out of the channel & smoothing out the streambank before winter shutdown. In the foreground the fabric encapsulated soil (FES) lifts have been completed near Cass Road Bridge to ensure the river stays in place as it flows under infrastructure.
June 2017 – What’s a dam made of? Sand, clay, concrete & lots of steel rebar. The dam core wall was 650’ long & "detached” from the powerhouse located 400’ to the east. The concrete wall inside the earthen embankment was 15” thick & 33’ high.

July 2017 - Cutting apart the sheet pile that was underneath part of the concrete wall in the dam embankment.
Chapter 5 – Boardman Dam Impoundment & Its Removal

May 2017 – Siphons used to help drain the pond were comprised of 30” diameter pipes made of high density polyethylene, fused together to make 300’ lengths.

June 2017 – Siphons were primed and gravity fed; 14 siphons were individually operated 24 hours a day at varying capacity & amounts according to stream flow & rain events so that the impoundment was drawn down between 6”-12” per day.
June 2017 – Siphons pour water from the pond into a dissipating pool lined heavily with stone to prevent erosion.

July 2017 – Siphons dropped the impoundment 21’.
June 2017 – Next to the siphons an additional channel was built called the auxiliary channel, that drained the rest of the pond once the siphons could no longer be gravity fed. This channel also had a lot of stone placed to prevent erosion & comprise a rock “weir” for the water to flow over.

July 2017 – The auxiliary channel was heavy duty. It measured 40’ wide, 70’ long & was comprised of drainage stone covered with mesh geotextile, overlaid with articulated concrete block mats grouted in between to ensure water didn’t undermine the channel.
August 2017 – Siphons were hauled away once they were no longer needed & water is flowing solely through auxiliary channel.

July 2017 – Auxiliary channel functioning with 8’ of dam height left to be removed. The 4 culverts on the right provided additional drainage of water from the bottom of the auxiliary channel pool.
A Bird’s Eye View
October 2016 – Before. Aerial of Boardman Dam impoundment. Photo provided by Jim Anderson Aerial Photography

July 2017 – Boardman pond being drawn down with water flowing through siphons & not through the powerhouse.
July 21, 2017 – The big day. Breaking apart more of the dam to allow water into the auxiliary spillway (on the left) where the remaining pond water will drain while the siphons (on the right) are removed & the final river channel is excavated in their place. This overall endeavor will return the river to its historic channel.

July 21, 2017 – Close up of breaking apart the dam wall to release water into the auxiliary channel.
2016 – Before. Looking downstream at the core wall with Cass Road Bridge discernible behind it.  
Note island point in the lower right.

July 21, 2017 – Dewatering operation in full force. Note that island in lower right is no longer an island!
The Pond & What Lies Beneath
August 2015 – Boardman Pond used to be 104 acres until MDEQ required it be drawn down 16’ due to structural insufficiency of the spillway. Then the pond became 78 acres. It supported warm water fish & waterfowl.

July 2017 – What once was an underwater “desert” is now a rather challenging worksite, but will be a river again.
July 2017 – Drawdown efforts uncover the accumulated sand, muck, tree stumps that were concealed by water.

September 2017 – Additional dewatering complete & access road (in foreground) is built along entire project area.
June 2017 - Edge of the former pond. Perhaps hydropower has its place in certain areas and situations; however dams do nothing beneficial for the rivers they block. The Boardman River is a gem, one of the highest quality tributaries to Lake Michigan – it’s best not to dam it but to develop truly clean energy through other means.

Tons of muck had accumulated in the former pond over the last 120+ years. The nearby Keystone Dam & its failure in the 1960s also contributed to this excessive buildup of sedimentation.
June 2017 – Rivers move a lot of things including sediment. Dams disrupt that natural movement & sediment builds up, creating underwater shelves of muck & sand over time. One day, equipment got stuck in 13’ of muck.

May 2015 – Drawing down the pond exposes raw, actively eroding streambanks comprised of sand/muck.
September 2017 – Tree stumps dot the landscape that has been daylighted from the dam removal.

December 2017 – Creeks previously submerged by the pond now try to find their course to the reclaimed river. These areas will be restored & graded out before the project end.
Beds of stone & gravel continue to surface. Can you find the Petoskey stone?

Leaning tree stumps confirm the original pattern of the river channel.
Chapter 6 – Returning the River to its Native Channel

April 2017 – Use it or lose it. Before excavation work begins, partners & volunteers harvest willow & red osier dogwood on-site to plant at the upstream Brown Bridge dam removal site for streambank revegetation efforts.

May 2017 – Getting started. Standing water areas had to pumped out & drained for equipment to work.
April 2017 – Before. Location of the first river bend to be returned.

April 2017 – During. A shell game of moving sediment & water. An estimated 285,000 cubic yards of sediment is being managed during this dam removal.
June 2017 – River bend taking shape. A lot of dirt to be moved around with this project.

July 2017 – After! Looking good at the same river bend, with floodplain being formed & topsoil placed.
June 2017 – Fish rescue efforts as the river is relocated to its original location at the upstream end of the project area. An estimated 1.8 miles of river is being “daylighted” or returned.
October 2017 – Surveyors mark the floodplain limits for equipment operators to grade out areas next to the river.

Surveyor staking the river channel for equipment operators. Shelves of muck interspersed with sand demand that all workers use caution. The contractor & engineers hold daily morning safety meetings.
July 2017 - Water flowing through the “sediment wedge” in the former pond takes the path of least resistance in an area once forested, with tree stumps & trunks as evidence. Large, heavy white “sand” bags slow down the movement of water & sediment giving excavators time to recreate the river channel & floodplain upstream.

August 2017 – Same spot as above photo where the river channel is being “moved over” to where it originally flowed before the dam was constructed. Note the same tree stumps in the foreground.
August 2017 – Equipment operators diligently working on managing the sand & muck to recreate the river & its floodplain.

October 2017 – A rock weir slows down the current and helps stop sediment so that it can be removed. This is where the dam core wall used to be, & is now the river’s final (& original) location.
Time for Habitat
June 2017 – Happy workers installing “toe wood.” Healthy rivers have log jams; excellent places for fish, otter, mink, turtles, frogs & aquatic insects to live & hide.

June 2017 – Building wood structures can resemble a game of “pick up sticks.”
June 2017 – Burying root wads in streambanks & anchoring with more wood. Instream wood also protects newly created river banks that have no root structure from trees & plants that are yet to grow.

April 2017 – Before. River channel is braided with a large plume of sand & gravel in the center of it. The river also needs to be moved away from the high, steep, eroding streambank on the left.
July 2017 – After! Same view of previous photo. Anchored wood looks natural & what critter wouldn’t want to live there? Note how the strongest river flow is directed towards the middle of the channel & there is sufficient floodplain on either side, providing room for “extra” water to flow during heavy rain & snowmelt events.

October 2017 – Moving downstream to another river bend, more “wood work.” Driving in log pilings to secure wood.
October 2017 - As the excavator drives piles, workers cut off the lengths sticking out above the river.

November 2017 – After! We like it. Root wads & logs secured along bank to protect this new river bend & provide habitat.
November 2017 – A balancing act. More wood structures being installed in the foreground with excavators working just downstream on the river channel.

December 2017 – Making progress. Floodplain created on the left & naturally occurring woody habitat on the right.
Bank Stabilization
December 2017 – Building fabric encapsulated soil (FES) lifts. These were prescribed for 600’ upstream, under & downstream of Cass Road Bridge to ensure the river channel is secured in place near this important infrastructure.

Framed sections of plywood (in the foreground) are temporarily installed at the river’s edge for coconut fiber mats to be rolled out & filled with earth by the excavator. Two layers were constructed; the base layer was filled with gravel & the top layer with a combination of sand/topsoil. Think of it as an earthwork “burrito.”
As the FES lifts are filled in, workers spread native grass seed mix in the soil to ensure natural revegetation of these newly created streambanks. The coconut fiber will break down over time as new roots of plants take hold.

Final product of the FES lifts! Workers have secured all the coconut mats with wooden stakes. This is a softer but strong remedy to stabilize & secure the streambank versus using fieldstone – a good example of “bioengineering.”
Chapter 7 – Powerhouse Removal

October 2013 – Before. An aerial view of the powerhouse & one-lane bridge. Water from the pond flows into the intake channel, through the powerhouse & into Sabin Dam pond on the other side of the road.

2015 – Ground view of intake channel when water was still in the pond. People often mistook this “intake channel” for the river channel; not so, this straight trench simply funneled water into the power generating part of the dam.
July 2017 – Intake channel dry with the pond being drained.

August 23, 2017 – Intake channel & the one lane bridge atop being demolished. This area will be filled & graded with a normal two-lane roadway built in its place leading to the new Cass Road Bridge.
October 2017 – Re-building the roadway using fill from on-site.

November 2017 – After! Road rebuilt & open to traffic. Seeding work in the foreground will happen before winter.
August 23, 2017 - Looking upstream at the power house of Boardman Dam as demolition begins.

August 25, 2017 - Powerhouse mostly gone. Sediment in the standing water is being controlled from entering Sabin pond with an earthen berm access road (from where the picture is being taken) & a turbidity curtain.
September 2017 – Powerhouse gone & earthwork continues.

September 2017 - Embankment & roadbed being graded for Cass Road, with much of fill coming from on-site.
December 2017 – After! Roadway is reconstructed & open to traffic where the powerhouse once stood.

August 23, 2017 – Tearing out the penstocks of the dam; these tunnels were where the water flowed through from the intake channel into the powerhouse to make electricity.
August 25, 2017 – Continuing to break down the power house & related materials. Picking out, loading & scrapping the metal.

September 2017 – Boardman powerhouse completely gone & area is being graded out.
April 2016 – Before. Cass Road was one-lane with a traffic light in order for vehicles to travel over the powerhouse.

December 2017 – After! The road is paved & has two lanes as it now connects the new bridge to Keystone Road.
Chapter 8 - Teamwork

May 15, 2017 – Project team partnering session. A dedicated, patient & strong network of partners continues to drive the overall Boardman River restoration effort.

August 2017 – Monitoring of amphibians & reptiles in the river corridor before & after dam removal will help measure the biological impacts of returning the river. Aquatic insects & fisheries assessments are also being compiled.
August 23, 2017 - Senator Debbie Stabenow with some of the many partners involved in restoring the river. We can do so much more when we stack hands. The Senator toured flagship projects of the Great Lakes Restoration Initiative (GLRI) in August to promote this vital federal program and the positive impact it has had on Michigan.

Senator Stabenow presented alongside Amy Beyer - CRA’s Director, Tom Shomin – Grand Traverse Band of Ottawa & Chippewa Indians Councilor, and Traverse City Mayor - Jim Carruthers.
October 13, 2017 – Forward motion. Signing of the Project Partners Agreement (PPA) between the US Army Corps of Engineers and the Grand Traverse Band of Ottawa and Chippewa Indians. A vital step toward removing the next dam - Sabin Dam, to fully reconnect and restore the Boardman River, originally known as the Ottaway.