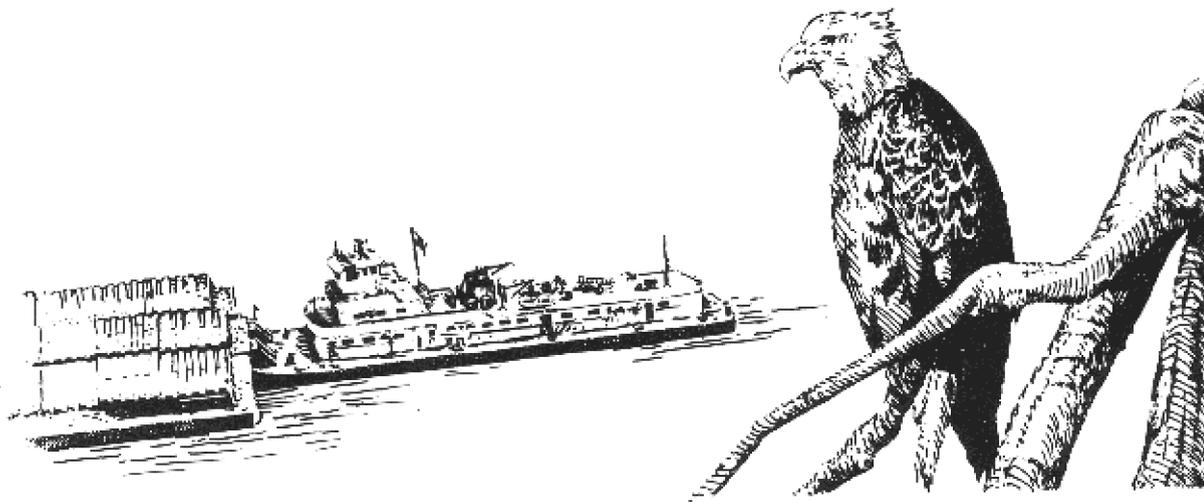


## Chapter 2

# The Engineers Go to School on the Mississippi



**From George Washington's Continental Army to the construction and operation of locks and dams serving modern commercial barge and towboat traffic on the Upper Mississippi may seem to be a long stretch in time and space for any organization, but that is one of the many directions the United States Army Corps of Engineers has taken in its 200-year history.**

**On June 16, 1775, the day before the Battle of Bunker Hill, the Continental Congress appointed a Chief Engineer and three assistants to aid in designing sieges and fortifications.<sup>1</sup> This unit was abolished in 1783 when the war with England was over, and it was not until March 16, 1802, that the Jefferson administration created a permanent Corps of Engineers. Sixteen officers and four cadets were directed to take station on West Point, New York, which was constituted as a military academy.<sup>2</sup>**

The first Engineer map of the Des Moines Rapids, drawn by Lieutenant Napoleon Buford to accompany his 1829 survey report. Though accurate, the map lacks much detail because Buford made his survey in February while the river was covered by a foot of ice and nine inches of snow.

**In 1816 a half-dozen officers were added as topographical engineers, though they were not strictly limited to surveying and mapping. These**

topographical engineers began the **first** surveys of the interior of the United States. One of these new engineers was Lieutenant Stephen H. Long, who was assigned to the Southern Division under General **Andrew Jackson**, and who was to take part in many of the **early** explorations of the Upper Mississippi Valley.

The expansion of the **Corps** of Engineers from fortifications to civil works was both natural, and, in a young country with vast public lands but limited industrial resources, necessary. By training on civil projects during peacetime, Engineers could prepare themselves and keep ready for wartime needs. At the same time, civil engineers were in extremely short supply during the first part of the 19th century. For a long time, West Point was the **only** school in the country which taught engineering. It remained the leading engineering school in the country until the Civil War. If the West were to be settled, it had to be reached. The only engineers available to do the job of building the roads and canals, charting routes for the growing railroad industry, and improving navigation on the inland waterways were those West Point graduates.

This early emphasis on transportation helped to formulate the long-lasting **Corps** policy of single purpose improvement projects on the Mississippi. Not until the Mississippi River Commission was established in 1879 did projects for other than navigation purposes begin.

Congress early in its history got the Federal Government into the business of public works. The first session in 1789 passed an act providing that "a lighthouse shall be erected near the entrance of Chesapeake Bay."<sup>9</sup> In 1802 President Jefferson ordered \$34,000 to be spent for public piers on the Delaware River.

In addition, most of the Colonies came into the new Republic with surplus land. Maryland refused to sign the Articles of Confederation until there was evidence that the new government would have control of these unsettled lands. In 1780 New York set

a precedent by ceding her claims to the United States. Others followed, and by 1802 Georgia, the last state, ceded her lands to the Government. With the Louisiana Purchase the following year most of the present United States passed into the public domain.

However, even Presidents such as Thomas Jefferson, Andrew Jackson, and Martin Van Buren, who saw the need for internal improvements, had doubts about the constitutionality of federal assistance in such projects. Jefferson suspected, and his successor James Madison was confident, that an amendment would be needed to permit the Federal Government to enter the field of public works. The expeditions of Lewis and Clark, and the later explorations of Lieutenant Zebulon Pike, Major Stephen H. Long, and Lieutenant John C. Fremont did serve primarily civil purposes, including taking stock of our national resources and identifying and classifying new plants and animals; but all of this had to be done under the guise of national defense. Until well into the 19th century, "military preparedness" was nearly always one of the reasons given for navigation improvements on the inland waterway. Even then, several Presidents, most notably Polk and Pierce, were opposed to Federal public works projects and succeeded in cutting appropriations to a minimum.

But the need for such improvements remained, and in 1818 the House of Representatives considered what improvements could be made as national defense measures. President Monroe's Secretary of War, John C. Calhoun, was instructed to write such a report. Calhoun went far beyond the official request and produced a carefully thought-out and detailed scheme for building roads and canals and for improving river navigation.

Calhoun's report played a major part in determining the role of the Corps of Engineers in civil works for his entire plan was based on the premise that the surveying, planning, and supervision of construction of these projects would be wholly in the hands of the Army Engineers. Calhoun's report also

smoothed the way for projects which, while having military value, were also of obvious commercial value as well.

Caught between increasing need for improvements and recurring questions of constitutionality, Federal navigation projects on the Mississippi and Ohio proceeded fitfully and piecemeal. The problem of constitutionality was not settled until 1866, after the Civil War. Only then did the improvement of the Upper Mississippi begin in earnest.

Nevertheless, within the hits of small and random appropriations, Engineers had performed a number of surveys and experimental improvement projects between St. Paul and St. Louis by the time Colonel Wilson arrived in 1866.

Much of this early surveying and experimenting was performed by the Topographical Bureau.<sup>4</sup> As has been mentioned, topographical engineers had originally been appointed in 1816 as part of the regular Engineer Corps. On July 2, 1818, a separate bureau was created, but still within the Corps of Engineers. As a result of the increasing number of civil improvement projects, the Topographical Engineers were removed from the Corps of Engineers on July 5, 1838, and formed into a separate and equal Corps of Topographical Engineers under Colonel J.J. Abert.

On August 1, 1838, Secretary of War Poinsett transferred all civil works directed by the United States to this new corps, reserving the Army Corps of Engineers for fortifications and other military construction. Although this dividing line was not strictly observed, most of the improvements on the Upper Mississippi between 1840 and 1860 were supervised by Topographical Engineers, Major G.K. Warren's early work on the Mississippi was as an officer in this Corps.

In 1863 the two Corps were again united as a single Corps of Engineers under Major General Andrew A. Humphreys. The Corps of Topographical

Engineers had only two Chief Engineers from 1838 to 1863: Colonel Abert and Major Stephen H. Long.

Long was the first Engineer to explore the Upper Mississippi. Between 1816 and 1818 he made surveys of the Illinois, Fox, Wisconsin and Minnesota Rivers. On July 9, 1817, with a party of 15, he set out from Prairie du Chien, Wisconsin, in a six-owed skiff to examine defense sites along the river valley. He reached the Falls of St. Anthony, then returned downriver to St. Louis. He stayed a few days at Fort Armstrong, which he considered an ideal fort, and then became the first of a series of Engineers to lose a contest with the Des Moines Rapids when his boat, much battered by the rocks, sprang a leak as he neared Fort Edwards.<sup>6</sup>

The first direct effect of the Calhoun report came in 1820 when Congress appropriated \$5,000 for the first Corps of Engineers survey, an examination of the Ohio and Mississippi Rivers from Louisville to New Orleans to "determine the most practical means of improving their navigation." The report of this survey, made by Brigadier General Simon Bernard and Major Joseph G. Totten suggested "clearing and snagging" as the primary means of improvement.

In 1822 Congress passed the first appropriation for river and harbor work, a sum of \$22,500. There was no appropriation in 1823, but in 1824 Congress appropriated \$115,000 for Improvement work, the first of what were to become regular annual appropriations for "rivers and harbors." In 1824 Congress also passed the General Survey Act "to procure the necessary surveys, plans, and estimates, upon the subject of roads and canals."<sup>7</sup> The General Survey Act was the most important direct result of the Calhoun report. It gave the President authority to employ officers of the Corps of Engineers to make surveys "as he [the President] may deem of national importance."<sup>8</sup>

To administer this Act, President Monroe appointed a Board of Engineers for Internal Improvements, consisting of Chief Engineer Alexander Macomb, his assistant, Bernard, and John L.

Sullivan, a Civil engineer. Topographical Engineers from the Topographical Bureau were attached to the Board, and a vigorous campaign to survey projects got under way.

Prior to 1828, however, few of these appropriations reached the Upper Mississippi. The Ohio and Lower Mississippi Rivers were more settled and more closely connected to the markets of the East. Although there was some trade as far north as St. Louis, steamboats were still in the process of developing enough power to brave the swifter currents above St. Louis. The Upper Mississippi was still dominated by keelboats and flatboats. The snagboat which Henry Shreve was asked to develop in 1829 was only for the Lower Mississippi.

Appearances on the Upper Mississippi by Corps officers during the 1820's was incidental to other purposes. Long had taken the *Western Engineer* up to Keokuk in 1820 just for show. In the spring of 1823 he again passed along the Upper Mississippi on an expedition to discover the source of St. Peter's River (later named the Minnesota River). Long and his party came by way of Chicago, "a few miserable huts inhabited by a miserable race of men."<sup>9</sup> From Chicago, they cut across the wilderness to Fort Crawford at the mouth of the Wisconsin River and then went by land up the right bank of the Mississippi into Minnesota. On this trip Long saw the advantages of a waterway connecting the Great Lakes with the Mississippi, and became the first Engineer to suggest a canal connecting the two between Lake Michigan and the Illinois River.

Not until 1829 did the effect of the General Survey Act of 1824 reach the Upper Mississippi. Late in 1828, Chief Engineer Brigadier General Charles Gratiot ordered Lieutenant Napoleon B. Buford, 3rd Artillery, on Topographical Duty, to "make reconnaissance and survey of the Des Moines and Rock River rapids, with a view to overcoming the obstacles to the navigation of the river at those points."<sup>10</sup>

Using the assistance of soldiers from Fort Arm-

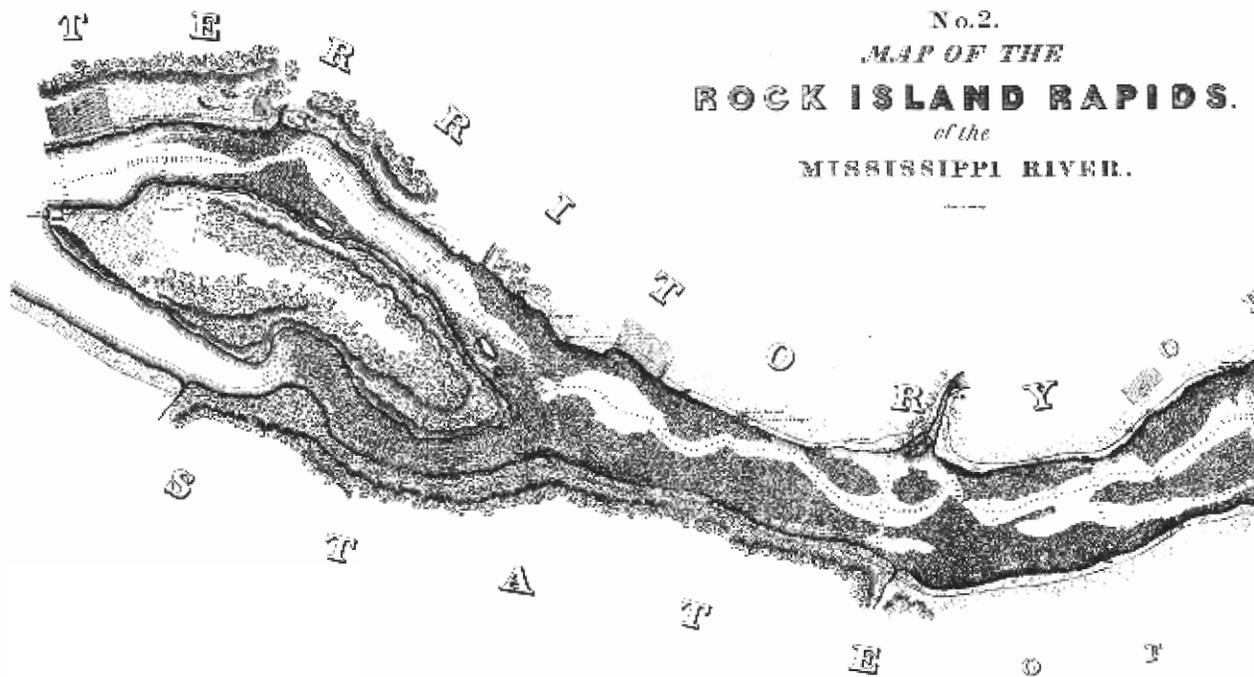
strong, Buford **began** his survey at the **Des Moines Rapids** on February 13, 1829, making **both** a topographical map and a **profile** of water levels at the surface. Lieutenant **Buford's map** was **too** general to be of much use to **later** engineer surveys, but it was amazingly accurate considering the fact that **when** the lieutenant made his survey, the Mississippi was **covered** with **one foot of ice and nine inches of snow**.

In his report, Buford noted that with the exception of  $1\frac{1}{4}$  miles at the **Des Moines Rapids** and  $13\frac{3}{4}$  miles at the **Rock River Rapids** (changed to the **Rock Island Rapids** after 1860), the whole of the river from **St. Louis** to the Falls of **St. Anthony** was **navigable** for eight months of the year by boats of  $4\frac{1}{2}$ -foot draft. **Because** of the rapids, **however**, navigation was reduced to the four months of high water **each** year.

**Buford's** report examined two alternative methods of improving the channel at **Keokuk** and **Rock Island**: constructing lateral canals around the rapids and excavating the existing channel to a depth of five feet. He concluded that the problems involved in lateral canals, especially around the **Des Moines Rapids**, were "almost insurmountable,"<sup>11</sup> and recommended using coffer dams to expose the rock in shallow places and blasting it loose. His estimates of the ease with which the improvement of them rapids could be achieved proved to be overly optimistic [a common problem for the next 40 years).

Supporting his recommendations for improvement, Buford pointed out both military and commercial advantages. **Foremost among these advantages** was assistance to the Galena lead traffic {which of course could be considered a military need). By 1829 the lead mines at Galena were **employing 10,000** workers. **The** Port of Galena, **then** reachable by boat, was by far the busiest steamboat landing north of **St. Louis**.

Although **Buford's** report was published as a **House Document**, Congress took no **action**. For the



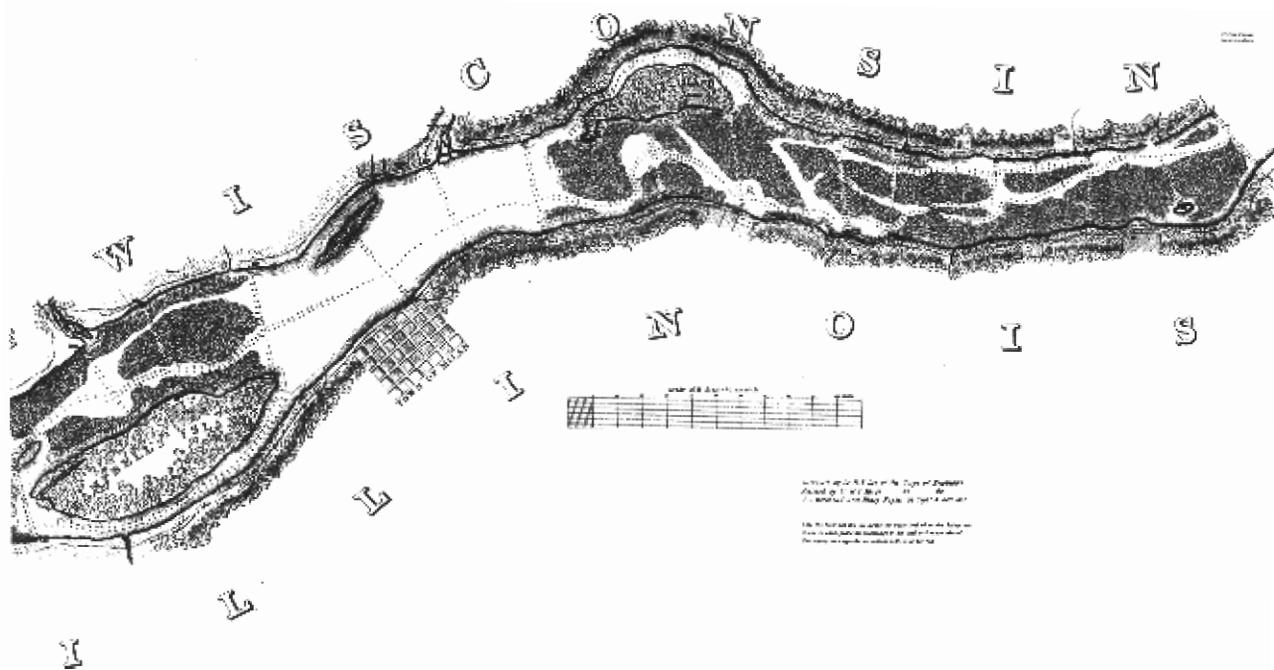
Lieutenant Robert E. Lee's map of the Rock Island Rapids, made in 1837 during the first of three seasons Lee spent on the Upper Mississippi. Lee recommended improving these rapids by cutting off the rock projections which made the natural channel twisting and dangerous.

next seven years there was no Corps of Engineer activity on the Upper Mississippi.

The end of official responsibilities did not end Buford's presence on the river, however. As was the case with other Engineers who came to work on navigation improvements, he fell in love with the area. In 1833 his parents and family moved from Kentucky to Rock Island, where his father opened the first store on Main Street of the young town. The Buford family built an imposing mansion in Rock Island (later used as the Tri-Cities Jewish Center), and over the years provided their share of well-known river pilots.

#### Lieutenant Robert E. Lee and the Rapids

Corps of Engineer activities resumed on the Upper Mississippi in 1835 when the river began cutting a new channel close to the Illinois shore opposite St. Louis. Bars had formed above and below



the St. Louis waterfront and were threatening to cut off river traffic. In 1836 Congress appropriated \$15,000 to build a pier above St. Louis to deflect the current back toward the Missouri shore and scour out the old channel, Chief of Engineers Gratiot asked Henry Shreve to draft a plan for the pier. At the same time, he requested Shreve to make recommendations for improving the Des Moines and Rock River rapids.

In the summer of 1836 Shreve went north in a small Government steamboat to look at the rapids. He was not familiar enough with either rapids to make recommendations without study. He visited the Rock River Rapids first, threading the mazes of those rapids until he knew them well. Then he charted a channel through the middle of them, and planned which edges to cut off.<sup>12</sup> He noted that marking such a channel with buoys would be difficult, especially because ice each winter would carry them away. Instead, Shreve's recommendation was "to establish Pilots authorized by law to be located at the Rapids with fixed Salaries,"<sup>13</sup> who knew the

rapids and could guide boats through the narrow and twisting channel. This is exactly what happened at the Rock Island Rapids with the arrival of regular steamboat traffic, though as a brisk private business rather than as a Government service.

A different set of problems confronted Shreve at the Des Moines Rapids. Here the rapids consisted of a single rather uniform layer of rock which made the whole stretch shallow and without the characteristic ripples to indicate obstructions. Shreve concluded that a channel cut through these rapids would be useless at night, and even during the day would require buoys and rapids pilots who knew where the improved channel was. Instead, Shreve recommended excavating a channel 90 feet wide along the Iowa shore. In this way the improvement would not interfere with present navigation while it was being built and more important, the shore line would form one side of the channel and serve as a guide for the pilots.<sup>14</sup>

Shreve returned to St. Louis and finished plans for the St. Louis pier, but too late to begin work during the 1836 season. He might have been assigned to complete these projects had not a young Engineer officer on duty with the Chief Engineer's Office in Washington volunteered for the St. Louis post. Lieutenant Robert E. Lee found official Washington dull and was looking for something more challenging. General Gratiot had taken a liking to Lee and gave him the post he had requested. As an assistant to Lieutenant Lee, General Gratiot assigned Second Lieutenant Montgomery Meigs, a young West Point graduate of 21. Meigs later supervised the construction of several important Corps projects, including the Capitol dome, the Washington Aqueduct and the Pension Building in Washington, D.C., and was Union Quartermaster-General during the Civil War.

Lieutenants Lee and Meigs set out for St. Louis in August 1837. Gratiot had already been there to make a personal inspection of the work to be done. He was a native of Missouri and had long been interested in the improvement of the Mississippi

River. **In giving this poet to a young, untried Engineer, he showed great faith in Lee's potential.**<sup>16</sup>

Lee was not impressed with St. Louis at first, "It is the **dearest and dirtiest place** I was ever in," he wrote to his close friend Andrew Talcott, "Our daily expenses **about** equal our daily pay."<sup>16</sup> But he grew to like the place during his **three seasons there, and the citizens of St. Louis grew to like him.** In 1838 when **Congress** cut off appropriations for completing the **St. Louis pier,** Lee **found** himself in the middle of a fight **between** St. Louis political factions, **each side blaming the other for** the Congressional action. True to Carps tradition, Lee refused to **take aides.** The *Missouri Republican* of October 1838 wrote of him:

The character of the Superintendent forbids the idea that he would make such a declaration for electioneering purposes; in fact, we believe he **has** deported himself throughout our election as every government officer **should,** but as very few at this day do, taking no part in the contest.<sup>17</sup>

**During the 1838 and 1839 working seasons,** Lee brought his growing **family** along to his **St. Louis** post.

**The Act of March 3, 1837,** appropriated an **additional \$35,000 for work** on the **St. Louis pier.** The same act appropriated \$40,000 for continued improvement of the **Mississippi River** above the **mouth of the Ohio and of the Missouri Rivers.** **With** these funds Lee was directed to **resurvey the Des Moines and Rock River Rapids,** to **determine** a plan for their **improvement,** and to **begin** such improvement as funds would allow.

Almost immediately on **arrival** in St. Louis in 1837, Lee and Meigs **made** plans to **survey** the two rapids. **Earlier,** in Louisville, Henry Shreve had **turned over to them** all the boats and equipment he had assembled for the project, **Using** these and a hired crew Lee and Meigs **proceeded** upriver. The captain of their **small steamer** was Henry Shreve's son-in-law, **Captain Morehead.**

Lee's original intention had been to begin the **survey** at the **Rock River Rapids,** but as the party

reached the lower rapids at Kaokuk their boat furnished concrete proof of the need for channel improvement by running aground on the rocks. Since the boat was impossible to move at the existing water stage, Lee decided to begin the survey at Keokuk. Lee and Meigs used the grounded boat as headquarters for the first three or four miles of the survey. After this they camped along the Iowa shore as they moved up the rapids.

Lee's letters during this period capture the flavor of frontier life. In a letter to Andrew Talcott, Lee related that at one encampment, having filled a vacant sabin with his men,

Meigs and myself took up our blankets and walked a short mile to the City of Des Moines composed of the worst kind of a small log cabin which contained the Proprietor and the entire population. Here we were kindly received and all accommodated with the softest Funcheon on the floor. How much I would tell you of the same city, its punchcons, dwellings and inhabitants, but I must look to my limits.<sup>18</sup>

Leaving the steamboat crew behind, Lee and his crew moved to the upper rapids where they found a greater degree of comfort and civilization at Davenport and the brand new town of Stephenson (later Rock Island). For accommodations Lee moved his party onto a steamboat that had been wrecked and abandoned on the rapids. The bottom had been torn out, but the two upper decks were above water. Here Lee and his men lived well, fishing for blue catfish over the side of the boat in the evenings.<sup>19</sup> "I assure you," he wrote to Talcott, "we were not modest, but fell without difficulty into the manners of the country, and helped ourself to everything that came our way."<sup>20</sup>

By the time Lee returned to Keokuk high water had floated his boat free and he returned to St. Louis by October 11 to draw up maps of the rapids and write reports of his surveys. He also drew up plans for improving the St. Louis waterfront, generally using Shreve's recommendations, but by the time they were finished the season was too advanced to begin work, and Lee requested permission to return to Washington and his family for the

winter. Before leaving he made preparations for the following spring by contracting to have a steamboat and four flatboats built.

His report on the two rapids was somewhat **more detailed** than Buford's, but Lee was equally **mistaken in imagining the ease with which the improvements could be made.** Lee's conclusions were consistent with Buford's, that improvement of the main channel at Keokuk and Rock Island was the best solution. He rejected Shreve's suggestion of a lateral canal at the Des Moines Rapids because it would involve an excavation of stone **three times as great as would be needed to improve the natural channel to a width of 200 feet and a depth of 5 feet.** Lee felt that cutting a channel through the Rock River Rapids would be even easier. The rapids were not consistently shallow. The difficulty was the natural channel's tendency to twist and turn its way though the chains of rock jutting out from the shores. These rapids Lee proposed to improve by cutting off **some of the projecting points of rock at short turns and narrow places, and by placing buoys to guide boats though the crooked channel.**

Lee estimated that to **complete the** entire project would require **\$189,622 at the Des Moines Rapids** and **\$154,658 at Rock Island, an estimate that turned out to be short by almost \$5,000,000.** In concluding his report Lee pointed out the necessity of the rapids improvement which would open up a **whole country above the rapids that was "daily increasing by a constant stream of emigration."**<sup>21</sup> **Twenty boats of over 150 tons each** were already in regular service on the **Upper Mississippi.**

In planning and carrying out improvement of the rapids and the St. Louis pier, Lee was doing pioneer work on the Mississippi. Prior to **this, Federal** activities on the river had been limited to cutting and removing trees along the shores and removing snags from the channel.

When Lee returned to St. Louis the following May to begin the actual work of improvement, he had been promoted to **Captain.** He remained in St. Louis to superintend the channel project there and sent

his new assistant, Horace Bliss, to the Des Moines Rapids to take charge of that improvement.

Bliss soon experienced an aspect of the Mississippi that would plague every Engineer involved in river improvement through the 19th century. The seasons of high and low water were extremely variable, forcing men to work when the river wanted them to work rather than when they were prepared to do so. The high water Bliss found when he arrived in Keokuk in the middle of May should have dropped, but Bliss and his crew were kept idle for weeks while the river continued to rise.

Just as Lee had given up hope for the season, the river fell unexpectedly. Lee and Bliss assembled a small crew and returned to the Des Moines Rapids, where they began cutting rock out of the Illinois Chute. Work was no sooner under way than cold weather hit on October 10. Lee kept on the hardest of his men, more than doubling their wages, but on the night of October 16 the river froze, followed by snow the next day. Lee was forced to abandon work on the rapids without really having had a chance to prove his plan. The small amount of work done in the fall of 1838 did not improve the channel much, but it did convince Lee that a channel could be cut.

The Act of July 7, 1838, appropriated \$20,000 for the Missouri River and for the Mississippi above the mouth of the Ohio, and \$1,000 each for surveys of the Rock River with a canal to Lake Michigan, and for a survey of the Des Moines and Iowa Rivers. But the whole \$20,000 was diverted to Shreve's snagging operations, and the tight money situation resulting from the "specie circular" scandal and the Panic of 1837 made further Congressional appropriations impossible. During the 1839 season Lee used what money was left from previous appropriations to finish the St. Louis project, limiting his work on the rapids to the Lower and English chains of the Des Moines Rapids. With Horace Bliss in charge again this season, work went ahead better than the previous year. Lee came to Keokuk about the middle of July to supervise the work, taking time out to make a trip to Galena where he happen-

ed on several old West Point friends and enjoyed soda water and ice cream "four times a day."<sup>22</sup>

Subsequent Engineers who came to work on the Des Moines Rapids generally regarded Lee's work as experimental and tentative without having much effect, but by the end of the 1839 season, when the work concluded, Bliss had removed nearly a whole reef at the Lower Chain and had opened a passage 50 feet wide and 4 feet deep through about four miles of the worst section of rapids. He had excavated some 2,000 tons of rock.

Lee had also experimented with buoys on this channel, placing four of iron and four of wood, bolted to the rock bottom, but the ice, as expected, pulled them all out.<sup>23</sup>

In his report of 1839, Lee recommended that the previous practice of working season after season with small appropriations and few pieces of equipment be abandoned in favor of using many boats and a large crew working along the entire rapids at the same time. The short and uncertain seasons on the Upper Mississippi and the expense of maintaining and repairing boats over the winter made the year-after-year approach more expensive in the long run.<sup>24</sup>

Neither method was approved, however, as the depression continued into 1840 and appropriations were not renewed. After August 27, 1839, Chief Engineer Brigadier General Joseph G. Totten, General Gratiot's successor, sent Lee on various surveys and inspections on the Ohio, Mississippi, and Missouri Rivers. At the end of the 1839 season, Lee left behind at Keokuk one steam towboat, three keelboats fitted for quarters, a smith's shop, a laboratory, five transportation boats, two double crane boats, one single crane boat, one current boat for towing, and enough platforms, drills, and stands for one hundred men.<sup>25</sup>

The method developed by Lee and Bliss for blasting rock under water was used with several improvements and variations throughout most of the

rest of the rapids improvement work. This method consisted of placing **iron tripods over the rack to be blasted**. On the tripod was placed a platform for **workmen**. It also served as a guide for the drills. Workmen then drilled a 1¾-inch diameter hole down through ¾ of a single rock layer. (Lee found it impractical to remove more than one stratum at a time.) A charge of one-half pound of powder was placed in a tin tube, and the remainder of the tube filled with sand. The tube was prepared and placed in the hole immediately on removing the drill. It rose above the water and was supported by the tripod. The effect of such an explosion was merely to **split the rack** so that it could be removed in large pieces. Using this method, underwater blasting could be done almost as economically as on shore.<sup>26</sup>

Congress again failed to vote further appropriations in the spring of 1840, and when Lee returned to St. Louis at the end of July, it was only to survey the previous work and advise his assistant, Henry Kayser, who had been hired by the City of St. Louis to complete the waterfront project. No further work was done on the two rapids.

Henry Kayser stuck to Lee's plan of improvement and eventually the bar that had been forming in front of St. Louis washed away. The channel along the Illinois shore that Lee had closed off filled in and later became East St. Louis, Illinois.

One interest — sidelight of Lee's years on the Upper Mississippi is a persistent story among local history buffs that the young Lieutenant was so impressed with the country along the river that he invested in, and laid out, a town site along the shore near the present city of Davenport, Iowa. One basis for this rumor can be found in *The History of Davenport and Scott County, Iowa*, by Harry Downer (Chicago: S.J. Clarke, 1910). Downer reprints an excerpt from a journal of an early Rock Island resident, Suel Foster, who recalled taking a trip down the Iowa (then Michigan Territory) side of the Mississippi in 1836. Foster went from Davenport to Muscatine and reported seeing stakes laid out for future towns along nearly the entire 50 miles. Six miles downriver from Davenport, he

reports coming across the town of Iowa "laid out by Captain Robert E. Lee and William Gordon (the same Lee afterwards the great Rebel general)." Suel Foster also noted that Captain Lee had appointed himself mayor of that future town, though he was absent when Foster arrived, busy "surveying the route of the great river."

No confirming evidence can be found for this account, and the 1836 date which Foster gives for his trip is two years before Lee spent any time in the area; but it remains just possible that Captain Lee's work on the Upper Mississippi did add to his honors a previously unreported title: "Mayor" Lee.

### Scattered Surveys, Examinations and Experiments

During the next 15 years from 1840 to 1855 only minor surveys and improvements were carried out on the Upper Mississippi. A survey of the Rock River and the Rock River Haven (a chain of four lakes in and near the present city of Madison, Wisconsin), authorized in 1838, was completed by Captain T.J. Gram of the Topographical Engineers. This was a preliminary investigation for a project to connect the Rock River by canal to Lake Michigan, with the chain of lakes serving as feeders for the canal. Gram outlined the rapids and bars that would have to be removed in order to make the Rock River navigable.<sup>27</sup>

Perhaps the only survey on the Upper Mississippi that resulted from a romance was made in 1841. John C. Fremont, a young Lieutenant with the Topographical Engineers in Washington, got to meet Senator Thomas Hart Benton from Missouri. Benton's expansionist ideas fired Lieutenant Fremont's zeal. Fremont had already spent some time on the Upper Mississippi in 1836-37, when he had assisted the distinguished French scholar, J.N. Nicollet with explorations for the source of the Mississippi.

In the course of events, Fremont fell in love with Jessie Benton, the Senator's daughter. In order to

separate the couple, Senator Benton arranged to have Fremont assigned to the survey of the Des Moines River which had been authorized in 1838. Fremont carried out a survey of 203 miles of the Des Moines River from its mouth to Raccoon Fork in July 1841. Fremont made a map of the river (never published though a copy exists in the National Archives), but he seems to have paid more attention to the flowers and wildlife along the way. His report contains extensive descriptions of flowers, plants, and geographical features.<sup>28</sup> Fremont then returned to Washington, where he married Jessie Benton.

In 1843 the Corps of Topographical Engineers adopted a divisional structure which placed Major Stephen H. Long at Louisville, Kentucky, as Superintendent of Improvements on the Mississippi, Missouri, and Arkansas Rivers, and on the Ohio below the falls at Louisville. Long reviewed the previous reports and surveys of the work in his charge and wrote a detailed report of the status of the projects for his superiors. He agreed with Lee's recommendation for excavating the natural channel at both the Des Moines and Rock Island Rapids. To solve the problem of pilots being able to find such an improved channel, Long suggested not buoys but "longitudinal strings or ribbands of large and heavy timbers, in continuous lines strongly spliced and bolted to the rocks at the side of the channel, and thus forming a guard to prevent the boats from impinging against the rocks."<sup>29</sup>

Under Long's direction the first harbor improvement work on the Upper Mississippi was begun. In 1844 Congress appropriated \$7,500 for deepening the harbor at Dubuque, Iowa, to accommodate steamers of the largest class. A small amount of dredging was done in 1844 by Joshua Barmy, United States Agent,<sup>30</sup> who had worked with Long in 1827 as a young Lieutenant, but the work was not completed with the amount appropriated, and no further funds were authorized until 1853. The Mexican War in 1846-47 stopped all appropriations and drew many of the Topographical Engineers away from civil works.



structed by the Corps specifically for an Upper Mississippi River project.

In 1850 Congress appropriated funds for the famous Mississippi Delta Survey. Under the supervision of Captain Andrew A. Humphreys and Lieutenant Henry L. Abbot, the Corps of Engineers began the first truly scientific survey and examination of nearly the entire Mississippi River Valley. When Humphreys' report was finally filed and published in 1861 as the *Report Upon the Physics and Hydraulics of the Mississippi River*, it immediately became a standard resource and a model of imitation for succeeding reports. Work on this report gave Humphreys a close look at the Des Moines and Rock Island Rapids, and his advice became valuable to Colonel Wilson when he began improving those rapids in 1866.

Renewed interest in the improvement of navigation on the Upper Mississippi resulted in the passage of the Western Rivers Improvement Act in 1852. This Act placed river and harbor work more firmly under the direction of the Corps of Engineers. Congress appropriated \$90,000 for improving navigation below the Des Moines Rapids, \$100,000 for work on the Des Moines and Rock Island Rapids, \$15,000 to complete dredging of the Dubuque harbor, and \$30,000 for improvement of the Illinois River. The last item was a Federal response to the Illinois and Michigan Canal which ran between Lake Michigan at Chicago to the Illinois River at LaSalle, and which had been completed by the State of Illinois in 1848.

The Western Rivers Improvement Act also brought Long new responsibilities, the Superintendency of Western Rivers. Long hired his brother, George Washington Long, to examine the Illinois River. George Long found 33 bars and shoal places at low water. By 1854 Major Long had sent the Corps dredge #2, the *Gopher*, up the Illinois to work at clearing a channel.

The improvement of Dubuque harbor, begun in 1844, was resumed on July 1, 1853, again under

local **charge** of Captain Barney. Captain Barney was also in charge of constructing a **new dredge** for the **work**, and was **responsible** for improvements at the Rock Island Rapids. **Also** on July 1, Long placed **Captain John Floyd** in charge of the Des Moines Rapids.

Barney went to Louisville, Kentucky (still Long's headquarters), **during** the spring of 1853 to **super-**vide construction of the new dredge. This dredge, built at a cost of just **over \$20,000**, was a ladder dredge **similar** to the *Devasseur* **built in 1344**. It had a draft of **3½ feet**, and was **very difficult** to operate properly. **Rising and falling water posed problem**, as did **the many submerged stumps in the harbor**. The dredge propelled itself by **anchoring lines** fore and **aft**, and **winching** itself ahead as **it made a narrow cut** in the channel. A **500-pound anchor** was needed to haul the boat **ahead**. In **addition**, the dredge **needed** lines anchored from **each side to keep** it from slipping back into the adjacent cut as **it made slice after slice** to obtain the **desired** channel width. **The two 76-foot by 15-foot belts which** ran the ladder of **buckets slipped** so badly when the **buckets hit hard mud that they** frequently **caught** fire and had to **be replaced**.

*Dredge Boat #1*, as it was called when it arrived at Dubuque in 1853, was renamed the **George W. Junes** in honor of a United States Senator from Dubuque. The **purpose** of dredging the Dubuque harbor in 1844 had been to open a channel **from Dubuque!** to the **main** Mississippi channel near the Illinois side, **but** by 1853 **something new had** been **added**. The 1853 **project**, reported Major Long, "obviously **has** for its object the **opening** of a navigable channel leading from the **main business landing of** Dubuque, directly **across** the Mississippi to the **contemplated** terminus of the westerly branch of the Illinois Central Railroad."<sup>31</sup> Railroads **were** approaching the Mississippi not only here **but** at Rock Island as well, and **they** were planned at several other **places**. **More and more**, these railroads would **complicate** the work **of** the **Engineers** on the Mississippi.

By 1854 the Dubuque harbor was in worse condition than it was before the work began. The new cut had not been completed, while dredged material from this new cut had been placed in the old former channel, making it even shallower. Further, business interests in Dubuque had begun construction of a causeway out into the river above Dubuque, using material dredged from Barney's project. All of this interfered with river traffic and the end result was that Long received a reprimand from Secretary of War Jefferson Davis over the Dubuque project. Long went to Dubuque to supervise the work personally but without success. Ice on the river made the immediate removal of the dredged material impossible.

Work on the project was suspended, and in May of 1855, the *George W. Jones* was ordered to assist in dredging on the Illinois River. The boat had difficulty getting over the Rock Island Rapids, considerably injuring its bottom, and it was permanently stopped by low water at the Des Moines Rapids.

Barney's responsibilities at the Rock Island Rapids consisted of contracting for improvement work. He advertised in both local and Eastern papers for the work to begin in early October of 1853, but no acceptable offers were received. Similar difficulties continued to be a problem on the Upper Mississippi. Much of the work was of such an experimental nature that few contractors had equipment to do the work or the knowledge necessary to make reasonable bids. And no contractor was eager to invest in expensive, specialized equipment considering the past history of Congressional appropriations.

Also in 1853, Major Long detailed another of his assistants, Lieutenant Gouverneur K. Warren, to make a third survey of the Des Moines and Rock Island Rapids. This was the first of many services Warren performed for the Corps of Engineers on the Upper Mississippi. Warren had gotten his field training three years earlier when, as a young 21-year-old West Point graduate, he had been

**assigned** to the Mississippi Delta Survey under Humphreys and Abbot.

Warren's orders were to examine both rapids "to determine the most direct favorable and economical passes or routes along the bar of the river for the formation of a continuous navigable channel at least two hundred feet wide and four feet deep at the lowest stage of the river ever known or likely to occur again."<sup>32</sup> He was to mark the sections of rapids into mile lengths, note how much improvement, was needed in each, and what kind, find a place to put the spoils, and then mark the proposed channel with buoys and landmarks.<sup>33</sup>

Warren began his survey work at the Rock Island Rapids on June 26 and worked there until September 21 when he left for Keokuk. His survey of the Des Moines Rapids took until December 1, when he left for St. Louis to write up his reports. His surveys took this long partly because of high water and partly because of a lack of cooperation from Captain Barney and Major Floyd, who were supposed to assist him, but it was also because of the careful and deliberate manner in which Warren worked. The Warren Report published in 1854 was far more detailed and useful than the earlier reports by Lee and Buford.

One of Warren's first suggestions to Long was to change the names of the two rapids in Corps correspondence to the "upper" and "lower" rapids. These were the names by which they were known in the area and used by steamboatmen; in addition, said Warren, it would avoid confusion with rapids in the Des Moines and Rock Rivers. Although this change was not adopted, the name of the Rock River Rapids did change shortly to the Rock Island Rapids.<sup>32</sup>

Because of continued support among rivermen for Shreve's recommendation of a lateral canal around the Des Moines Rapids, Lieutenant Warren made a particularly close examination of the existing shore channel along the Iowa side of the river. That channel had only 10 to 12 inches of water in places and was used wholly by "lighters," small, horse-drawn

flatboats 100 feet long by 20 feet wide, which could carry from 100 to 200 tons of goods. Lighters were needed at the rapids to relieve the large packetboats of their cargo so that the steamers could pass the rapids at low water. During the low-water season, boats with drafts larger than 24 inches could not get over the rapids. Warren reported that the lighters needed "luck and eight horses" to make the trip from Keokuk to Montrose at the head of the rapids in six hours.<sup>35</sup>

Lighters were expensive as well as slow. In 1853 it cost \$1 per ton to lighter goods down the rapids and \$1.25 to lighter them up. In addition, Warren reported, the money lost by waiting steamboats was even greater because "salaries are paid as high as 33 35¢ per hour."<sup>36</sup> The rapids drove other wages up as well. Warren found that he was unable to hire rowers for his survey, even at \$1.25 per day, because "the great quantities of freight at both ends of the Rapids gives employment to every industrious man at high wages."<sup>37</sup>

Travel on the Rock Island Rapids was not much faster. On one occasion while he was surveying these rapids, Lieutenant Warren and his crew were forced by the current to tow their rowboat along the shore from Davenport fifteen miles up to the head of the rapids at Le Claire. They arrived three hours ahead of a steamboat that had left Davenport at the same time.<sup>38</sup>

As directed, Warren also experimented with buoys at the Rock Island Rapids. He used white cedar logs eight inches in diameter and three and one-half feet long, but he could only get them to show adequately where the current was slack.

In his report on the Des Moines Rapids, Warren anticipated that such a lateral canal as suggested by Shreve might eventually become the permanent method of improving the Des Moines Rapids, but recommended that the present work be limited to deepening the natural channel. Such an improvement would be immediately useful, while a canal would give no improvement until the whole was

**completed — no sure bet considering past appropriations,**

Warren agreed with Buford, Shreve, and Lee in feeling **that** the Rock Island Rapids was a far easier problem than the Des Moines Rapids. Low water at Rock Island gave a 2½-foot channel naturally, and this had been raised another 10 inches by damming the small channel separating Rock Island from the Illinois shore. The real dangers of the Rock Island Rapids were the crookedness of the channel and a swift, unpredictable current,

The need for improvement on the Upper Mississippi was shown by the fact that in 1853 seven steamers had been wrecked between Keokuk and St. Paul, two of them on the Rock Island Rapids and one on the Des Moines Rapids. Major Long calculated that the average loss of these boats, including wages and freight, was \$50,000 per boat.<sup>39</sup>

Contract work on both rapids began in August 1854 and continued until November, Major John Floyd replaced Captain Barney as United States Agent supervising these projects. Although the contractors did not assemble as many men as had been hoped for, they did good work and in the short three-month season significant improvement was noted. Using the drilling and blasting methods developed by Lee, contractors at the Des Moines Rapids worked on the English Chain at the points designated on Warren's map as Centre and Brown's Patches. These points were almost entirely removed, giving Centre Patch a low water depth of six feet and Brown's Patch a depth of five feet. Contractors at the Rock Island Rapids worked at Campbell's and Sycamore Chains. At Campbell's Chain, a channel 100 feet wide and 4 feet deep was obtained.

The problem encountered with the advent of serious work on the rapids soon made those in charge aware of how optimistic early estimates had been. A single rock in Brown's Patch required two men four days to drill a hole 23 inches deep and dulled 72 steel points. At Campbell's Chain four men

took two weeks to cut off 2½ feet of rock projecting into the channel, even though breakwaters were used to protect the men from the current.<sup>40</sup>

Floyd foresaw that at the present rate, improvement of the rapids might take "forever."<sup>41</sup> He suggested that in 1855 appropriations should be doubled, work should be carried on during the two months of low water in early spring using India rubber suits for the men, and that contractors should run three shifts around the clock.

Although the two months of low water never materialized in 1855, work progressed well because of the introduction of powerful new steam equipment. Wrought iron drills with cast steel cutter heads four to six inches wide, and a new steam chisel with massive iron cleaver heads were put into operation, along with new boats designed to support them. This new equipment was apparently designed by Floyd and built by the contractors. Adapting to this new fleet delayed the beginning of work in 1855 until September 15.

During the 1855 season a new problem developed in connection with contract work. The Corps of Engineers found it increasingly difficult to find contractors to do the work, and the contractors themselves found it impossible to hire enough men to complete their contracts with the Corps. The reason was competition from the railroad companies who were building westward as rapidly as possible. The Corps of Engineers had been involved in the railroad craze in the East in the 1830's in much the same capacity as they were now on the waterways. Now railroad fever had affected most of the general public in the Upper Mississippi Valley.

This fever may account for the fact that the significant improvements finally now being carried on by the Engineers, though they had been requested by people of the Upper Mississippi for many years by memorials to Congress, pressure on Congressmen, and river improvement conventions, now went all but unnoticed in the local newspapers. The *Davenport Gazette* of June 9, 1853, noting the new appropriations for rapids improvement, claimed not to

feel much interest in it, now that the "certainty of direct Railroad communication with the East was assured."<sup>42</sup> Other newspapers along the river echoed similar sentiments.

Part of the excitement over the railroads involved land speculation; new towns would be made by the railroad as they had been by the rivers. Another reason for excitement was the realization that railroads would give the Upper Mississippi Valley a direct transportation route to the Eastern markets. Shippers would no longer be tied tightly to St. Louis or to New Orleans, who, aware of their strategic locations, had made use of their facilities expensive.

Public sentiment, then, was pro-railroad in 1856 when the first bridge across the Mississippi, the Chicago, Rock Island, and Pacific Rail Road Company Bridge, opened for traffic. Steamboatmen sensed an end to their transportation monopoly and complained bitterly about the location of the bridge as an obstruction to boats in the channel. There was **some truth to this. The bridge had been built in the worst possible place and at a bad angle for boats passing through the drawspan. In the spring of 1856, weeks after it opened, the steamboat *Effie Afton* struck a bridge pier, wrecking both boat and bridge. The ensuing legal tangle involved Abraham Lincoln as a lawyer for the railroad company, and ended with no firm conclusion as to how much of an obstruction the bridge really was or whose fault the accident had been.**

**Floyd in his 1856 report to Long, now a Lieutenant Colonel, took an especially dim view of the bridge:**

It has been deemed proper by your orders not to work on the Rock Island rapids with the balance of the appropriation. Indeed, it were useless to do any more work there as long as the bridge remains to obstruct the navigation. I look upon that bridge, as now located and constructed, being situated at the narrowest point on the rapids, where the current has the greatest velocity, and the piers at an angle to the current, to be a greater obstruction to the navigation of the Rock Island rapids than all the balance of the rapids besides.<sup>43</sup>

**Floyd had a point. Of the 1,667 boats and rafts passing the Rock Island Bridge in 1857, 55 collided with the structure.**

**The other Corps projects on the Upper Mississippi in 1855-56 fared as poorly. The Dubuque harbor project grew more and more complicated. On August 21, 1854, a Board of Engineers of Lake Harbors and Western Rivers authorized a survey at Dubuque to find a site most suitable for a bridge and "causey" [causeway]. The railroad bridge was to go from Dubuque across the river to Dunlieth (now East Dubuque), Illinois. Long assigned this survey to J. C. Jennings, United States Agent in charge of the harbor improvements at Dubuque, on May 31, 1855.**

**The need for harbor improvements at Dubuque was increasing rapidly. Commercial statistics listed 672 steamboat arrivals at Dubuque in 1854, bringing 97,633 tons of goods with a value of almost \$5,000,000. Exports from Dubuque reached 11,736 tons in 1854.<sup>44</sup>**

**Agent Jennings at once began making changes in the causeway and harbor plans. He determined to change the location of the causeway and construct it with dirt from the bluffs rather than from river islands as originally called for, and he made deviations from the original harbor lines. At the same time, a Dubuque Harbor Company had been formed on February 27, 1855. This joint stock company of private Dubuque businessmen owned land near the harbor and proposed causeway. A controversy began between the Corps and the company over rights-of-way, stopping the work. Jennings failed to respond to Long's letters of inquiry during the summer of 1855, and when Long made an inspection tour to Dubuque on October 22, he found the harbor still unimproved. Disagreements were settled the following spring, but no further appropriations were forthcoming.**

**Work continued through the 1856 season on the Des Moines Rapids with the new steam equipment performing well. In 1856 a new blasting technique involving "galvinism" was put into use. Floyd reported to Long that now he could "set off a line of blasts of almost any length simultaneously."<sup>45</sup> But work on the Des Moines Rapids came to a close un-**

finished at the end of the season. Later, in response to a Congressional inquiry about a possible lateral canal around the Des Moines Rapids, Floyd reported that the natural channel was adequate, and that all the engineers who had seen it felt that it could be easily expanded "to suit the exigencies and requirements of commerce, even fifty years hence; which will be far different from now."<sup>46</sup>

Although the Act of August 16, 1856, appropriated an additional \$200,000 for improvement of the Des Moines Rapids, no further work was done on either rapids following the 1856 season. Only a small section of each rapids had been improved. The *Keokuk Whig* of September 6, 1856, reported that there was still only 20-22 inches of water on the Des Moines Rapids. A President opposed to Federal civil works, and the impending national crisis, served to dry up appropriations.

## Notes

### Chapter 2

1. Ralph P. Thian, *Legislative History of the General Staff of the United States Army 1775-1901* (Washington, GPO, 1901), p. 485.
2. 2 stat. 132.
3. 1 stat. 53, discussed in Frank Smith, *The Politics of Conservation* (New York: Pantheon Books, 1966), p. 3.
4. Henry Beers, "A History of the U.S. Topographical Engineers, 1813-1863," *The Military Engineer*, XXXIV (1942), 288.
5. Richard G. Wood, *Stephen Harriman Long* (Glendale, California: Arthur H. Clark Co., 1966), pp. 38-57.
6. Stephen H. Long, *Voyage in a Six-Oared Skiff to the Falls of St. Anthony in 1817* ("Collections of the Historical Society of Minnesota"; Philadelphia: Henry B. Ashmead, 1860), p. 75.
7. General Survey Act of 30 Apd 1824. 4 stat. 22.
8. *Ibid.*, p. 23.
9. U.S. War Department, *Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean* (no pub., 1858), p. 25.

10. U.S. Congress, House, *Message from the President of the United States, Transmitting Copies of Surveys Made in Pursuance of Acts of Congress, of 30th April, 1824, and 2nd March, 1829*, Executive Document 7, 21st Congress, 1st Session, 1829, p. 7.
11. *Ibid.*, p. 20.
12. Florence Dorsey, *Master of the Mississippi, Henry Shreve and the Conquest of the Mississippi* (Boston: Houghton, Mifflin Co., 1941), p. 189.
13. Henry Shreve, quoted in Robert E. Lee, Survey Report to Colonel J.G. Totten, Chief of Engineers, October 21, 1839, RG 77, NA.
14. Dorsey, p. 189.
15. Douglas Freeman, *R.E. Lee, a Biography*, Vol. I (New York: Scribner's, 1935), p. 137.
16. Robert E. Lee, quoted in Freeman, p. 141.
17. *Ibid.*, p. 154.
18. *Ibid.*, p. 143.
19. A.L. Long, *Memoirs of Robert E. Lee* (New York: J.M. Stoddart and Co., 1886), pp. 41-43.
20. Lee, as quoted in Freeman, p. 144.
21. U.S. Congress, Senate, *Report from the Secretary of War, in Compliance with a Resolution of the Senate of the 25th Instant, in Relation to the Rock River and Des Moines Rapids of the Mississippi River*, Senate Document 139, 25th Congress, 2d Session, p. 6.
22. Lee, as quoted in Long, p. 45. General Brooke, whom Lee met here was apparently not a West Point graduate, but Dick Tilghman was a graduate of the class the year before Lee's. He had resigned from the Corps of Engineers at the time Lee met him at Galena, and was a civil engineer on projects throughout the Upper Midwest.
23. Lee, Survey Report.
24. *Ibid.*
25. *Ibid.*
26. U.S. Congress, House, *Letter from the Secretary of War, Transmitting the Inspection of Colonel S.H. Long, and the Report of Lieutenant Warren of his Operations During the Past Year on the Des Moines and Rock River Rapids, in the Mississippi River*, Executive Document 104, 33d Congress, 1st Session, 1854, p. 1.
27. U.S. Congress, Senate, *Report from the Secretary of War, Transmitting, in Compliance with a Resolution of the Senate Copies of Reports, Plans, and Estimates, for the Improvement of the Neenah, Wisconsin [sic], and Rock Rivers; the Improvement of the Haven of Rock River; and the Construction of a Pier at the Northern Extremity of Winnebago Lake*. March 25, 1840. Survey of Rock River, by Thomas Jefferson Cram, Captain, Topographical Engineers. Senate Doc. 318, 26th Congress, 1st Session.
28. John C. Fremont, *The Expeditions of John Charles Fremont*, Vol. I, Ed. Donald Jackson and Mary Lee Spenser (Urbana, Illinois: University of Illinois Press, 1970), p. 115. See also Frank N. Schubert, *Vanguard of Expansion: Army Engineers in the Trans-Mississippi West* (U.S. GPO, 1980).
29. Major Long to Colonel Abert, September 1, 1843, File 338, RG77, NA.
30. Joshua Barney graduated from West Point in 1820. He was commissioned in the Corps of Engineers but resigned in 1832. He worked as a civil engineer in service to the United States from 1844 to 1854. The title United States Agent was apparently given to civilians who supervised projects for which a set amount of money had been appropriated. They supervised such projects until the money ran out.
31. Colonel Long to Lieutenant Colonel J.E. Johnston, November 25, 1853, File 338, RG77, NA.
32. Colonel Long to Lieutenant G.K. Warren, June 1, 1853, File 338, RG77, NA.
33. *Ibid.*
34. Lieutenant Warren to Colonel Long, September 1, 1853, File 338, RG77, N.A.
35. G.K. Warren, "Journal" Warren Papers, New York State Library, Albany, New York.
36. *Ibid.*
37. *Ibid.*
38. *Ibid.*
39. U.S. Congress, House, *Letter from the Secretary of War, Transmitting the Report of Colonel S.H. Long*, p. 56.
40. U.S. Congress, Senate, *Report of the Secretary of War in Answer to a Resolution of the Senate Relative to the Improvement of the Des Moines and Rock River Rapids*. Report by John G. Floyd, United States Agent. Executive Doc. 12, 33d Congress, 2d Session, 1854, p. 3.
41. *Ibid.*
42. *Davenport Gazette*, June 9, 1853, p. 2.
43. U.S. Congress, Senate, *Report of the Secretary of War, Communicating in Compliance with a Resolution of the Senate of December 26, 1856, Information Relative to the Des Moines and Rock River Rapids, and the Harbor at Dubuque, Iowa*, Executive Doc. 45, 34th Congress, 3d Session, 1857, p. 32.
44. *Ibid.*
45. *Ibid.*
46. U.S. Congress, House, *Letter from the Secretary of War, Transmitting a Report Furnishing Information in Relation to the Improvement of the Des Moines Rapids*. Report of John G. Floyd, Executive Doc. 83, 35th Congress, 1st Session, 1858, p. 2.