21. Dredge No. 4
Bonanza Creek
11 km. south south east of Dawson, Yukon

22. Dredge No. 12
Dominion Creek
60 km. south east of Dawson, Yukon

INTRODUCTION

The two dredges under review are flat-hulled vessels with superstructures housing massive machinery. Extending in front of each is a bucket elevator or ladder - a crane-like arm with large buckets mounted on an endless chain. When operating, this bucket elevator bit into the gold-laden Klondike gravels, either downward below the artificially-formed pond in which the dredge floated, or up the banks of the creek which fed the pond. The gravel was then brought into the dredge's mid-section where it could be processed. Tailings were spewed out behind on a moving belt. As the dredge dug ahead and tailings were deposited behind, the pond would be brought along with the dredge. Thus the vessel would be able to float up and down the valleys processing billions of tons of gravel, depending on where geologists determined it would be most profitable to do so.

Stampeders had already extracted the most easily accessible paystreaks from the Klondike gravel, or placer as it is properly called - roughly from 1896 to 1905. After this period, corporate interests moved in to do large-scale mining with dredges. As it turned out, there was enough gold left to make it worth their while for another sixty years. In fact, gold prospecting and mining in the Klondike are now experiencing another revival, and the valleys are again alive with the operating sounds of trucks,

earthmoving equipment, and at least one dredge. Rather than being owned by large corporations as in the heydays of dredging, however, the equipment is being run by individuals and small companies - a new generation of gold-seekers for whom the Klondike still holds promise.

For the increasing numbers of tourists to this area, the current mining activity serves to enhance Parks' interpretation programme of historical mining, and vice versa. In the last decade or so, there have been deliberations within CPS as to where resources should be expended in this programme designed to "even the commemorative balance" between Dawson City and the goldfields. Both Dredge No. 4 and Dredge No. 12 have been acquired for the purpose, but it now appears that only one will be preserved. The preference is to retain Dredge No. 4. However, this will involve a mammoth procedure to remove the frozen silt that now fills the hull, recreate the Bonanza Creek dredging pond, and float the dredge a short distance to higher ground. There it would be left high and dry, out of the path of the creek's damaging spring floods. The proposed procedure is the result of CPS engineering studies undertaken in 1985; its validity was confirmed in 1988 through an independent study undertaken by the Canadian Armed Forces,[1] requested by CPS.

If the operation is undertaken and is successful, and Dredge No. 4's safety is ensured, the superintendent of KNHS would like to sell Dredge No. 12, considering it superfluous to Parks' present requirements.[2] A few years ago, it was hoped that the structure could be moved to Bear Creek (an abandoned mining company town about 5 miles from Dawson now owned by KNHS) (see Figure 1) where it would be restored and opened to the public. There are a number of advantages to this scenario: it would be less costly to restore and maintain (compared to Dredge No. 4); it would fit in well with long-range interpretive plans for Bear Creek; and being smaller, the structure's operations might be more easily comprehended by the average layperson. Given the current

atmosphere of fiscal restraint, however, the possibility of Dredge No. 12's relocation in addition to Dredge No. 4's preservation and interpretation, appears to be unlikely. The FHBRO committee's evaluation of the two dredges will help to determine the immediate future of Dredge No. 12.

HISTORICAL ASSOCIATIONS

Thematic

The commemoration of historically important mining sites in Canada - the Klondike gold fields in particular - has been a concern of the HSMBC for some time. This has resulted in a number of studies (some referred to throughout this paper),[3] National Historic Site designations,[4] and policies. Policy developments have included CPS adoption of Theme 2(a), formulated to give direction to KNHS, i.e. "The Historical Consequence of the Gold Rush: development of the goldfields, including related mining technology, the consolidation of claims, and the era of corporate operations." The two dredges under review relate strongly to this theme, illustrating the most significant mechanized technology for gold extraction ever demonstrated in the North, and the corporate mining methods put in place to support it.

Dredging for gold in the Klondike began in 1899 with a relatively small steam-driven structure built by Risdon for the Lewes River Mining and Dredging Company (Figure 22). In twenty hours with a crew of three, it could do the equivalent work of one hundred and fifty-six men using picks and shovels,[5] then the predominant mode of processing placer. The Risdon was the only dredge operating in the Yukon before 1905. During this six year period, there were various other experiments to mechanize gold retrieval and to overcome the problems associated with the permanently frozen overburden of worthless muck and gravel that lay on top of the paystreaks. Dredging was to win out over other methods, however.

The substantial capital costs of dredging had a number of implications. Among them was the need for large corporations to supply financing and sophisticated management, and the need for professional engineers and geologists to ensure that the expensive equipment worked efficiently. It also meant a consolidation of mining claims that had heretofore been parcelled out to individuals. The Canadian Klondyke Mining Company (CKM) established in 1905, and the Yukon Gold company (YGC) established in 1906, became the two corporate giants in the region, each with its own dredges, territory, and base of operations. Bear Creek was the base for the CKM; Guggieville for the YGC (named after the New York Guggenheim family, of which some members were the principal backers of the company).[6]

It was the CKM Co. that built Dredge No. 4 in 1912-13 - the company's fourth as the name suggests. Before the company was officially incorporated in 1905, its visionary founder, Joe Boyle (who had come as an individual prospector/miner to the Klondike in 1897), had been busy preparing the way for corporate mining in a big way, perhaps inspired by the smaller Lewes River model. By 1900 he had secured from the government a large mining concession which emcompassed a seven mile stretch of the Klondike River Valley and included other creek valleys which fed into it: those of Bonanza, Hunker, Bear and Lindow creeks. In addition, he obtained all the water and timber rights within the concession - resources which he was to fully exploit. Over the next five years he arranged a deal with a group of Detroit investors to form the CKM; he also engaged the Marion Steam Shovel Company in Marion, Ohio to design a dredge suited to Klondike conditions. Steel mechanical parts and framing members were manufactured there and shipped to the Klondike where they were assembled and incorporated into an otherwise wooden structure built in the Klondike River valley, opposite the mouth of Bear Creek. Much more powerful and efficient than the Lewes River dredge, No. 1 was the precursor of approximately 30 similar dredges to follow,

many of which were owned either by the CKM or the YGC. No. 4 Dredge differed from No. 1 only in its larger size and a few details of hull and superstructure design. Reported to be the biggest of its kind in the world,[7] and almost certainly the biggest in North America, the former could process as much gravel in a day as could 2000 men using manual methods.[8]

Dredging prolonged the economic viability of gold retrieval in the Klondike well past the early years of the Rush when individuals had quickly exhausted easily mined deposits. Eventually, however, even the dredges began to run out of profitable gravels and there were other difficulties too, including reduced demand and fallen prices for gold during the first World War. Inevitably, there came a consolidation of companies working in the area including the CKM and the YGC; these were amalgamated to form the Yukon Consolidated Gold Corporation (YCGC) in 1926. Dredge No. 4 continued to work for YCGC in the Klondike Valley until 1940 when it was dismantled, modified, and rebuilt on Bonanza Creek. This is the structure that remains today on the site where it ceased operations in November 1959 - a structure remarkable not only for its size and capabilities, but for its longevity of use.

Dredge No. 12 was acquired by the YCGC in 1953 when it was purchased second-hand from a company in Alaska and moved to Dominion Creek. A steel-hulled vessel, it was designed by a California company in the 1930s, used in Alaska until 1953, and in the Yukon from 1954 to 1965 - one of the last of the working dredges owned by a large mining corporation in the North. In September 1966, YCGC ended operations in the Klondike, thus bringing to a close an historically significant era of Yukon resource development.

Person/Event

Adventurer, mining magnate and international hero, Joseph Whiteside Boyle is the man most closely associated with Dredge

No. 4 as its initiator and one-time proprietor. One of the North's most colourful historic characters, he has been the subject of at least one book,[9] has figured prominently in others,[10] and has been designated of national historic importance, following a HSMBC paper written by a CPS historian.[11] A HSMBC monument commemorating his life has been erected near the dredge (visible in Figure 6). Its plaque reads:

> Joseph Whiteside Boyle
> Born in Toronto and raised in Woodstock, Ontario, Boyle had a varied career before arriving in Dawson in 1897. Becoming involved in many businesses, "Klondike Joe" soon recognized the potential of large-scale mining. He left the Klondike in 1904 but returned five years later at the head of one of its largest mining operations. "The King of the Klondike" lived here until 1916, when he left for England to help in the allied war effort. For his war-time services, especially his heroic achievements in Russia and Romania, Boyle was decorated by several European nations. He died in London, England.[12]

Local Development

Dredges No. 4 and No. 12 are the best preserved of the more than 30 similar vessels that extracted gold from the placer gravels of the Klondike region between 1905 and 1966. As such, they are the best extant structures to illustrate the enormous impact of corporate mining, not just in the valleys where they operated, but in Dawson, and in the whole Yukon.

In the valleys, dredging was responsible for the massive alteration of the landscape, still marked by the miles of tailings left behind. Dredging was also central to the establishment of company towns such as Bear Creek owned by the CKM Co., and later the YCGC. Everything here was built in support of dredging - repair and maintenance shops, a building to house the engineering and administrative functions, a warehouse for electrical equipment, an oxy-acetylene plant, as well as messhalls, bunkhouses and other buildings for workers. Of

interest to visitors in recent years is the gold room where raw gold from dredge "clean-ups" was smelted into ingots for shipment to the mint.

Cutting across the valleys were hydro lines, pipe lines and sluices which supplied power and water needed in dredging operations. One ditch and pipeline snaked some 120 kimometres from the Ogilvie mountains to deliver extra water to Bonanza Creek where Dredge No. 4 now sits.[13] Remnants of this highly engineered work completed in 1909 are still visible.

Dredging of the creeks hastened the development of hydraulic operations on bench and hill claims.[14] Previously, it had been a problem to dispose of hill tailings without infringing on the creek beds (note the elaborate cribs erected to hold back the hill tailings in Figure 22). With the creek beds thoroughly mined by the dredges, they could now become the dumping grounds of areas located above them that were worked by other means.

Regarding Dawson, the dredges are significant of a downturn in that community's economy when far fewer workers were needed to mine the gold fields. Dredge No. 4 alone could do the work of some 2000 men and so the population of the region Dawson served was drastically reduced; inevitably the city's businesses suffered and many closed down entirely. Still, during the halcyon years of dredging, from 1905 to 1915, there were some beneficial effects on the economy of Dawson, including heightened activity at the riverside docks where dredge parts were brought in by steamers (Figure 12). Even after 1915, dredging did keep alive the gold mining industry which would have otherwise died and left Dawson a complete ghost town.

To the Yukon in general, the dredges are among the most visible expressions of gold mining and the presence in the territory of the YCGC. As CPS historian David Neufeld has written:

> Gold mining was the largest single contributor to the Yukon economy from the turn of the century to the 1960s, except for a brief period in the 1920s and early 1930s when the Mayo silver mines were in peak production. YCGC's operations in the Klondike regularly contributed two-thirds of total Yukon gold produced. The company was also the major employer in the territory for many years. This was especially important during the Depression when the company provided about 100 permanent jobs and another 600 seasonal jobs. The company's importance to the Yukon for most of the first half of this century cannot be overstated.[15]

ARCHITECTURE

Aesthetic Design

It is highly unlikely that aesthetics have ever been a consideration in dredge design. However, Dredge No. 4 is capable of inspiring something akin to artistic appreciation by the ingeniousness of its design, and by its impressive size - the biggest mining dredge ever built in North America. Some may consider the miles of churned gravel left by this and other dredges as a blight on the natural landscape (Figure 1); others may find the neat tailing piles to be of aesthetic interest because of their regular patterns, not unlike certain earth work sculptures created by environmental artists in the 1960s and 1970s. A description of them by art historian H. H. Arnason could just as easily apply to the work of the dredges: ". . . [they] have reconstituted nature on a scale rarely seen since the pyramids in Egypt."[16] Dredge No. 12 has done its share of "reconstituting nature" but the structure itself is not large enough to be very striking in appearance.

Functional Design

In principle, dredging for gold was not much different than hand mining for gold.[17] A hand miner would work his claim by digging the placer gravels with pick and shovel. When a paystreak was encountered (sometimes quite a few feet below surface) he would pan for its gold dust and nuggets by swirling and shaking a pan

of the promising material with water added to it. Gold, with its high specific gravity, would drop and be left in the bottom of the pan, while the lighter gravel was washed out. The next step in mechanization was the construction of wooden sluices designed to direct water and gold-rich gravel along an incline (Figure 21); in this method, the gold dust and nuggets would drop to the bottom of the sluice where it would be recovered.

Problems with permanently frozen ground in the Yukon were addressed by a variety of means. Initially, miners built fires over the area to be worked. Later, when the technology was available, they would apply steam heat through metal "points" stuck into the gravel.[18] The steam source would be a portable boiler, usually mounted on a horse-drawn wagon, with rubber tubing connecting it to the "points" (similar to that seen in Figure 22 in Report No. 19). Still later, cold water application was found to be an easier, cheaper method of thawing and even more effective (Figure 20).

In dredging, these same principles of hand mining were used but on a much larger and more sophisticated scale. A year before a dredge was to work a particular area, geologists would prospect the region for the location most likely to yield gold. Crews were then sent out to clear the designated land of trees and the thin layer of "muck" composed of decayed vegetation and clay. Gravel thawing was undertaken just before the dredging was to start.[19]

The dredges themselves were machines housed on top of a hull and within a superstructure that resembled a building (Figures 2-6, and 15-19). They would process the placer by picking it up in a movable bucket chain which extended out front. This would deliver gravel (22 buckets per minute in the case of Dredge No. 4) onto revolving screens and tumblers in the vessels' centre sections. Smaller particles of gold-permeated sand and gravel would soon fall down to "gold-saving tables" underneath. These

were fitted with cocoa matts and "riffles" to trap the ore. Gold "clean-up" (the hand picking of particles and nuggets from the tables) would take place regularly. Excess gravel was sent on out the back of a dredge by means of a conveyer belt which deposited tailings at the edge of the pond. Thus, as the dredge dug ahead and the tailings were dumped to the rear, the pond moved with the vessel and kept it afloat. A number of companies produced this general type of dredge in America, including Bucyrus which manufactured the one shown in Figure 23. It differs from some dredge designs in that the giant bull wheels driving the machinery are not enclosed in a wooden housing.

Dredge No. 4, designed by the Marion Steam Shovel Company (which manufactured the prototype Dredge No. 1), conforms to the typical features found in most Klondike dredges, the notable exception being its huge size - bigger than all the rest. It has the usual hull constructed of five pontoon-like boxes that were originally watertight. Extending forward from the hull is the digging ladder supported by winches attached to a boom. An operator would control the electrically-powered winches from a windowed control room high on the uppermost deck (Figure 9). The front part of the hull is split to create a digging recess, allowing the bucket chain to move up and down and to efficiently move loads of gravel into the processing part of the dredge's mid-section (Figure 10). Here are the revolving screens and the giant gears and belts that keep things moving (Figure 7). Underneath are the sluices and riffles where the gold is caught and collected (Figure 8). Below some of the sluices (where there is sufficient height) is a workshop for repairing machine parts as necessary.

At the dredge's stern is an immense steel "spud" - a vertical pile which, when dropped to the bottom of the pond, holds the dredge in place (visible in the diagram of Figure 13). From this point, the dredge could pivot and dig gravels within the arc of its reach. This particular process, and that of advancing the

machine along its course, was controlled by adjusting towing cables attached to "dead-men" or posts on the pond's shores, both ahead and astern of the dredge.

A prominent feature of the dredge's appearance is the 131 foot tailing stacker extending to the rear (Figures 2, 6). Supported by cables attached to an even larger boom than the one up front, it has a conveyer belt of rubber that deposited the worthless processed gravel behind. Originally, there was a canvas housing for the entire length of the stacker; today only the aluminium housing at the end of the stacker remains. The purpose of the housing was two-fold: to protect the workman on the stacker from inclement weather, and to retain at least some of the heat from the steam he used to remove accumulated mud, thereby keeping it and the machinery from freezing solid.

Dredge No. 4 (and others like it in the Yukon) differed in a few respects from those used in southern places such as British Columbia, California and New Zealand.[20] One northern feature was the boiler used for heating the superstructure which enclosed all machinery and stairways, and for producing the steam needed to clean the mud off the digger and stacker. The bucket ladder for digging was also more likely to be used in the North, instead of dippers or grapples suspended from cranes, more common in the South. This permitted the continuous delivery of gravel to the screen - advantageous because of the minimum amount of agitation and leakage that would occur, resulting in loss of gold particles.[21] The other main differences in Yukon dredges were the increased strength and weight, and the high quality of materials used in principal parts - needed primarily because of the difficulty in handling northern gravels, composed of bigger and heavier rocks than in the South. For example, all the shafting in Dredge No. 4 is of nickel steel, and the bucket "lips" (edges) are of chrome nickel or manganese steel. These lips had to be replaced every season because of wear - a job for the winter months in the workshops at Bear Creek, in the case of

those owned by YCGC.

The Yukon dredges and their infrastructure of operations was considered a marvel of their time. Dredge No. 4 was hailed by the American Institute of Engineers in its Engineering Journal of 1912 as the engineering feat of the decade.[22] Today it sits partly submerged in silt, the result of creek flooding and failure of the hull after 1960 when dredging ceased. Most parts are in reasonably good condition, however, including the hull which is entirely submerged. It is expected that the dredge could be well restored if a plan to raise it and float it a short distance to higher ground is adopted.

Dredge No. 12 is similar to Dredge No. 4 in most respects except that it is much smaller. About 120 feet long, it has buckets with a capacity of two-and-one-half cubic feet each (as opposed to No. 4's buckets with capacity of sixteen cubic feet each). The bucket ladder could process 2,900 cubic yards of gravel in 24 hours. No. 12 also differs from No. 4 in that it has a metal hull and metal superstructure, and its control room is on the starboard side rather that in the middle (Figure 14). The current arrangement of gold saving tables in a longitudinal line does not appear to be original, according to evidence on site and in extant drawings.[25]

Some CPS staff have expressed the opinion that because Dredge No. 12 is smaller, its operations would be more easily comprehensible to the average lay person viewing it in an exhibit. Also, because of its small size and its metal hull and superstructure, it could be moved with relative ease to Bear Creek and interpreted there along with other mining displays. In the long run, it would likely require less maintenance than Dredge No. 4.[25]

ENVIRONMENT

Dredge No. 4

Site

Dredge No. 4 is located on the flood plain of Bonanza Creek, about 11 kilometres south south east of Dawson. This is about 5 kilometres downstream (north) from Discovery Claim where the gold ore that set off the Klondike Gold Rush was found in 1896. It has come to rest on the alluvial gravels here, subsequent to the draining of the artificial pond on which it last floated in the spring of 1960. Since then, Bonanza Creek has assumed its natural cycle of being a trickle in summer, and a rushing torrent during spring run-off. It was during the spring run-offs between 1960 and 1984 that the dredge turned about 45 degrees north in its resting position, and eventually had its hull buried in silt.[26] A berm erected by CPS around the dredge in 1983 has since given it some protection from the yearly flooding. It is now easily accessible by a public road. Other than these changes, and the loss of mining activity, the site remains much as it was when operated by the YCGC. Miles of tailing piles created by the dredge are still visible downstream.

Setting

Dredge No. 4 dominates its natural setting and clearly establishes that this was gold mining country. It does this by its size and conspicuousness on a public road (Figure 2), and by its proximity to a small interpretation centre for mining in a mobile hut nearby. Almost all of the other 30 dredges that once churned up the Klondike creek beds (about 100 miles of the valleys) are now in advanced states of decay. This dredge therefore stands out as the one that best represents the area's famous character, at least in its latter period of intense corporate activity. Miles of tailing piles downstream from it reinforce its pre-eminent position.[27]

Landmark

Dredge No. 4 is one of the most popular historic sites in the

Klondike region. Second only to Dawson's Palace Grand theatre in attendance, it attracted some 20,000 visitors in 1987.[28] In 1990, the structure will be one of the feature attractions for the American-based Society of Industrial Archaeology as it plans to have its fall meeting in Dawson that year. Currently, Dredge No. 4 is the focal point of KNHS gold fields interpretation. On the same site is a trailer housing a mining exhibit, and a HSMBC plaque commemorating Joe Boyle, mining magnate and international hero. The dredge itself is fully open for viewing with or without a tour guide.

This centre of interpretation is one of several stops a visitor can make on a gold fields tour out of Dawson (Figure 1), including some privately operated spots and some owned by Parks. Gold panning facilities, souvenirs and refreshments are offered at two locations between Dredge No. 4 and Dawson. About one mile upstream from Dredge No. 4 on Bonanza Creek is the HSMBC monument commemorating Discovery Claim. At this location, the Klondike Gold Rush was touched off by a major discovery of the precious metal on August 17th, 1896. About another mile upstream is an historic marker commemorating the once-thriving town of Grand Forks. Eight thousand people lived here during gold minings' heydays around 1900, but virtually no trace remains of it now. Dredging operations have obliterated even its remnants as a ghost town. Up and down this valley, and in other valleys of the region, the visitor can also see quite a lot of activity relating to current prospecting and mining - once more being carried on by individuals and small groups who believe that Klondike gold has not yet been exhausted. Of all these sights, Dredge No. 4 is surely one of the most impressive.

Dredge No. 12

Because the site where Dredge No. 12 now sits is not owned by CPS, this section of the FHBRO evaluation does not appear to be

apropos for this structure. Furthermore, this site is relevant to Dredge No. 12 only for the years 1963-65. It is in a relatively remote location that is not nearly as accessible as Dredge No. 4, being about 40 km. beyond on a less travelled road. From the road, a visitor would have to clamber over tailing piles and vegetation for about a half mile to reach it. From 1953 to 1963, it operated at another location on Dominion Creek, churning up some 1,440,000 m^3 of ground and recovering over $1,071,000 in gold.[29]

Endnotes

1 "Engineering Study 87-CEU-15. Dredge No. 4 Recovery Study. Dawson City, Yukon" (Ottawa: [Canadian Armed Forces], 1988.

2 Conversation with KNHS Superintendent Al Fisk in Dawson, 28 July 1988.

3 Other CPS general studies not specifically referred to in this report are: Hal Guest, A Socio-economic History of the Klondike Goldfields, 1896-1966, Microfiche Report Series No. 181 (Winnipeg: Parks Canada - Prairie and Northern Region Office, 1985); and William N.T. Wylie, "Exploring Mining History: A Preliminary Study," HSMBC Agenda Paper 1986-30.

4 Mining-related national historic sites in the Klondike region (along with their HSMBC reference numbers) include the following: Joseph Whiteside Boyle (12.10); Discovery Claim (12.1); Joseph Burr Tyrrell (12.4); and Yukon Gold Discovery (12.7). In addition to these "plaqued" historic sites, at least one of the two dredges could be considered as having the status of a national historic site by being the best preserved of all the dredges left in the Klondike, by being selected by KNHS for further preservation measures, and - most importantly - by relating to HSMBC's recommendations at its 1967 meeting in Dawson "that the operation of dredges in the Yukon be considered of national historic importance." See HSMBC Minutes, Ottawa, 23-24 October 1967, p. 5. For other mining-related sites, people and equipment designated by HSMBC to be of national historic significance, see the Appendix at the end of William N.T. Wylie, "Exploring Mining History: A Preliminary Study," HSMBC Agenda Paper 1986-30, pp. 69-70.

5 Staff Report, "The Development of Gold Dredging Operations in the Yukon," HSMBC Agenda paper 1967-15, p. 126.

6 See David Neufeld, "Bear Creek, Yukon Territory, Headquarters for the Yukon Consolidated Gold Corporation," HSMBC Agenda Paper [unnumbered], November 1987. Apparently

nothing remains and little is known of Guggieville, other than a basic inventory of its buildings. Ibid., p. 10.

7 The reference to it being the biggest in the world is from an unattributed quote in Staff Report, op. cit., p. 129.

8 Neufeld, op. cit., p. 11.

9 Leonard W. Taylor, The Sourdough and the Queen. The Many Lives of Klondike Joe Boyle (Agincourt, Ontario: Methuen Publications, 1983).

10 For example, see Pierre Berton, Klondike: The Life and Death of the Last Great Gold Rush (Toronto: McClelland and Stewart, 1961); Martha Black, My Ninety Years (Anchorage: 1977); and L. Green, The Gold Hustlers (Anchorage: 1977).

11 David Smyth, "'Klondike Joe' Boyle (1867-1923)," HSMBC Agenda Paper 1984-25, pp. 435-443.

12 Plaque Listing Binder No. 12. Yukon. (available in HSMBC office)

13 Neufeld, op. cit., p. 10.

14 Staff Report, op. cit., p. 129.

15 Neufeld, op. cit., p. 15.

16 H. H. Arnason, History of Modern Art (New York: Harry N. Abrams, 1978), p. 661.

17 Newfeld, op. cit., p. 6.

18 Norman Ball, The Development of Permafrost Thawing Techniques in the Placer Gold Fields of the Klondike, Parks Canada Research Bulletin No. 25 (Ottawa: Parks Canada, 1975).

19 For a more detailed description of the process and of Dredge No. 4 itself, see A. Barbour and C. Faucher, Status Report and Proposals for Gold Dredge No. 4, Bonanza Creek, Yukon (Ottawa: Parks Canada, Restoration Services Division, 1985).

20 The earliest dredges with bucket elevators designed for placer mining were built in New Zealand - first one that was powered by water current wheels (1867), and later ones that were powered by steam (beginning in 1881). See Gold Dredges [information sheet available at Dawson's Visitor Reception Centre and other locations including EC-CPS, AHB Resource Centre - Call No. A 11 028) (Ottawa: Parks Canada, 1975).

21 This advantage is cited in Staff Report, op. cit., p. 128.

22 This was pointed out in conversation with KNHS Superintendent Al Fisk, 28 July 1988, but has not been confirmed through my own research.

23 A. Barbour and C. Faucher, Status Report and Proposal for Relocating Gold Dredge No. 12, Dominion Creek, Yukon (Ottawa: Parks Canada, 1985), p. 7.

24 Ibid., p. 9.

25 These opinions are all summarized in Ibid., p. 25.

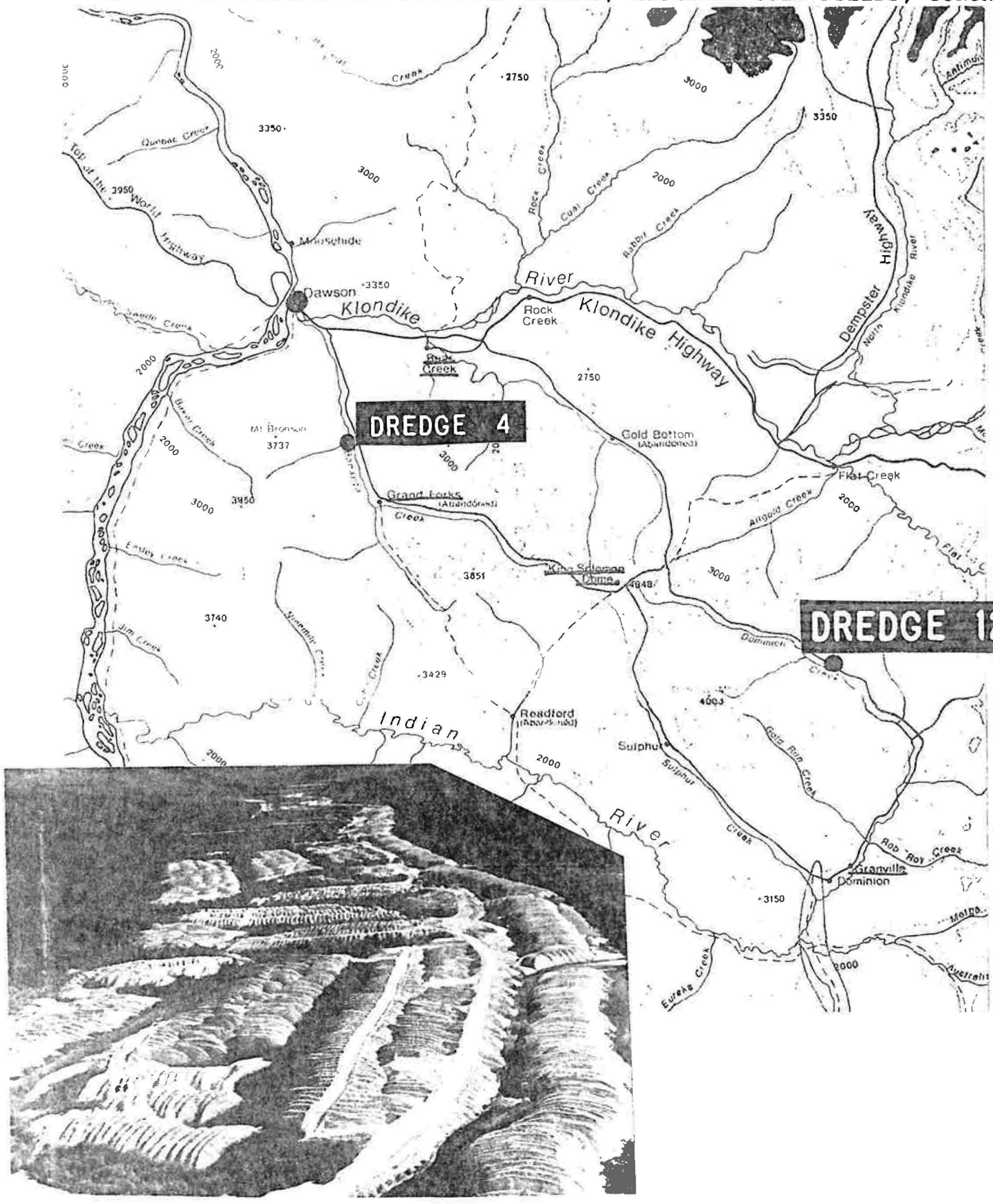
26 For a more complete description of Dredge No. 4's history since its shut-down, see Barbour and Faucher . . . Dredge No. 4, op. cit., p. 35.

27 For a more complete description of historic remnants left in the goldfields, see Sheila J. Minni, "Gold Fields", Archaeological Exploration of the Klondike Historic Sites. 1976 and 1977. Parks Canada Manuscript Report No. 309 (Ottawa: Parks Canada, 1978), pp. 128-133.

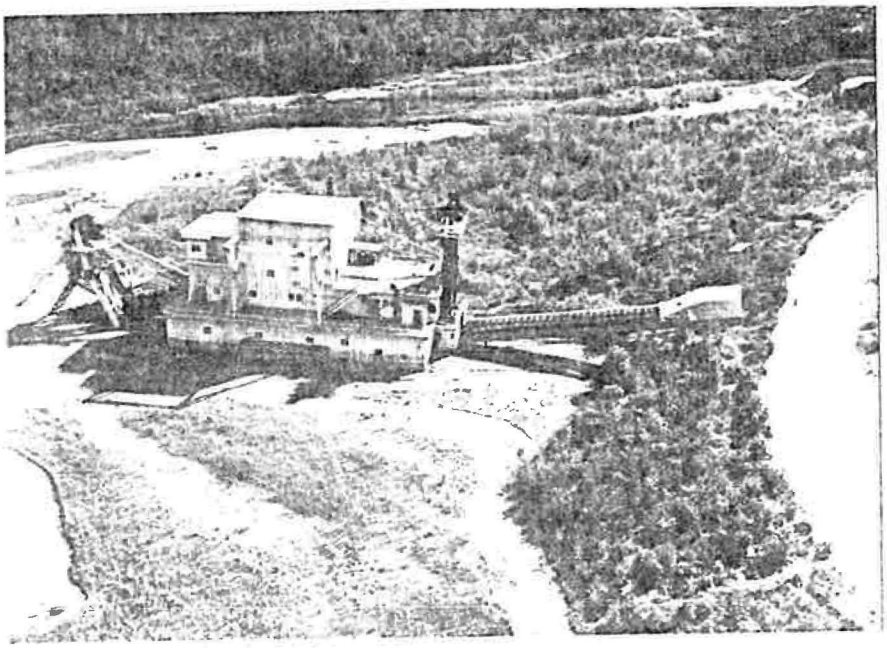
28 "Background to and Status of Dawson City. Klondike and Gold Rush-Related National Historic Sites. For Review by Historic Sites and Monuments Board of Canada, November, 1987," Appendix "B".

29 Barbour and Faucher . . . Dredge No. 12, op. cit., p. 3.

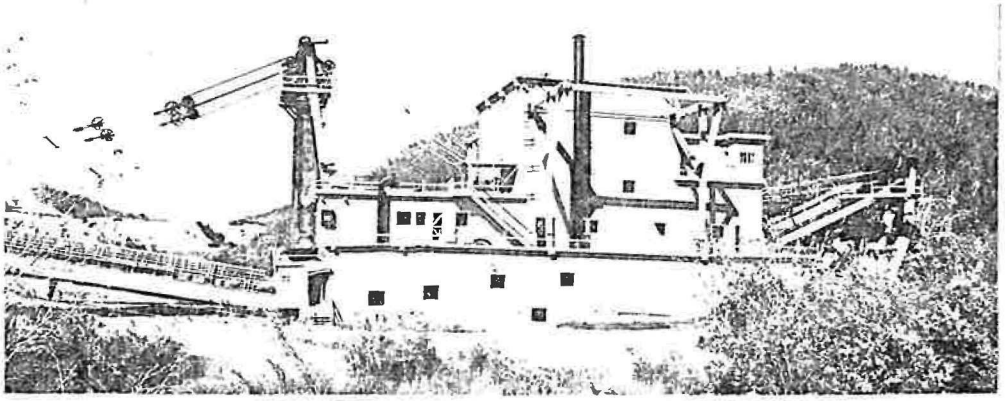
DREDGES AT BONANZA AND DOMINION CREEKS, KLONDIKE GOLD FIELDS, YUKON



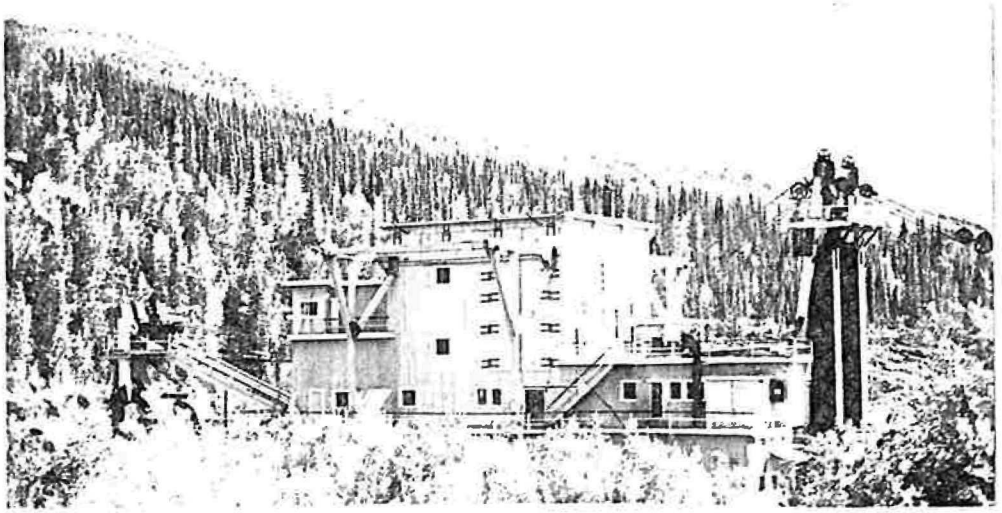
1 Map of Klondike region showing locations of Dredge No. 4 and Dredge No. 12. (Map supplied by EC-CPS, KNHS, 1988.) Inset (lower left) shows some of the tailing piles left by dredging near Granville. (PWC-AES, DU, EC-CPS, Chris Grant Photo Collection, 1970.)



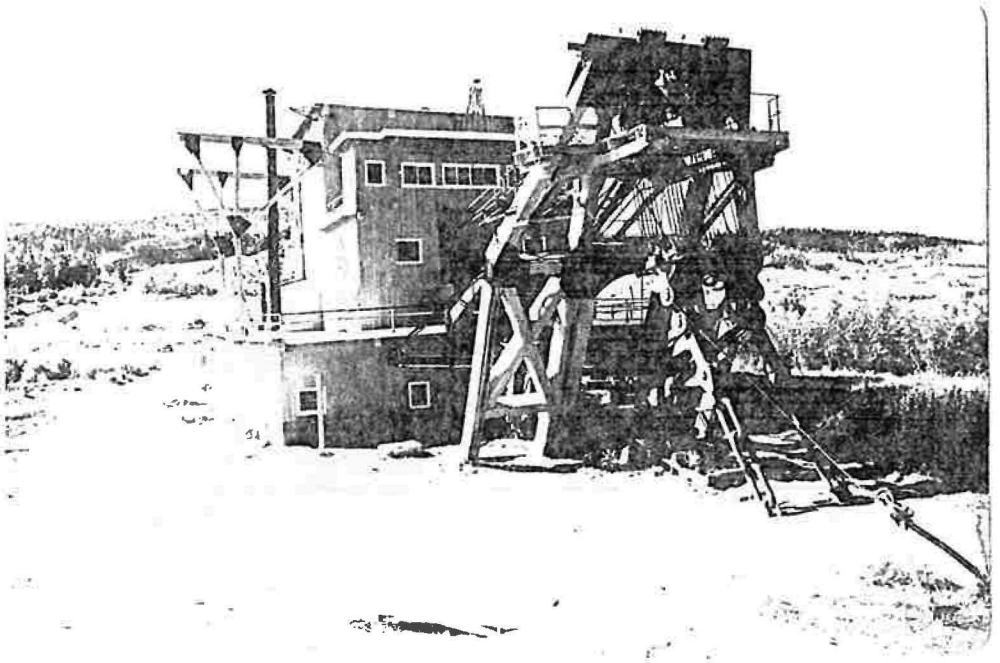
2 Dredge No. 4; aerial view. (PWC-AES, DU, EC-CPS, Chris Grant Photo Collection, 1970.)



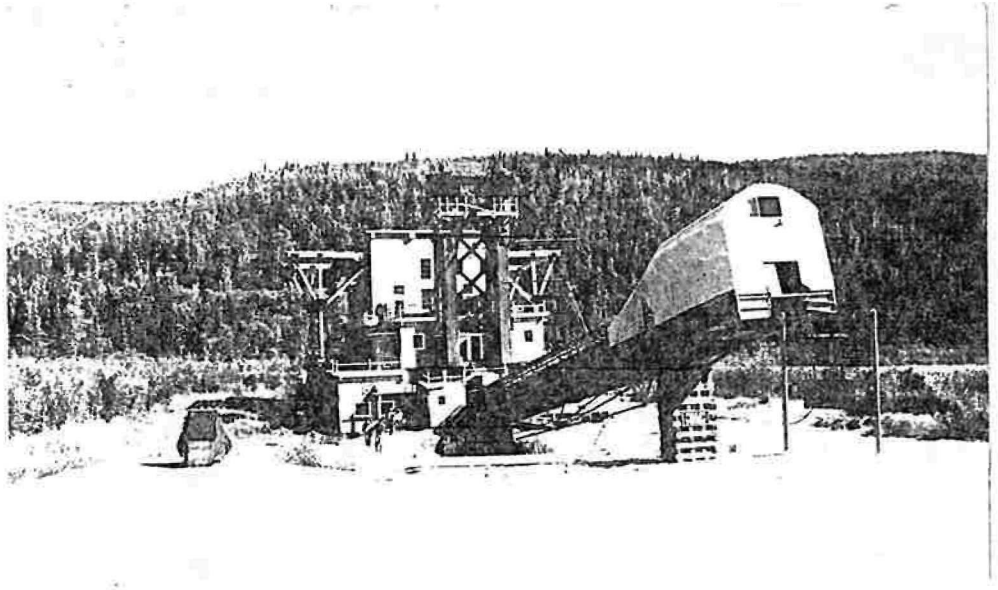
3 Dredge No. 4; starboard side view. (EC-CPS, KNHS, 1987.)



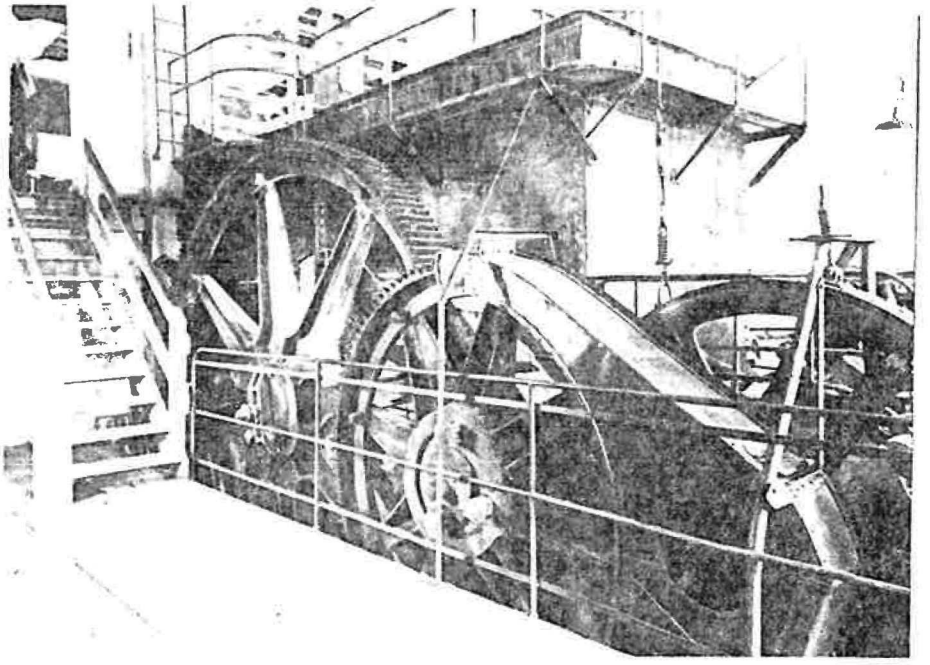
4 Dredge No. 4; port side view. (EC-CPS, KNHS, 1987.)



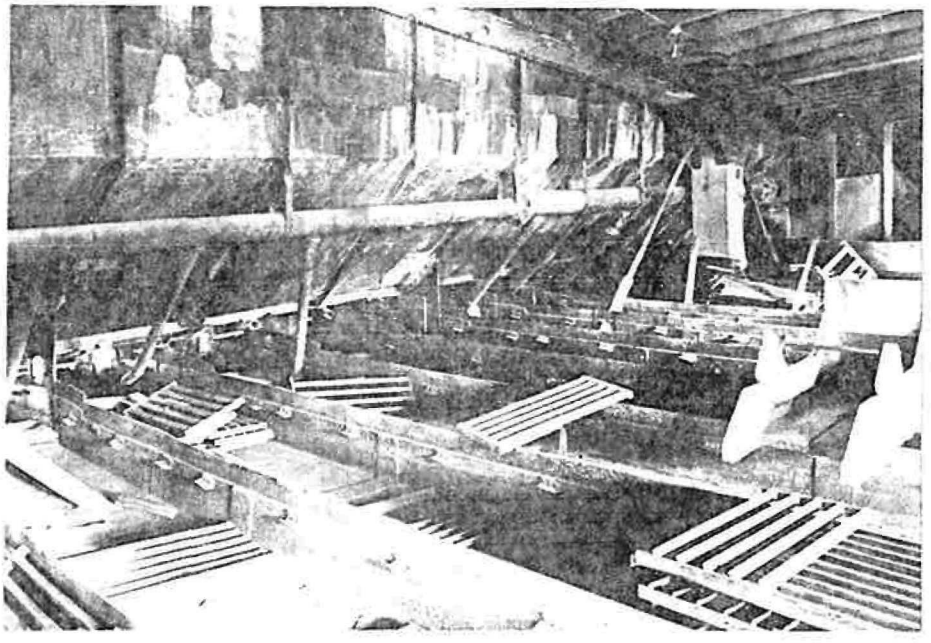
5 Dredge No. 4, Bonanza Creek, Yukon; designed by Marion Steam Shovel Co., Marion, Ohio; constructed in the Klondike River Valley in 1912-13; dismantled and reconstructed in the Bonanza Creek Valley in 1940; view of forward section with portion of digging ladder visible in foreground. The hull and the rest of the digging ladder have been buried in silt and are therefore not visible. (EC-CPS, KNHS, 1987.)



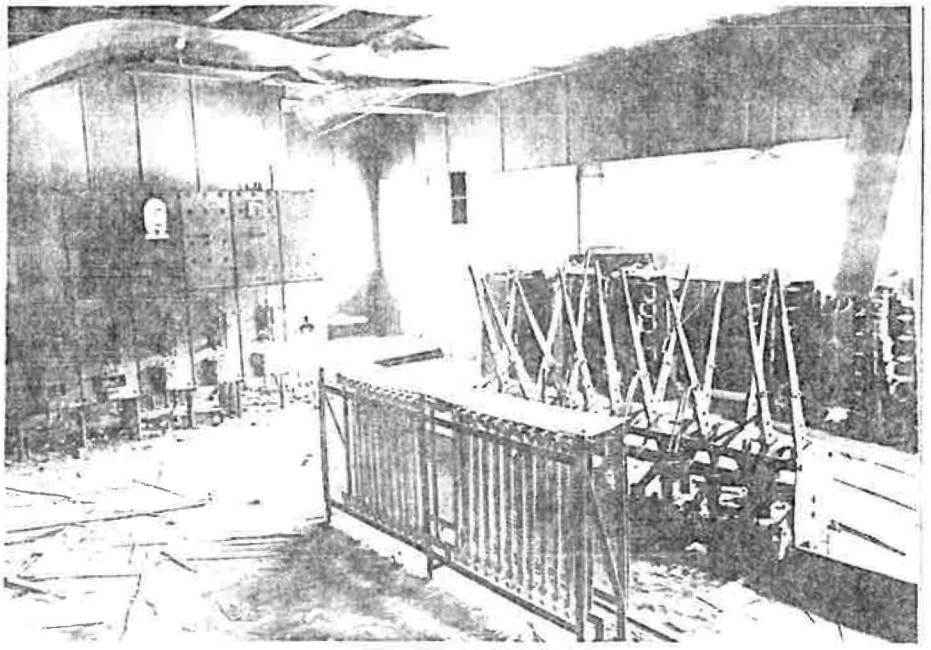
6 Dredge No. 4; view of aft section with tailing stacker in the foreground. This is the view that greets the public stopped at the parking lot and mining exhibit in the CPS mobile hut. The HSMBC monument to Joe Boyle is visible at left. (EC-CPS, KNHS, 1987.)



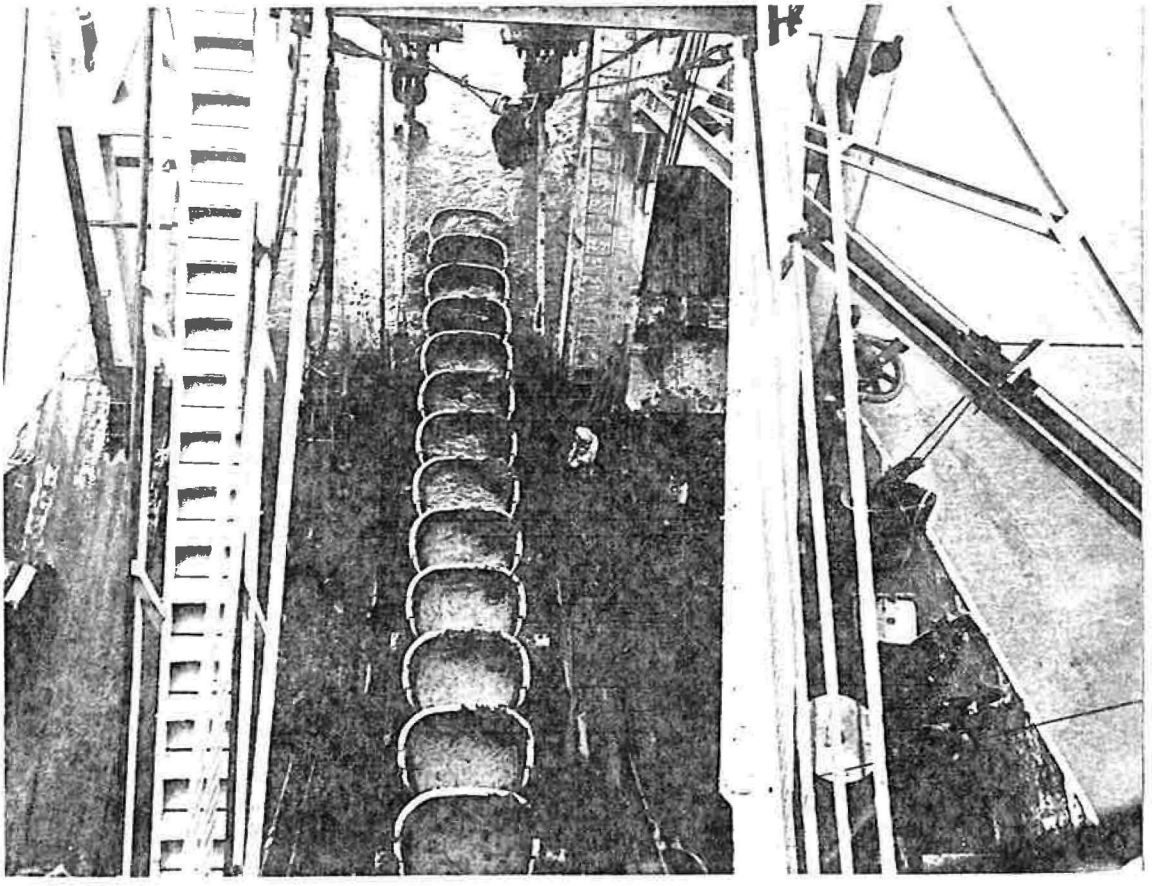
7 Dredge No. 4; drive wheels for bucket line on second deck (interior). (PWC, AES, DU, EC-CPS, Chris Grant Photo Collection, 1970.)



8 Dredge No. 4; sluice boxes and riffle plates comprising the gold saving tables. (PWC, AES, DU, EC-CPS, Chris Grant Photo Collection, 1970.)

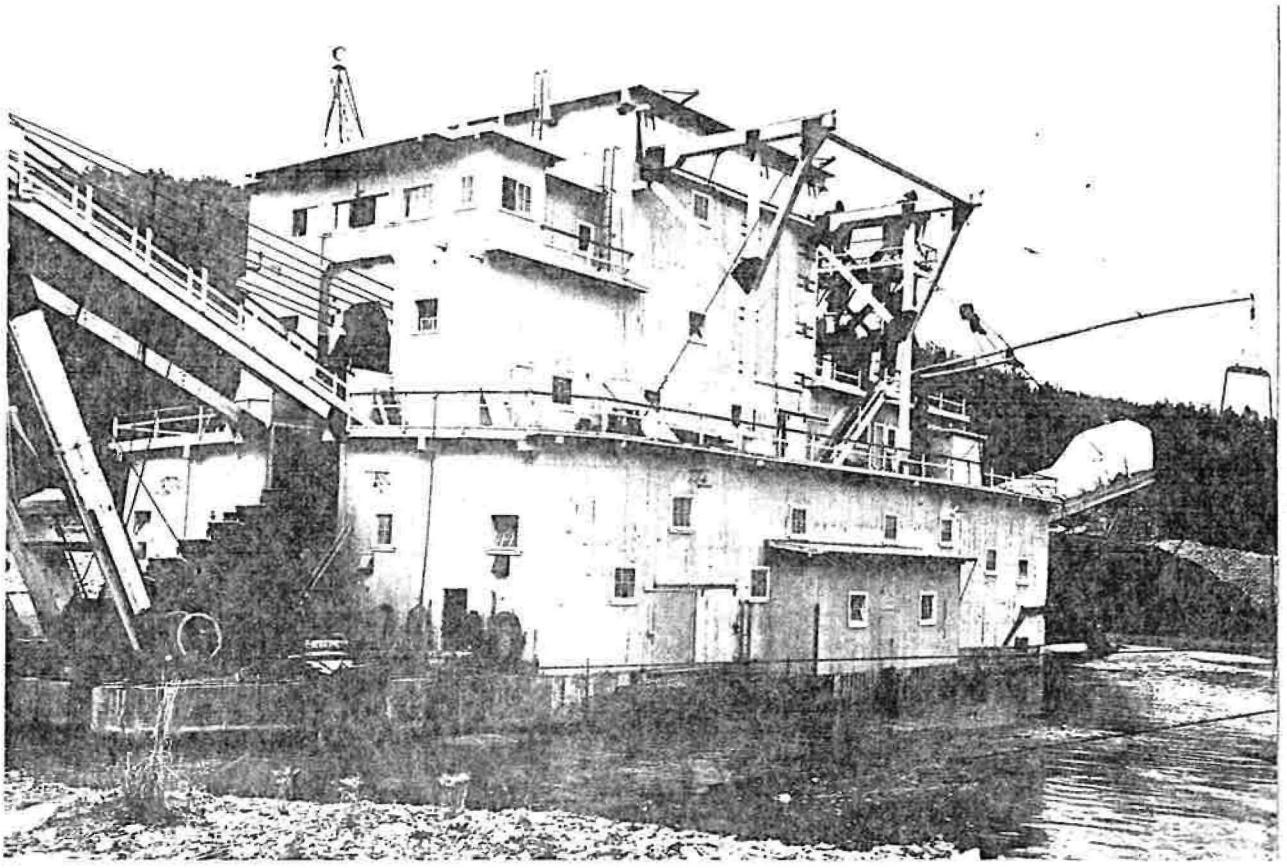


9 Dredge No. 4; inside of control room; large levers for controlling the winches are visible at right. (PWC, AES, DU, EC-CPS, Chris Grant Photo Collection, 1970.)

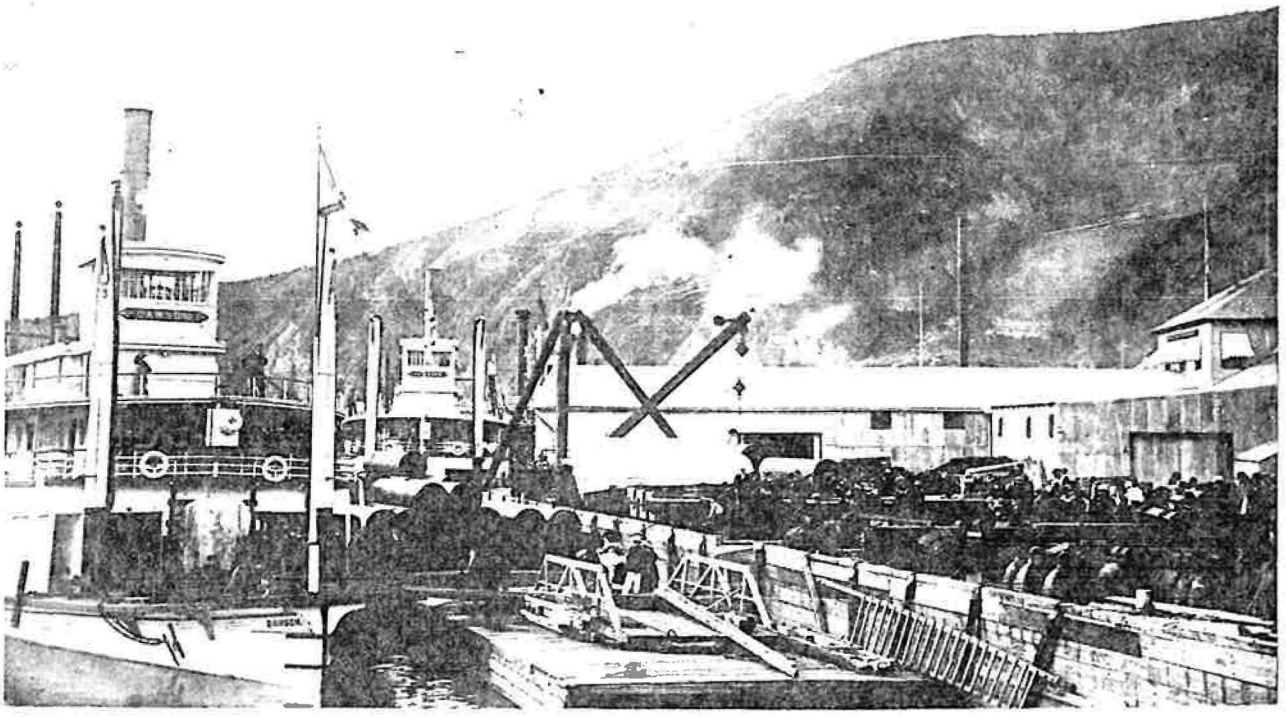


10 Presumed to be Dredge No. 4; bucket line in operation, ca. 1950. (NA/AN, C-17018.)

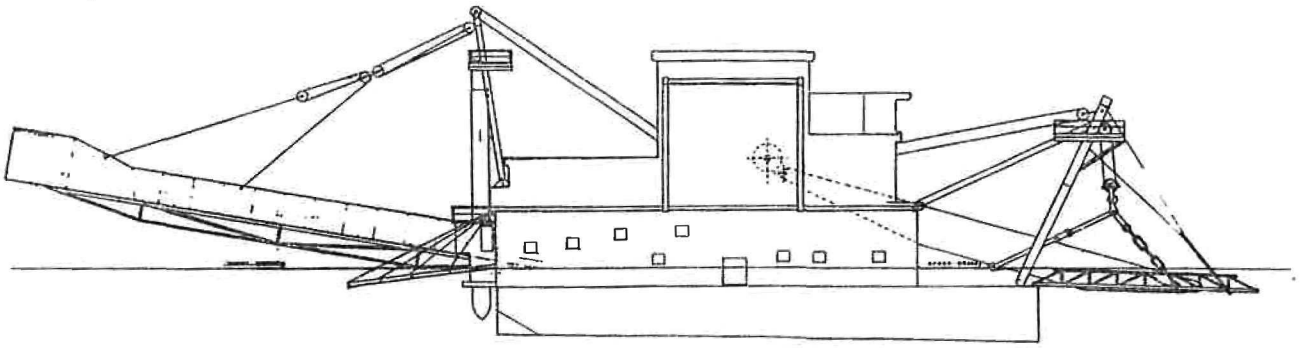
DREDGES AT BONANZA AND DOMINION CREEKS, KLONDIKE GOLD FIELDS, YUKON



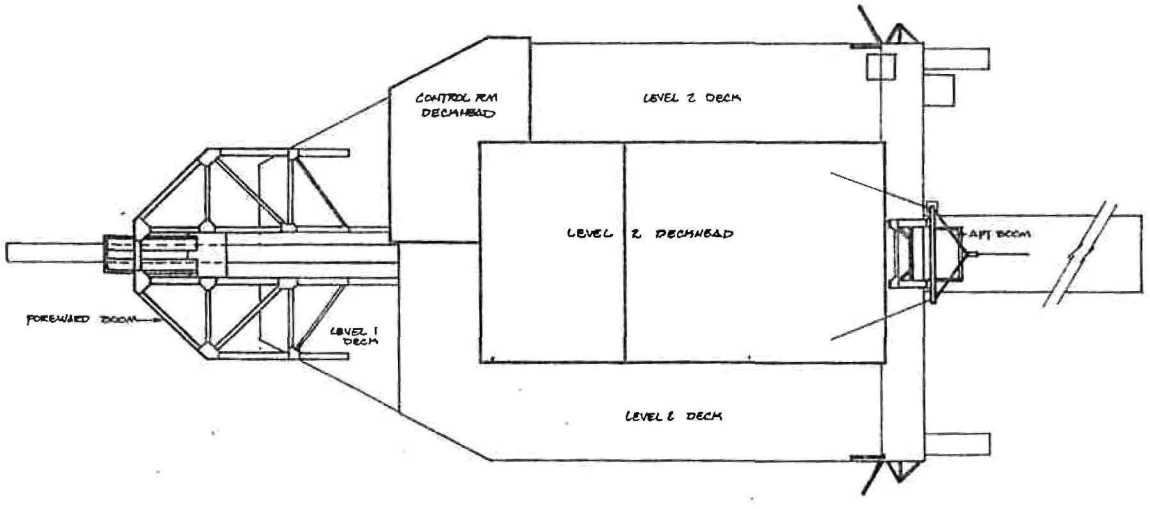
11 Dredge No. 4 in operation, ca. 1950. (NA/AN, C-17025.)



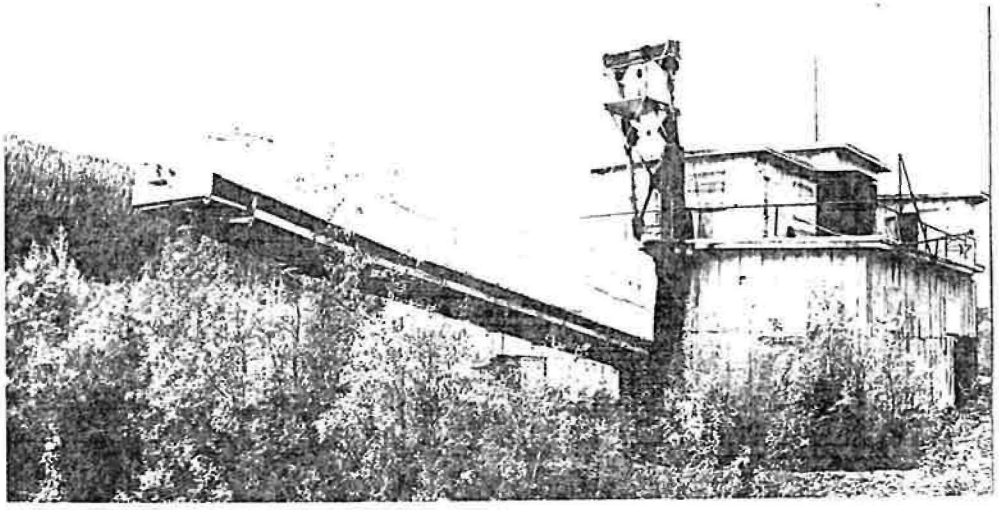
12 Docks at Dawson; unloading of dredge buckets (right) and probably other equipment destined for the gold fields, ca. 1910. (NA/AN, C-3068.)



13 Dredge No. 4; elevation showing level of silt accumulation. (A. Barbour and C. Faucher, Status Report and Proposals for Gold Dredge No. 4, Bonanza Creek, Yukon, Ottawa, Parks Canada, RSD, 1985, p. 26.)

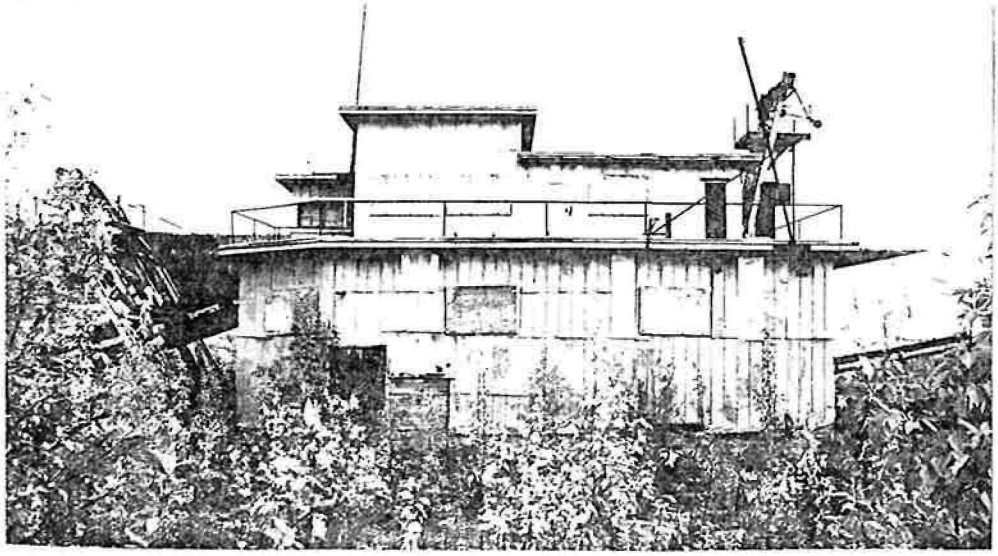


14 Dredge No. 12; plan. (EC-CPS, KNHS, 1987.)

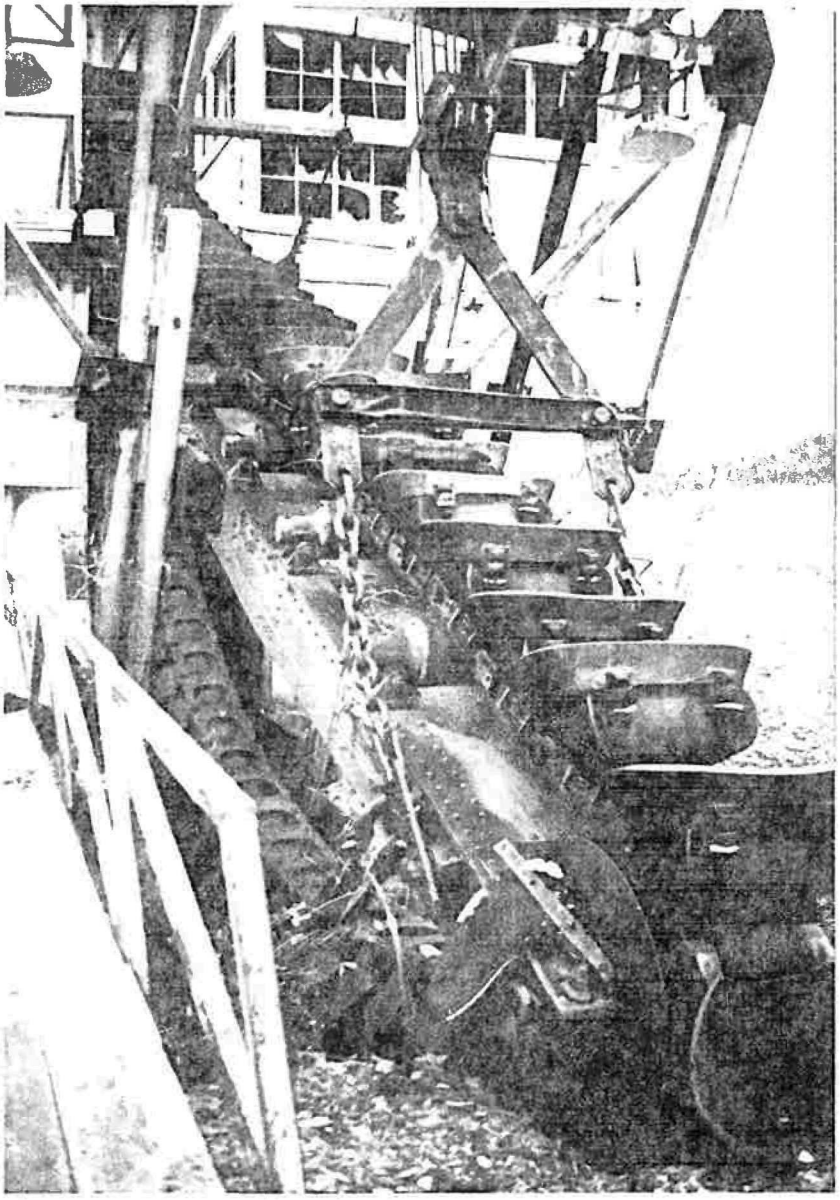


15 Dredge No. 12; Dominion Creek, Yukon; designed by a San Francisco Company - either Walter W. Johnson Co. or Yuba Manufacturing Co., probably in the 1930s; tailing stacker is in foreground (EC-CPS, KNHS, 1987.)

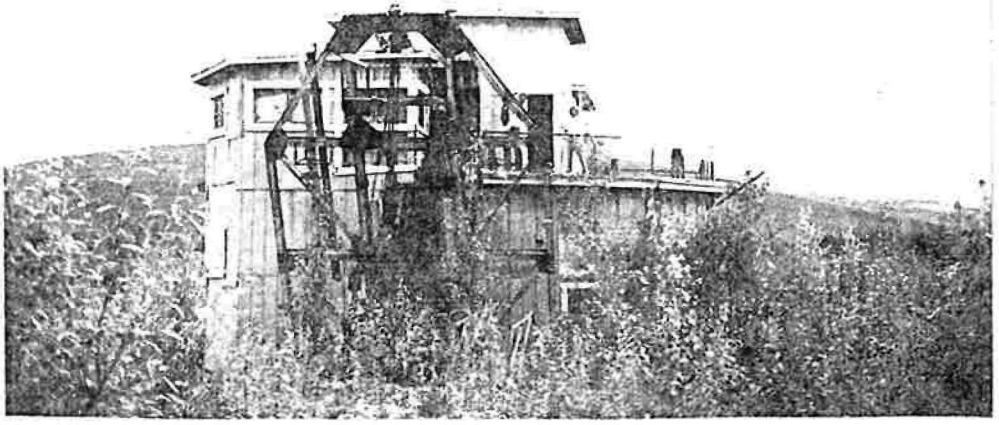
16 Dredge No. 12 in wide valley of Dominion Creek; old tailings are visible in foreground. (EC-CPS, KNHS, 1987.)



17 Dredge No. 12; port side view. (EC-CPS, KNHS, 1987.)

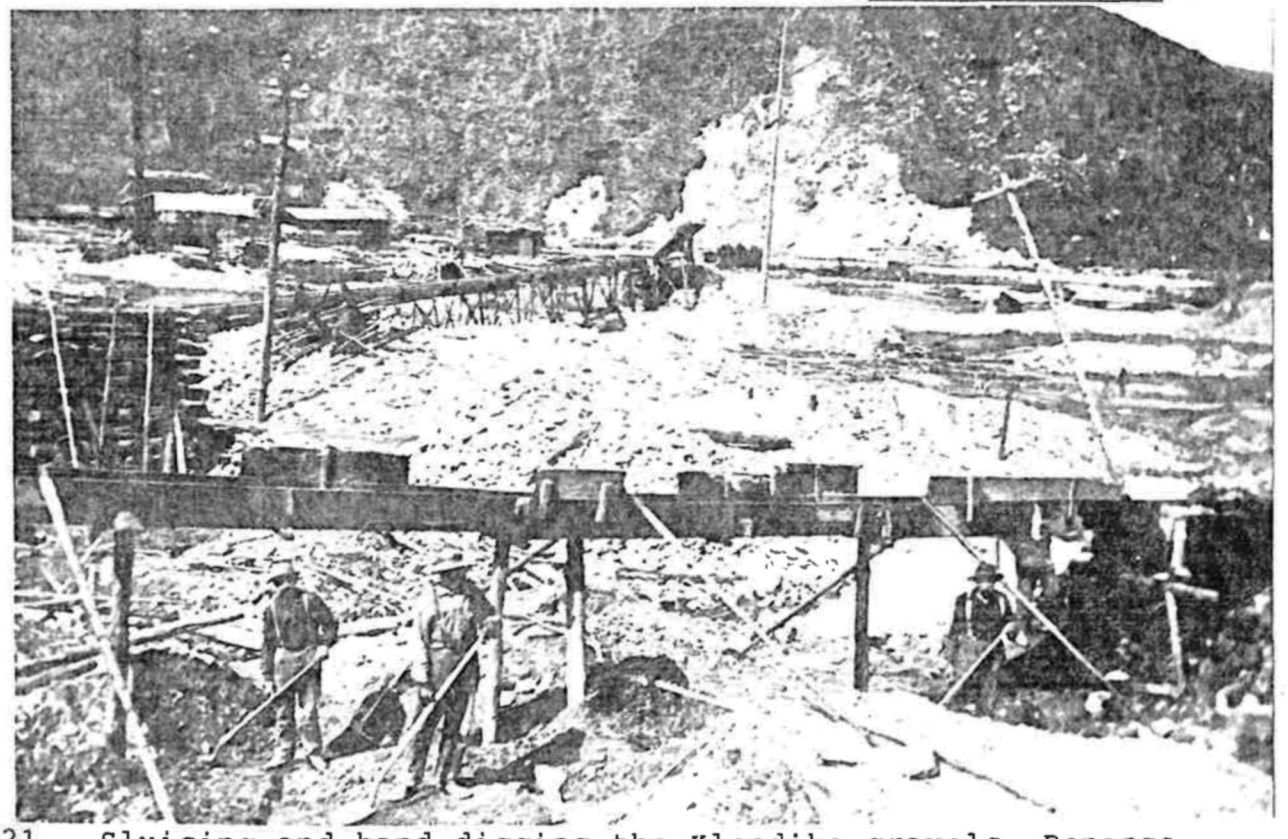


18 Dredge No. 12; view of bucket chain. (PWC, AES, DU, EC-CPS, Alex Barbour, 1982.)



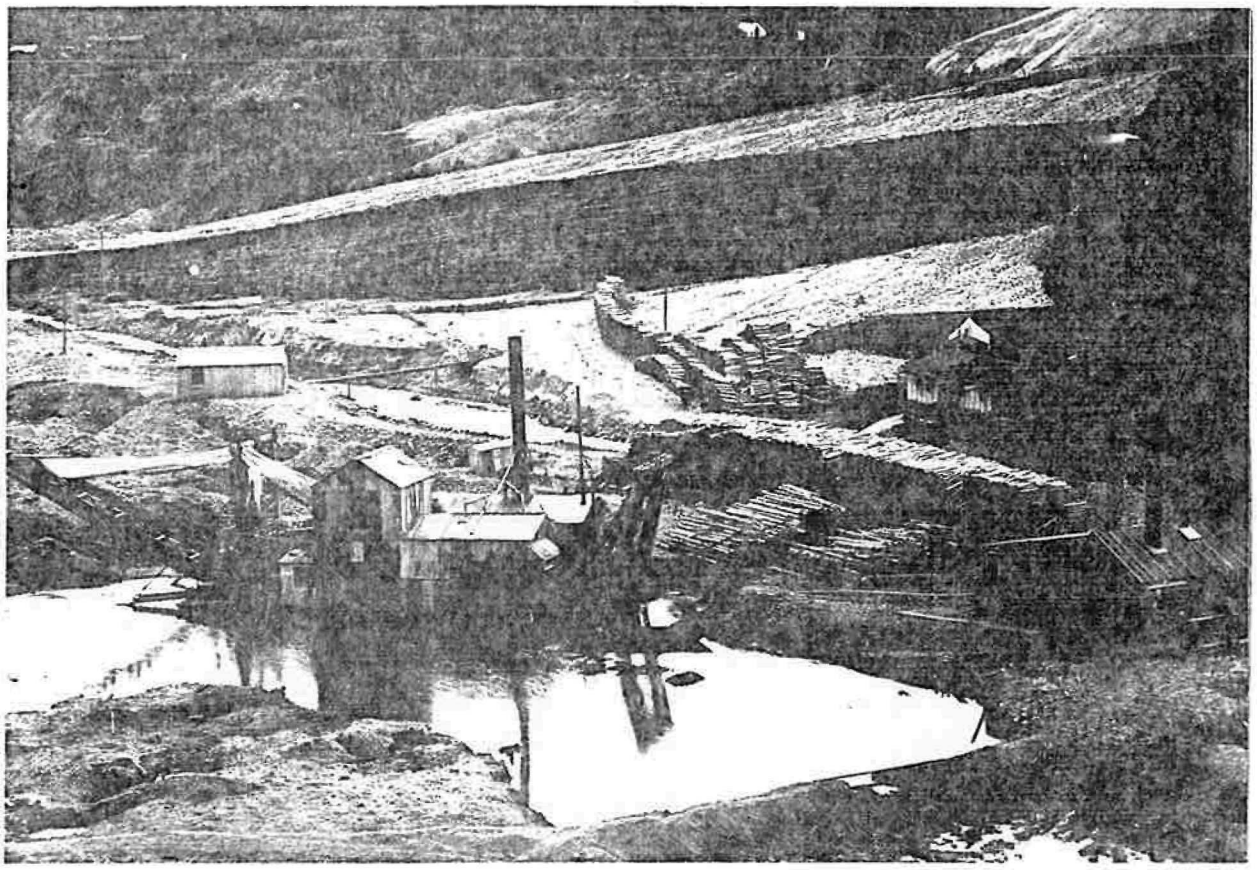
19 Dredge No. 12; view of forward section. (EC-CPS, KNHS, 1987.)

20 Early days of semi-mechanized gold mining in the Klondike: hydraulic thawing of frozen material on a small scale at Flat Creek, ca. 1903. (NA/AN, PA-51480.)

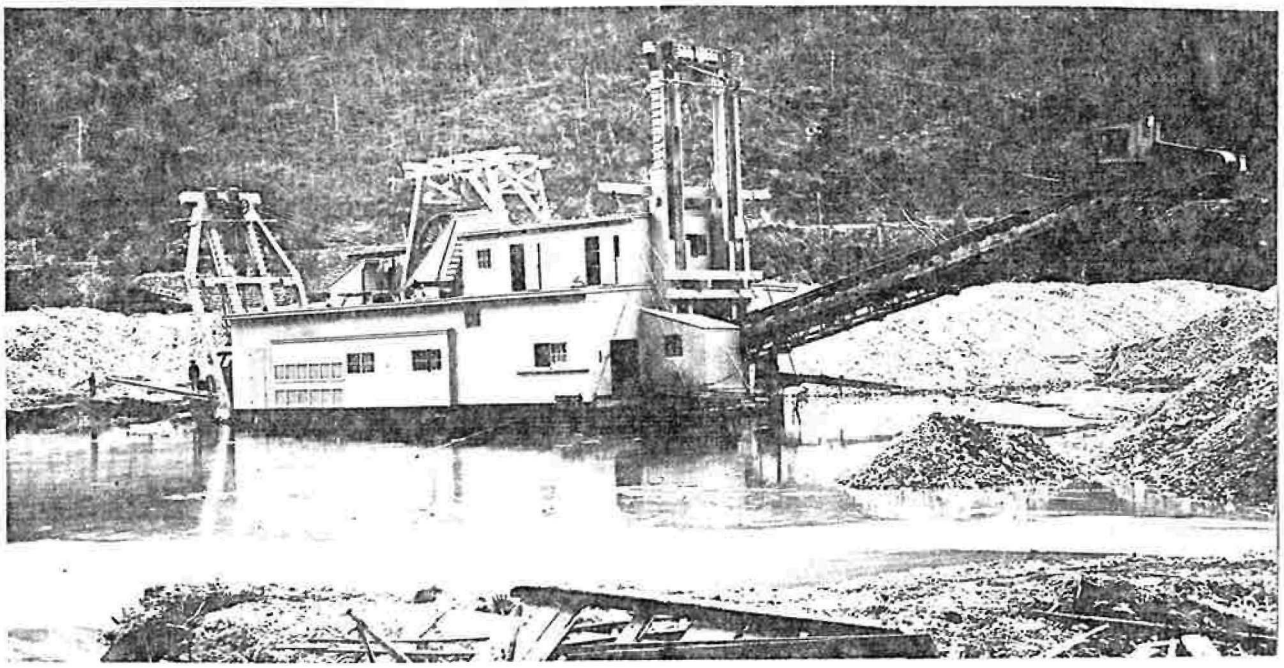


21 Sluicing and hand digging the Klondike gravels, Bonanza Creek, 1903. (NA/AN, PA-16475.)

DREDGES AT BONANZA AND DOMINION CREEKS, KLONDIKE GOLD FIELDS, YUKON



22 "The Lewes River Company's dredge operating on Discovery claim, Bonanza Creek, Y.T., 1906." Log cribbing is containing the hill tailings above it. (NA/AN, PA51484.)



23 "Side view of Yukon Gold Co.'s Dredge No. 6 digging on Bonanza Creek, July 1908"; dredge designed by Bucyrus [Bucyrus, Ohio]. (NA/AN, C-20060.)