DEPARTMENT OF THE INTERIOR
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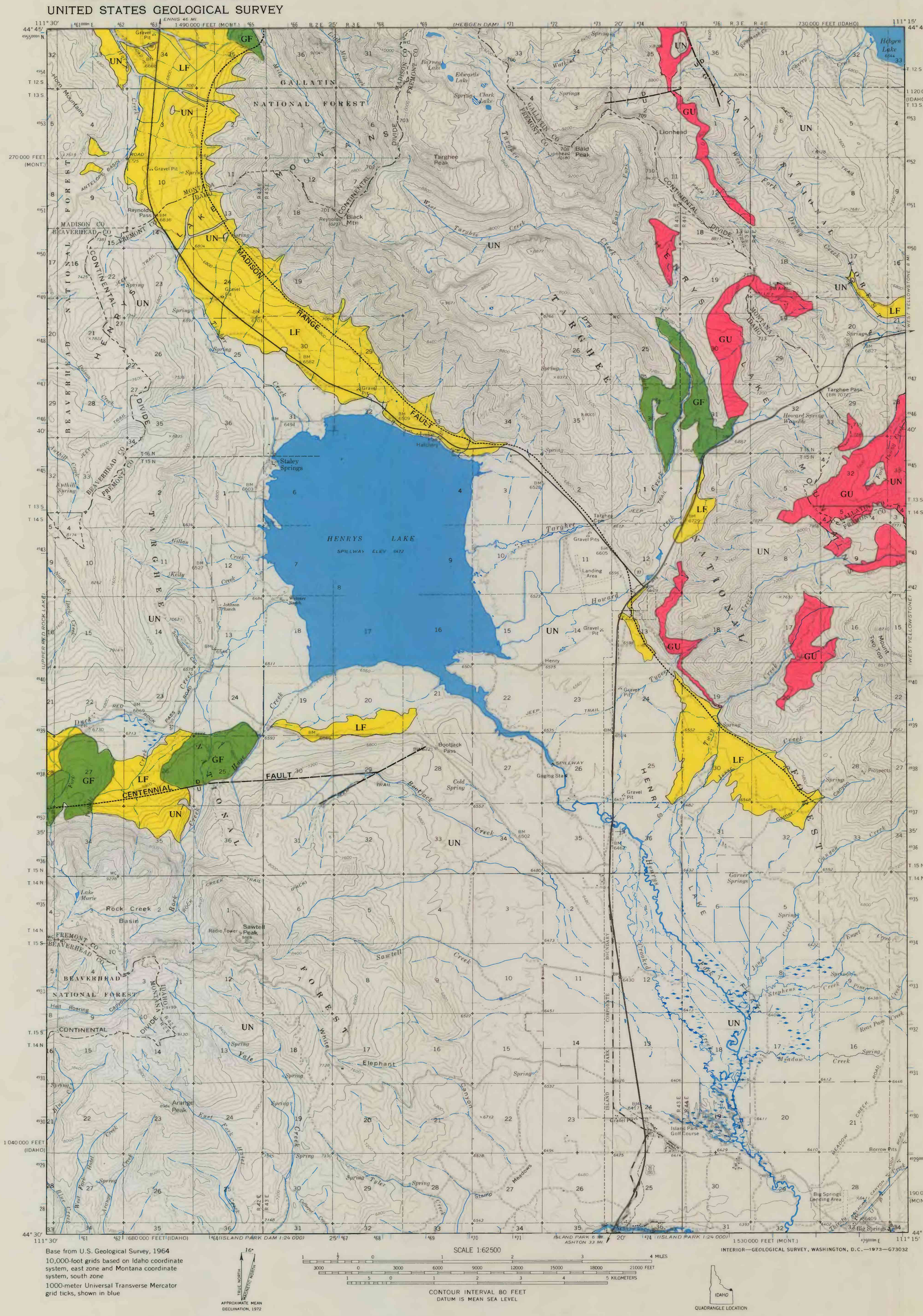

MAP SHOWING GEOLOGIC CONSTRAINTS ON THE PLACEMENT OF SANITARY LANDFILLS IN THE HENRYS LAKE QUADRANGLE, IDAHO AND MONTANA

By Irving J. Witkind, 1972

INTRODUCTION

The disposal of solid waste in the Henrys Lake area poses no problem during the winter when very few people live there. But in the summer, when the recreational facilities of the area and nearby Yellowstone National Park attract thousands of people, waste disposal is a problem. Existing facilities for disposing of refuse will be inadequate in the future, and new sanitary landfills will have to be constructed. This map, based on geologic constraints, shows an evaluation of various geologic materials in the area as possible sites for the disposal of solid waste.

NOTE: Most of the physical characteristics of geologic materials, such as permeability, workability, and compactability, are inferred from observations made in the course of geologic mapping. Detailed field and laboratory investigations will be required to determine the suitability of a specific site for solid-waste disposed.

SANITARY LANDFILLS

In an attempt to preserve the environmental qualities that make life pleasant, many communities prohibit the open burning and dumping of refuse, and have turned to using sanitary landfills. In these, refuse is dumped into a trench and then compacted and covered daily by a layer of dirt, which is then compacted. When properly employed, this technique is a satisfactory and sanitary method of disposing of refuse. If incorrectly located, however, these landfills are sources of pollution of ground and surface waters. The compacted refuse decays slowly, and sooner or later water finds its way into the decomposing material. This water dissolves many constituents of the refuse and becomes heavily laden with bacterial and mineral pollutants. Such a polluted liquid is called a leachate. A major problem is to minimize contamination of surface- and ground-water supplies by the leachate. The protection of water resources is emphasized in the following list of geologic constraints judged desirable for solid-waste disposal sites – four of the six constraints are intended to protect the water resources from contamination.

GEOLOGIC CONSTRAINTS BEARING ON SANITARY LANDFILL SITES[1]

1. Should be in material of low permeability. (Permeability is the relative ease with which a porous medium can transmit a liquid.) If the geologic deposit has low permeability, water can pass through it only with difficulty and very slowly. Conversely if it has high permeability, water can pass through it easily and rapidly.
2. Should not intersect aquifers. (An aquifer is a water-bearing formation that can yield water to wells.)
3. Should be at least 20-30 feet above the highest seasonal level of the water table. Permeability of the various materials considered GENERALLY FAVORABLE or LOCALLY FAVORABLE for use for sanitary landfill differs; nevertheless it is believed that 20-30 feet of an undisturbed geologic unit between the base of the fill and the water table will effectively minimize the contamination of the ground water from leachate.
4. Should be far enough from streams to protect surface waters from contamination. Its position should be such that water-course runoff is diverted to one side or another. Moreover, it should be so located that it will not be inundated by local floods. Local conditions of topography, permeability of deposits, and direction of ground-water movement will determine how near to a stream a fill can be located so as to minimize the risk of polluting the stream by escaping leachate.
5. Should have suitable cover material near site. The cover keeps the landfill relatively free of rodents and vermin, prevents the escape of odors and wind-blown rubbish, and in general precludes an unsightly appearance. The covering material should be relatively impermeable, and should form a series of low-permeability barriers which divide the landfill into multilayered cells thus effectively restricting the free circulation of the leachate.
6. Cover material should be easy to work and compact year-round.

The 51 geologic units mapped in the Henrys Lake quadrangle (U.S. Geol. Survey Map I-781-A) are grouped into four categories of favorability for sanitary landfill sites (see table below). Of these 51 units, only a glacial till (Qpt) is considered GENERALLY FAVORABLE (GF), chiefly because it consists of a heterogeneous mixture of materials of all sizes and has low permeability. Two units, coalesced alluvial fans (Qfc) and colluvium (Qc), are considered LOCALLY FAVORABLE (LF). The coalesced alluvial fans (formed at the mouths of canyons), and the colluvium (formed along the base of steep slopes) are for the most part also relatively impermeable. In places, however, they contain discontinuous lenses of silt, sand, gravel, cobbles, and boulders that may serve as escape routes for leachate if a landfill were to intersect them. Eight units are grouped as GENERALLY UNFAVORABLE (GU). Of these, one (Qpbt) is an old till which, in places, has had much clay and silt washed out of it, leaving a permeable residue of sand, gravel, and boulders. The other seven units, relatively impermeable siltstones and a shale (Ꞓpa), contain interlayered beds of sandstone or fractured limestone, both of which may be water bearing. Here too, leachate from a landfill either in the siltstones or the shale could seep downward along fractures and find its way into these more permeable sandstone and limestone beds. The remaining 40 units are considered UNFAVORABLE (UN). All are considered too permeable – either because they are closely fractured or because they consist of granular materials which offer little resistance to the passage of ground water.

The Henrys Lake quadrangle is within a seismically active area in which major destructive earthquakes have occurred. The three geologic deposits considered GENERALLY FAVORABLE or LOCALLY FAVORABLE (Qpt, Qfc, Qc) overlie active faults whose general trend is shown on the map by dashed or dotted lines. If a landfill is on one of these faults, and the fault should move, the resultant fractures might serve as channels for escaping leachate.

[1] Based in part on the following environmental studies:

Bleuer, N. K., 1970, Geologic considerations in planning solid-waste disposal sites in Indiana: Indiana Geol. Survey Spec. Rept. 5.
Cartwright, Keros, and Sherman, F. B., 1969, Evaluating sanitary landfill sites in Illinois: Illinois Geol. Survey Environmental Geology Notes no. 27.
Hughes, G. M., 1967, Selection of refuse disposal sites in northeastern Illinois: Illinois Geol. Survey Environmental Geology Notes no. 17.

GEOLOGIC CONSTRAINTS SUGGEST THAT THESE UNITS ARE –

Symbol	Category	
GF	GENERALLY FAVORABLE	As sites for the disposal of solid waste
LF	LOCALLY FAVORABLE	
GU	GENERALLY UNFAVORABLE	
UN	UNFAVORABLE	

Fault – Dashed where approximately located; dotted where concealed. U, upthrown side; D, downthrown side

EXPLANATION: Y Yes; N No; U Uncertain

	FAVORABILITY											
	GENERALLY FAVORABLE (GF)	LOCALLY FAVORABLE (LF)		GENERALLY UNFAVORABLE (GU)								UNFAVORABLE (UN)
GEOLOGIC UNIT[1]	Qpt	Qfc	Qc	Qpbt	Kk	Jm	Je	Ѣw	ℙMau	MDt	Ꞓpa	All other units
GEOLOGIC CONSTRAINTS 1. Does geologic unit have low permeability?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	All other units lack characteristics essential for use as adequate sanitary landfill sites
2. Is geologic unit free of aquifers?	Y	U	U	Y	N	N	N	N	U	U	Y	
3. Can landfill be sited on this unit so that its base will be 20 feet to 30 feet above highest seasonal level of water table?	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	U	
4. Can landfill be sited on this unit so that it will be distant from streams?	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	
5. Is geologic unit or are adjacent earth materials suitable for use as cover material?	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y	
6. Is this cover material workable and compactable year-round?	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	Y	

[1] Extent of outcrop and description of these geologic units are given in U.S. Geological Survey Map I-781-A.

MAP SYMBOL (I-781-A)	FORMATION NAME
Qpt	Till of Pinedale Glaciation
Qfc	Coalesced alluvial fans
Qc	Colluvium
Qpbt	Till of pre-Bull Lake glaciations
Kk	Kootenai Formation
Jm	Morrison Formation
Je	Ellis Group
Ѣw	Woodside Sandstone
ℙMau	Upper part of Amsden Formation
MDt	Three Forks Formation
Ꞓpa	Park Shale

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