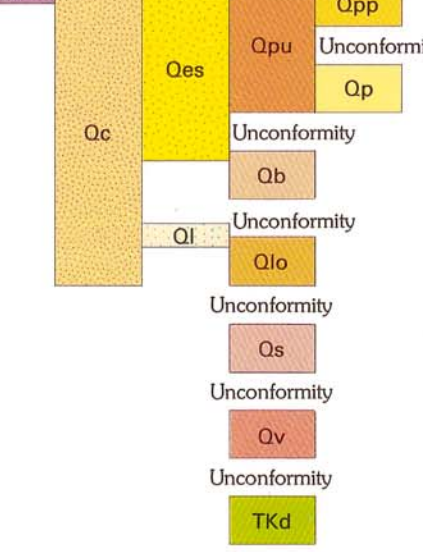


CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

(Surficial deposits not mapped where less than 1 m thick)

- af** ARTIFICIAL FILL (UPPER HOLOCENE)—Mann-made deposits composed of varying amounts of earth, rock fragments, and refuse. Includes embankments, dikes, and other engineered fill placed at optimum moisture and maximum density, compacted landfill, and uncompact dump fill and spoil banks along irrigation ditches. Only mapped where visible in the field or recognizable in 1949, 1963, or 1971 vintage aerial photographs. This discontinuous fill that covers much of downtown Denver, Lowry Air Force Base, and lowlands along the South Platte River and Cherry Creek are not shown. The large areas of artificial fill on the west side of the South Platte River and along the north side of Cherry Creek are the sites of mixed sand and gravel pits that were reclaimed for commercial, industrial, and recreational use. Poorly compacted fills are susceptible to differential settlement and slow consolidation with time and are unsuitable sites for most structures. Landfills are potential sources of ground-water pollution when placed in permeable material. Unvented landfills may contain methane and other gases that are produced by the decomposition of organic substances. Thickness generally less than 3 m; some embankments and earth dams greater than 6 m.
- Op** PINYON CREEK ALLUVIUM (UPPER HOLOCENE)—Light gray to dark gray-brown, humic, silty calcareous, sandy silt and clay overlying noncalcareous, clean to silty pebbly sand along with sandy silt along major streams and sandy clay to silty sand along intermittent streams. The upper 1-1.5 m of the alluvium along major streams is finer grained and darker colored than the lower part. Forms terraces about 6-8 m above the South Platte River, 3-5 m above Cherry Creek, and less than 3 m above Little Dry Creek. Includes thin deposits of post-Pinyon Creek alluvium along intermittent streams and gravelly very coarse sand along Cherry Creek. Stated beneath younger alluvium and eolian deposits. Exposed along Lettsville Drive between South Monaco and South Quebec Streets. Maximum thickness about 4.5 m in terraces along Cherry Creek, and 15 m in the valleys of the South Platte River and Cherry Creek; data from subsurface logs.
- Ob** BROADWAY ALLUVIUM (PLEISTOCENE)—Light brown, noncalcareous, clean to slightly pebbly sand interbedded with sandy silt to silty sand along the South Platte River and silty pebbly sand interbedded with sandy silt along Cherry Creek. Slightly finer grained in the upper meter. Forms terraces about 12-14 m above the South Platte River, 6 m above Cherry Creek, and 5 m above Little Dry Creek. Partially buried by eolian sand in places along the South Platte River and Cherry Creek and completely buried by eolian sand along Little Dry Creek, east of South Broadway. Thickness 6-9 m along the South Platte River in Denver's central business district and probably less than 9 m along Cherry Creek and Little Dry Creek.
- Olo** LOUWERS ALLUVIUM (PLEISTOCENE)—Light brown, clean pebbly sand interbedded with clayey silt to silty sand and pebbly coarse gravel along the South Platte River and clean pebbly sand interbedded with sandy silt to silty sand along Cherry Creek. Forms terraces approximately 11-14 m above Cherry Creek. Stated beneath younger alluvium and eolian deposits. Exposed along Lettsville Drive between South Monaco and South Quebec Streets. Maximum thickness about 4.5 m in terraces along Cherry Creek, and 15 m in the valleys of the South Platte River and Cherry Creek; data from subsurface logs.
- Osl** SLOUCM ALLUVIUM (PLEISTOCENE)—Light brown, clean pebbly sand interbedded with pebbly to cobble gravel. Coarse silt till about 45 m above Cherry Creek near the intersection of East Hampden Avenue and South Yosemite Street. In places buried by as much as 5 m of loess. Thickness about 1.5-3 m.
- Ov** VERDES ALLUVIUM (PLEISTOCENE)—Reddish-brown, silty pebbly sand interbedded with pebbly to cobble gravel. Coarse silt till about 45 m above Cherry Creek near the intersection of East Hampden Avenue and South Yosemite Street. In places buried by as much as 5 m of loess. Thickness about 1.5-3 m.
- TKd** DENVER VALLEY (PALEOCENE AND UPPER CRETACEOUS)—Olive-gray to light-gray, silty claystone and sandy siltstone interbedded with thin, lenticular beds of olive-yellow to light-brown, tuffaceous sandstone and sandstone pebbly conglomerate. Occurs within 1.5-3 m of the surface in most of the southeastern part of the quadrangle. Sandstones and their grained units contain varying amounts of nontronitic clay that produce low to very high swelling pressures when wetted. Thickness ranges from about 90 m in downtown Denver to about 300 m in the southeast corner of the quadrangle (Romero, 1976).
- TKc** DENVER FORMATION (PALEOCENE AND UPPER CRETACEOUS)—Light yellowish brown to yellowish-brown, silty clay to very coarse sand. Grain size decreases from northwest to southeast. The upper 0.3-0.6 m is slightly finer grained than the lower part. Noncalcareous in the upper 1.2 m and very slightly calcareous to the depth of greater than 4.5 m. Covers large areas on the east sides of major streams. Partially buried by eolian sand in the area south of Windsor Lake. Sand dunes and deflation basins are vegetated and have a northwest-southeast orientation. Low to high consolidation and very low shear strength; nonexpansive. Thickness usually less than 6 m, locally greater than 9 m.
- Ql** LOESS (PLEISTOCENE)—Yellowish brown, nonstratified, clayey sand. Slightly more clayey and noncalcareous in the upper 0.6 m. Contains numerous small carbonate nodules and vesicles to a depth of 1.2 m and slightly calcareous to a depth of greater than 3 m. Covers extensive areas in the eastern two-thirds of the quadrangle. Locally may include deposits of younger sand in an area adjacent to eolian sand. Moderate to high shear strength when dry and low to very high consolidation when wet. Produces low to moderate swelling pressures when wetted. Thickness less than 7.5 m; frequently less than 4.5 m.
- Qp** UNDIFFERENTIATED ALLUVIUM (UPPER HOLOCENE)—Deposits of post-Pinyon Creek alluvium and Pinyon Creek Alluvium along Cherry Creek, west of Glendale, where units are too extensively modified by urban development to permit mapping. Includes large areas of artificial fill along Cherry Creek.
- Qpp** POST-PINYON CREEK ALLUVIUM (UPPER HOLOCENE)—Light gray to light-brown, noncalcareous, clean to slightly silty pebbly sand interbedded with sandy silt. Forms channel, flood plain, and low terraces less than 5 m above the South Platte River and less than 3 m above Cherry Creek. Subject to periodic flooding. Thickness about 1.5-3 m.

TABLE 3.—Dry density, moisture content, volume change, swelling pressure, and shear strength of selected surficial and bedrock units

Map unit	Number of samples	Statistical range	Sample depth (meters)	Dry density (Mg m <sup>-3</sup> )	Moisture content (%)	Volume change			Swelling pressure (kN m <sup>-2</sup> )	Swelling percent (%)	Source of data	Number of samples	Sample interval (meters)	Unclassified shear strength (kN m <sup>-2</sup> )	Source of data	
						Initial <sup>1</sup>	Final <sup>2</sup>	Sw <sup>3</sup>								
Osl	Eolian sand	37	Range	0.9-2.7	1.386-1.876	0-22	0.1-2.3	0.1-1.8	0.2-2.3	0	0	0	0	0	0	0
				Mean	1.68	1.629	10	0.5	0.5	0.7	0	0	0	0	0	0
Ob	Culottes	8	Range	0.6-2.7	1.468-1.714	7-23	0.3-1.4	0.1-0.4	0.3-1.4	0-9	0-19	0	0	0	0	0
				Mean	1.67	1.609	17	0.6	0.4	0.7	1.1	7	19	0	0	0
Olo	Loess	68	Range	0.9-2.7	1.361-1.842	0-27	0.1-1.8	0.1-0.5	0.2-0.3	0-17	0-30	0	0	0	0	0
				Mean	1.8	1.618	14	0.7	0.4	0.5	1.1	25	35	0	0	0
TKd	Denver Valley	18	Range	0.9-4.3	1.618-1.842	0-30	0.2-1.3	0.1-0.3	1.3-10.1	100-990	0	0	0	0	0	0
				Mean	2.1	1.842	20	0.7	0.4	2.2	280	280	0	0	0	0
TKc	Denver Valley	11	Range	1.6-7.0	1.270-1.676	10-30	0.1-1.0	0.0-0.3	0.1-0.0	0-100	0	0	0	0	0	0
				Mean	3.0	1.579	21	0.5	0.0	0.5	1.0	45	50	0	0	0
TKc	Verdes Alluvium	3	Range	1.8-2.1	1.530-1.794	4-15	0.3-0.8	0.0-0.9	0.0-0.8	0-30	0	0	0	0	0	0
				Mean	1.8	1.724	11	0.5	0.1	0.6	0.5	15	15	0	0	0

TABLE 4.—Sections showing estimated grain-size distribution and thickness, in meters, of surficial materials and lithology of the underlying bedrock—Continued

Section number	Location	Altered columnar section	Source of data
190	290	190	190
191	291	191	191
192	292	192	192
193	293	193	193
194	294	194	194
195	295	195	195
196	296	196	196
197	297	197	197
198	298	198	198
199	299	199	199
200	300	200	200
201	301	201	201
202	302	202	202
203	303	203	203
204	304	204	204
205	305	205	205
206	306	206	206
207	307	207	207
208	308	208	208
209	309	209	209
210	310	210	210
211	311	211	211
212	312	212	212
213	313	213	213
214	314	214	214
215	315	215	215
216	316	216	216
217	317	217	217
218	318	218	218
219	319	219	219
220	320	220	220
221	321	221	221
222	322	222	222
223	323	223	223
224	324	224	224
225	325	225	225
226	326	226	226
227	327	227	227
228	328	228	228
229	329	229	229
230	330	230	230
231	331	231	231
232	332	232	232
233	333	233	233
234	334	234	234
235	335	235	235
236	336	236	236
237	337	237	237
238	338	238	238
239	339	239	239
240	340	240	240
241	341	241	241
242	342	242	242
243	343	243	243
244	344	244	244
245	345	245	245
246	346	246	246
247	347	247	247
248	348	248	248
249	349	249	249
250	350	250	250
251	351	251	251
252	352	252	252
253	353	253	253
254	354	254	254
255	355	255	255
256	356	256	256
257	357	257	257
258	358	258	258
259	359	259	259
260	360	260	260
261	361	261	261
262	362	262	262
263	363	263	263
264	364	264	264
265	365	265	265
266	366	266	266
267	367	267	267
268	368	268	268
269	369	269	269
270	370	270	270
271	371	271	271
272	372	272	272
273	373	273	273
274	374	274	274
275	375	275	275
276	376	276	276
277	377	277	277
278	378	278	278
279	379	279	279
280	380	280	280
281	381	281	281
282	382	282	282
283	383	283	283
284	384	284	284
285	385	285	285
286	386	286	286
287	387	287	287
288	388	288	288
289	389	289	289
290	390	290	290
291	391	291	291
292	392	292	292
293	393	293	293
294	394	294	294
295	395	295	295
296	396	296	296
297	397	297	297
298	398	298	298
299	399	299	299
300	400	300	300

<sup>1</sup> Dry density means per unit volume of sample.

<sup>2</sup> Moisture content means as a percentage of dry weight of the sample.

<sup>3</sup> Final consolidation pressure means the pressure at which the sample was consolidated.

<sup>4</sup> Swelling pressure means the pressure at which the sample swelled to the specified volume.

<sup>5</sup> Swelling percent means the percentage increase in volume of the sample when the sample was allowed to swell to the specified volume.

<sup>6</sup> Shear strength means the shear stress at failure of the sample.

<sup>7</sup> Shear strength means the shear stress at failure of the sample.

<sup>8</sup> Shear strength means the shear stress at failure of the sample.

<sup>9</sup> Shear strength means the shear stress at failure of the sample.

<sup>10</sup> Shear strength means the shear stress at failure of the sample.

<sup>11</sup> Shear strength means the shear stress at failure of the sample.

<sup>12</sup> Shear strength means the shear stress at failure of the sample.

<sup>13</sup> Shear strength means the shear stress at failure of the sample.

<sup>14</sup> Shear strength means the shear stress at failure of the sample.

<sup>15</sup> Shear strength means the shear stress at failure of the sample.

<sup>16</sup> Shear strength means the shear stress at failure of the sample.

<sup>17</sup> Shear strength means the shear stress at failure of the sample.

<sup>18</sup> Shear strength means the shear stress at failure of the sample.

<sup>19</sup> Shear strength means the shear stress at failure of the sample.

<sup>20</sup> Shear strength means the shear stress at failure of the sample.

<sup>21</sup> Shear strength means the shear stress at failure of the sample.

<sup>22</sup> Shear strength means the shear stress at failure of the sample.

<sup>23</sup> Shear strength means the shear stress at failure of the sample.

<sup>24</sup> Shear strength means the shear stress at failure of the sample.

<sup>25</sup> Shear strength means the shear stress at failure of the sample.

<sup>26</sup> Shear strength means the shear stress at failure of the sample.

<sup>27</sup> Shear strength means the shear stress at failure of the sample.

<sup>28</sup> Shear strength means the shear stress at failure of the sample.

<sup>29</sup> Shear strength means the shear stress at failure of the sample.

<sup>30</sup> Shear strength means the shear stress at failure of the sample.

TABLE 5.—Source of subsurface and analytical data

Section number	Location	Altered columnar section	Source of data
190	290	190	190
191	291	191	191
192	292	192	192
193	293	193	193
194	294	194	194
195	295	195	195
196	296	196	196
197	297	197	197
198	298	198	198
199	299	199	199
200	300	200	200
201	301	201	201
202	302	202	202
203	303	203	203
204	304	204	204
205	305	205	205
206	306	206	206
207	307	207	207
208	308	208	208
209	309	209	209
210	310	210	210
211	311	211	211
212	312	212	212
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218	318	218	218
219	319	219	219
220	320	220	220
221	321	221	221
222	322	222	222
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224	324	224	224
225	325	225	225
226	326	226	226
227	327	227	227
228	328	228	228
229	329	229	229
230	330	230	230
231	331	231	231
232	332	232	232
233	333	233	233
234	334	234	234
235	335	235	235
236	336	236	236
237	337	237	237
238	338	238	238
239	339	239	239
240	340	240	240
2			