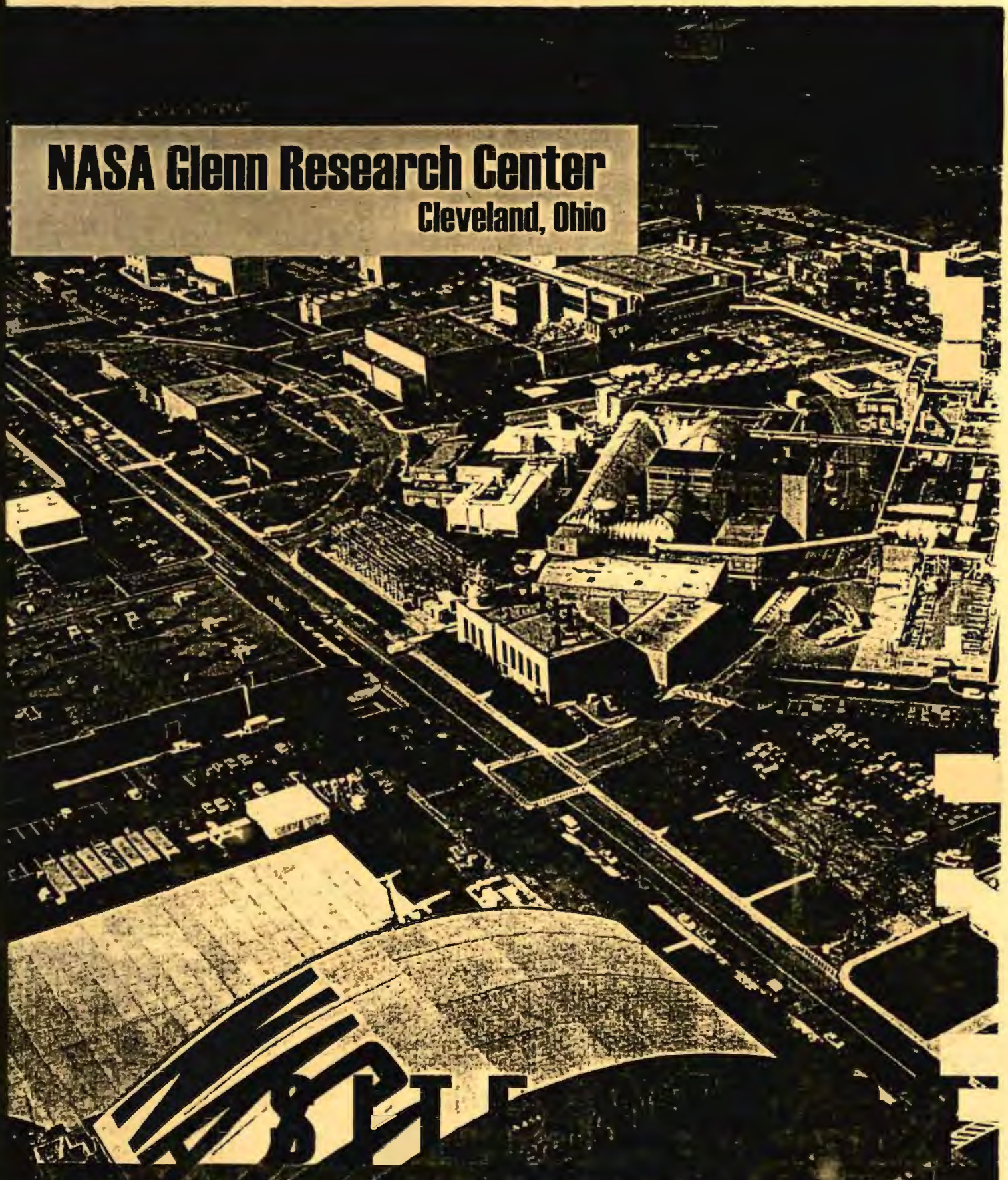
NASA Glenn Research Center
Cleveland, Ohio



South 40 Facilities Relocation • 90% Submittal Supplement

October 1999

Prepared for:
The City of Cleveland Department of Port Control

Prepared by:
PARSONS

South 40 Facilities Relocation

Site Study

90% Submittal Supplement

NASA Glenn Research Center
Cleveland, Ohio

Prepared for:

The City of Cleveland
Department of Port Control
&
NASA Glenn Research Center
Cleveland, Ohio

Prepared by:

Parsons Engineering Science, Inc.
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KS Associates, Inc.

October 1999

Foreword

The 90% Site Study Submittal Supplement, (90% Supplement) is in response to NASA's July 23, 1999 letter requesting flood plain, property line and sound level information as well as alternate site layouts for various South 40 facilities, including Cryogenic Component Laboratory (CCL) A Cells, Central Chemical Storage Facility (CCSF) and several Gated and Outside Storage Areas.

The floodplain issues have been well communicated via a demonstration of the Abram creek Basin Storm Water Management Model (SWMM) and correspondence. Although all questions cannot be answered until the Abram Creek culvert and detention basin are fully designed, it is understood that both the Pond Valley and Creek Road Sites have completely mitigatable floodplain issues. Please refer to the specific evaluations for a presentation of the supporting Environmental Impact Statement (EIS) documentation.

The sound level issue has been equally well communicated. The City has demonstrated that common building practices are capable of mitigating the sound levels predicted (in the South 40) in 2003 (based on the application and analysis of mandatory Stage III aircraft engine sources).

The property line issue has also been thoroughly reviewed via face to face meetings with the City's runway consultant and various discussions. The City has presented a case supporting the property line as proposed in the original 90% Site Study Submittal.

The applicability of the Supremacy Clause to several of the relocation sites (e.g. Federal preemption of local codes and requirements) remains uncertain. An opinion on this matter has been rendered by the City of Cleveland Law Department and is being forwarded to NASA under separate cover. Therefore the West Area Research sites have been conditionally evaluated.

This Site Study 90% Supplemental Submittal is organized to work closely with the original 90% Submittal as follows:

The new Section 1 replaces the 90% Submittal Section 1 in it's entirety. The 90% Supplement includes updates to both of the Relocation Site Area Maps as well as Table 1-1, the Site Layout Summary and Recommendations.

There are no additional assumptions for the 90% Supplement. Most of the new information is presented conditionally.

Section 5 provides the six additional layouts and discussion developments (as requested) that can be inserted into the appropriate sections of the 90% Submittal.

The new Section 5.3 replaces the existing Section 5.3 in it's entirety. The new section summarizes the overall scoring for all site layouts considered. The new Section 5.3 is intended to re-cap all of the recommended, viable and conditionally rated layouts.

Section 1: Executive Summary

1.1 PURPOSE.

The South 40 Facilities Relocation Site Study addressed facility and operations relocations, required because of the expansion of Cleveland-Hopkins International Airport, CHIA, and its subsequent impact on the NASA Glenn Research Center's operations. The proposed CHIA Airport Layout Plan (ALP) includes the replacement of an existing runway with a new runway (parallel to and west of the existing primary runway) which impacts the Glenn Research Center (GRC) area commonly referred to as the "South Forty" (South 40). The airport expansion will require the relocation of existing facilities and transfer of about 35 acres of the South 40 to CHIA. Approximately 15 acres and several facilities will remain in the South 40 area as part of the GRC installation.

The South 40 area is unique at GRC because it is isolated from the more densely developed main campus area. This allows for research testing requiring larger exclusion safety zones. The twelve facilities addressed as a part of this Site Study were grouped into the following five projects:

1. B-Stand, several transient storage dewars and miscellaneous equipment identified for relocation by NASA.
2. Cryogenic Component Laboratory (CCL), including the Supplemental Multi Layer Insulation Research Facility (SMIRF), four Test Cells (1,2,7 and Proof), the Propellant Densification Test Site and the Liquid Hydrogen Transfer/Storage Station.
3. Materials Storage Building (208)
4. Grounds Bulk Materials Storage Building (210) and Outside Storage Areas (Contractor and Gated Storage Areas)

5. Central Chemical Storage Building (212) and related areas

The relocation of these GRC South 40 facilities is on the critical path for meeting the schedule objectives of the airport expansion. CHIA now anticipates a Record of Decision, ROD, on it's Environmental Impact Statement, EIS, by August 2000. This will allow runway construction to begin in August 2000 and be completed in 2003.

1.2 **PROCESS.** The laboratory facilities in the South 40 are very unique facilities that have detailed operational requirements needed to meet NASA's highly specialized performance objectives. In addition, the CHIA expansion has very specialized aviation and scheduling requirements. The planning process, used to address such unique study objectives, must be dynamic and must have the flexibility needed to address both known and evolving issues. The basic planning framework established for this project retained this flexibility to allow for refinements as more detailed information, opportunities and constraints were identified. The basic planning framework was initially based around four submittals (15%, 50%, 90% and Final). Due to several policy issues and related complexities a 90% Site Study Supplement (90% Supplement) was added. The study methodology included the following activities:

- Operations Overview: Review of available information, interviews, tours and other forms of data gathering to analyze existing facility and operational requirements.

- Identification of Alternative Sites: General overview of various sites at NASA Glenn Research Center at Lewis Field and at Plum Brook Station to develop a listing of potential relocation sites.

- Relocation Evaluation: Analysis of the adaptability of locating facilities to specific sites. Relocation sites were evaluated and scored against seven (initially six) established criteria having 21 sub-scores. Scores were initially based on a pure mathematical scoring system, but later in the process, a pass - fail screening criteria was added to many of the elements in order to converge on only viable alternatives. Safety and related issues were the key discriminators.

- Scenario Analysis: The many combinations of scenarios were reviewed to identify compatibility/conflict issues between potential site layout schemes.

- Recommended Sites: Recommended site locations were identified based on the relocation evaluations and Scenario Analysis.

1.3 ALTERNATIVES CONSIDERED. Based on the availability of land, the implementation schedule and NASA preferences, potential locations considered for replacement facility siting were limited to the two Northern Ohio NASA installations. NASA Glenn Research Center at Lewis Field has limited suitable land available. Plum Brook Station in Sandusky, Ohio however has significant undeveloped land that is well suited for cryogenic propellant research facilities.

Initially the project team envisioned as many as 22 site layout combinations to site the five projects. After applying the safety exclusion zone criteria, the team quickly discovered that the existing cells would not all fit at the Lewis Field location. The five projects were eventually divided into twelve facilities that were addressed individually to segregate the exclusion zones and fit as much as possible at Lewis Field.

The potential facility layouts identified during the planning process (including those in the 90% Supplement) are listed in Table 1-1, Site Layout Summary and Recommendations. This Table assigns unique "Facility Layout Scheme" reference numbers, and locates them on the following GRC and Plum Brook maps:

- Figure 1-1: John H. Glenn Research Center, Map of Potential South 40 Potential Relocation Site Areas
- Figure 1-2: Plum Brook Station, Map of Potential Relocation Site Areas.

Table 1-1 and the two maps identify each of the 77 Facility Layouts studied at the two NASA locations:

- the 9 Project 1 alternatives,
- the 30 Project 2 alternatives (including Test Cells A at Creek Rd.),
- the 6 Project 3 alternatives,
- the 23 Project 4 alternatives (including alternate layouts for combined storage areas), and
- the 9 Project 5 alternatives (including Building 212 in South 40).

Ultimately the project team is recommending twelve site layouts to accommodate the five projects. These twelve locations are shown in large red numbers on the GRC and Plum Brook maps and in bold highlighted text in Table 1-1. In addition to the

recommended locations, the maps show the alternate viable sites in smaller blue colored circles. Table 1-1 also provides an Evaluation Summary that describes the ranking and recommendations.

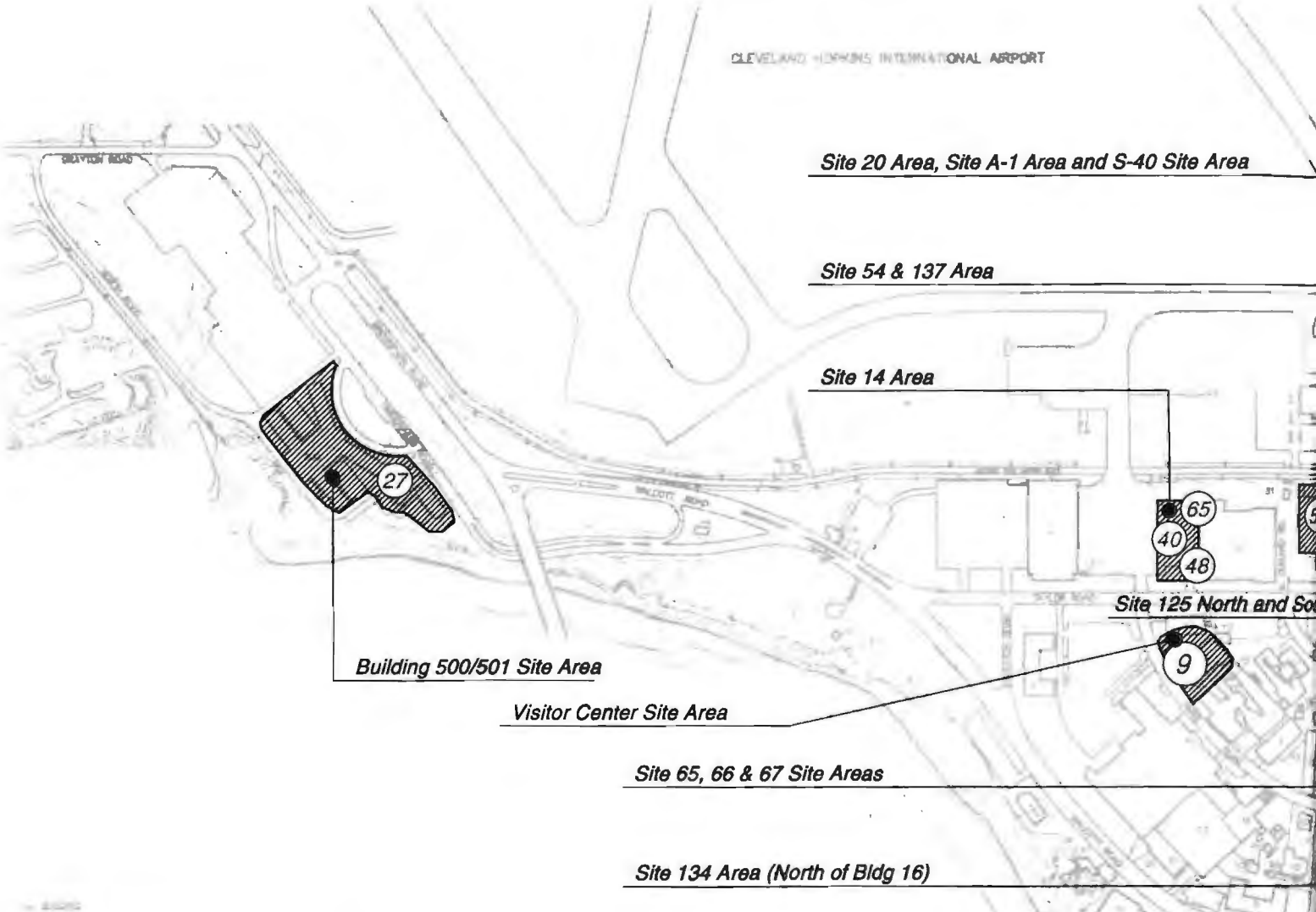
Following the maps and Table 1-1 is a summary of each recommendation by project segment.

Table 1-1 Site Layout Summary and Recommendations
NASA S-40 Site Study Project

Facility Layout Scheme	*Project or Project Segment (See Chart above)*	*Site Layout or Site Area Description*	*Evaluation Summary*
1	Transient Storage	Site 125 North/South Area	Failed on Facility Requirements, Impact and Compatibility
2	Transient Storage	Guerin Rd South Site Area	Failed on Safety, Compatibility and Brook Park
3	Transient Storage	Site 134 Area	**Viable Alternative with Traffic / Access Issues**
4	***Transient Storage***	***South 40 Site Areas***	***Recommended Alternative***
5	B-Stand	35-10 Site Area	**Conditionally acceptable** based on Facility Requirements, Safety and Compatibility.
6	B-Stand	Squaw Valley North w/various control rms.	Failed on Facility Requirements, Safety, Compatibility, Environmental and Brook Park
7	B-Stand	PB "HTF" Site Area	**Viable Alternative that meets all criteria.**
8	B-Stand	Squaw Valley South,w/various control rms.	Failed on Facility Requirements, Safety, Compatibility and Brook Park
9	***B-Stand***	***Museum***	***Recommended Alternative***
10	A + B Cells complete	S-40 Site Areas A-1 & 20 w/various control room options	Failed on Impact and Compatibility
11	A + B Cells complete	Guerin Road Site Area	Failed on Safety, Impact, Compatibility and Brook Park
12	A + B Cells complete	West Area Road Layout 1	Failed on Safety, Impact, Compatibility and Brook Park
13	A + B + C Cells complete wo/ Proof and LH2 Transfer	Plum Brook "K" Site Area, split into C alone + A/B in 2811.	Failed on Safety
14	A + B Cells complete	Cryogenic Rd. Site Area	Failed on Safety, Impact, Compatibility and Brook Park
15	A + B Cells complete	West Area Rd. Layout 2 for 50%	Failed on Safety, Impact, Compatibility and Brook Park
16	A + B Cells complete	S 40 Central Layout @ 50%	Failed on Safety, Impact and Compatibility
17	A + B wo/LH2 or Proof Cells	Plum Brook "K" Site Layout, A (wo/ Proof & LH2 Transfer) in Building # 2811, B and C to SW and South respectively	Failed on Safety
18	SMIRF + Cell 7 + B Cells	Pond Valley layout @ 50%	Failed on Safety, Impact and Compatibility
19	A (wo/ LH2 Transfer and Proof) + B Cells	S 40 Site @ Sub A, after 50%	Failed on Safety, Impact and Compatibility
20	SMIRF + Cell 7	S 40 layout @ Sub A, 50%+	Failed on Impact and Compatibility
21	SMIRF + Cell 7	Creek Road Layout	**Conditionally acceptable** based on Safety, Impact, Compatibility and Brook Park..
22	SMIRF + Cell 7	West Area Rd North Finger layout	Failed on Safety, Impact, Compatibility and Brook Park
23	SMIRF + Cell 7	West Area Rd South Finger layout	Failed on Safety, Impact, Compatibility and Brook Park
24	***A + B wo/LH2 or Proof Cells (new shop/control Rm).***	***Plum Brook "K" Site 50%+ layout w/A Cells East of 2811.***	***Recommended Alternative. Pond Valley is also viable. Creek Rd is conditionally acceptable.***
25	SMIRF + Cell 7 + Proof Cell	Pond Valley enhanced 50%+ layout	**Viable Alternative, but Complex Site (EIS, Floodplain, Wetlands, Safety, Lease) For This Active Cell**
26	***Day Care, Picnic, Fitness Center***	***Existing Location***	***Recommended if no Test Cells are moved nearby.***
27	Day Care, Picnic, Fitness Center	Buildings 500/501	Failed on Facility Requirements, Impact and Compatibility
28	Day Care, Picnic, Fitness Center	Guerin Rd Cul-de-sac layout	**Viable/recommended Alternative if SMIRF goes to Pond Valley or Creek Rd.**
29	B Cells alone	Squaw Valley North layout	Failed on Safety, Compatibility, Environmental,
30	B Cells alone	Squaw Valley South layout after	Failed on Safety, Compatibility and Brook Park
31	B Cells alone	Pond Valley layout 50%+	Fails on Safety, Impact and Compatibility
32	***B Cells (see layout # 24 above)***	***Plum Brook K Site Layout SW of B-2811.***	***Recommended Alternative. May include A and/or C Cells.***

Table 1-1 Site Layout Summary and Recommendations
NASA S-40 Site Study Project

Facility Layout Scheme	*Project or Project Segment (See Chart above)*	*Site Layout or Site Area Description*	*Evaluation Summary*
33	C Cells, Densification	Cryogenic Rd layout w/ reduced 1000#LH2	Failed on Facility Requirements, Safety, Compatibility and Brook Park
34	***C Cells complete w/new shop, exist control room***	***Plum Brook "K" 50% Layout moved further S of B-2811.***	***Recommended Alternative. May include A and/or B-Cells.***
35	LH2 Transfer + Proof Cell	Guerin Rd. layout (w/A+B @ PB)	Failed on Safety, Impact and Compatibility
36	LH2 Transfer/Storage	South 40 Site Area	Failed on Safety, Impact and Compatibility
37	Proof Cell alone	South 40 Site Area	Failed on Facility Requirements
38	LH2 Transfer/Storage (wo/proof)	Guerin Rd Site Area	**Viable alternative. Renew existing LH2 Transfer Permit.**
72	***LH2 Transfer Station***	***South 40 Area***	***Recommended Alternative***
39	Building 208	Site 84 and 107 Areas	Bldg. 208 Relocation Not Required.
40	Building 208	Site 14 Area	Bldg. 208 Relocation Not Required.
41	Building 208	Site 134, layout NE of bldg. 16	Bldg. 208 Relocation Not Required.
42	Building 208	Site 84 & 137 areas	Bldg. 208 Relocation Not Required.
43	Building 208	Site 20 Area @ Walcott & CP Rd.	Bldg. 208 Relocation Not Required.
44	***Building 208***	***208, exist site***	***Recommended Alternative. Relocation Not Required.***
45	Building 210 (salt dome)	Site 20 Area	Bldg. 210 Relocation Not Required.
46	Building 210 (salt dome)	Site 84 area	Bldg. 210 Relocation Not Required.
47	Building 210 (salt dome)	Site 107 area	Bldg. 210 Relocation Not Required.
48	Building 210 (salt dome)	Site 14 area	Bldg. 210 Relocation Not Required.
49	Building 210 (salt dome)	Site 134 area,NE of bldg. 16	Bldg. 210 Relocation Not Required.
50	Building 210 (salt dome)	Site 137 area	Bldg. 210 Relocation Not Required.
51	***Building 210 (salt dome)***	***210, exist site***	***Recommended Alternative. Relocation Not Required.***
52	Outside Gated Storage	Squaw Site Areas	Fails on Environmental
53	Outside Gated Storage	Plum Brook Site Areas	Fails on Facility Requirements
54	Outside Gated Storage	Guerin Rd South Layout	Fails on Facility Requirements
55	Outside Gated Storage	S-40 layout @ A-1(@sub-A)	Eliminated and Reworked. See #58 below
56	Outside Gated Storage	Cryogenic Rd Site Area	Fails on Facility Requirements
57	Outside Gated Storage	S 40 Site areas near 210/208	Eliminated and Reworked. See #58 below
58	***Gated Storage***	***South 40 Site Areas***	***Recommended Alternative.***
74	Outside Gated Storage Alt.	S 40 Partial Scenario w/ B-212	Viable
76	Outside Gated Storage Alt.	Creek Rd Partial Scenario	**Conditionally acceptable.**
77	Outside Gated Storage Alt.	Pond Valley Partial Scenario	**Conditionally acceptable.**
59	Contractor Storage	Squaw Site Areas	Fails on Environmental
60	Contractor Storage	Cryogenic Rd Site Area	Fails on Facility Requirements and Compatibility
61	Contractor Storage	South 40 A-1 Site Area, East of Sub A	Eliminated and Reworked. See #63 below
62	Contractor Storage	Guerin Rd South layout	Fails on Facility Requirements and Compatibility
63	***Contractor Storage***	***South 40 Site Areas***	***Recommended Alternative.***
75	Contractor Storage(partial)	Guerin Rd Scenario w/outdoor + LH2	**Conditionally acceptable.**
64	Chemical Storage B-212	South 40, Site A-1 Area	Fails on Compatibility
65	Chemical Storage B-212	Site 14 Area	Fails on Facility Requirements, Life Cycle Costs, Compatibility
66	Chemical Storage B-212	Bldg. 212, exist site layout	Fails on Facility Requirements, Life Cycle Costs, Compatibility
67	Chemical Storage B-212	Various Site 20 Areas	Fails on Facility Requirements and Compatibility
68	Chemical Storage B-212	Wiggins Fuel Farm Site Area	Fails on Facility Requirements and Compatibility
69	Chemical Storage B-212	Site 65, 66, 67 Areas	**Viable Alternative, but Traffic / Access Issues**
70	Chemical Storage B-212	Site 94 Area	Fails on Facility Requirements and Compatibility
71	***Chemical Storage B-212***	***Site 16 Area***	***Recommended Alternative***
73	Chemical Storage B-212	South 40, Central Site Area	**Viable.**



CHEMISTRY LABORATORY
MICROWAVE SYSTEMS LABORATORY
8 VISITORS CENTER
REFRIGERATION BLDG
COOLING TOWER NO
EPB WEST WING
SUBSTATION "C"
SUBSTATION "D"
46 6' X 6' SWT DOOR
49 MATERIALS AND
50 FABRICATION SHOP
51 HIGH TEMPERATURE COMPOSITES
52 8' X 8' SWT DRIVE EQUIPMENT
54 8 X 8' SWT JENO
56 COMMUNICATIONS LABORATORY
57 STRUCTURAL DYNAMICS LABORATORY
58 8' X 6' SWT AIR DRYER BLDG
59 SUBSTATION "M"
60 ACT-UPS BLDG
62 LIBRARY SERVICES BLDG
63 8' X 6' SWT MODEL PREP LABORA
64 TRANSMISSION TEST STAND
65 CENTRAL AIR EQUIPMENT BLDG
66 PSL ALTITUDE CHAMBERS (2)
67 PSL ACCESS BLDG
68 PSL PRIMARY COOLERS (2)
69 PSL SECONDARY COOLER
70 PSL TIE LINES
71 PSL COOLING TOWER NO. 3
72 SERVICE SUPPORT BUILDING
74 PSL COOLING TOWER

EPB COMPRESSOR
35 VERTICAL LIFT FAN ACF
36 COMPONENTS CLEANING FACILITY ANNEX
37 WAREHOUSE NO. 2
38 8' X 6' SWT HYDR. PUMP HOUSE
COMMUNICATIONS SATELLITE STATION
40 MATERIALS & STRUCTURES AUXILIARY BLDG
FLIGHT RESEARCH DRAW STORAGE BLDG
RESEARCH ANALYSIS CENTER
CENTRAL CONTROL BLDG
PSL TURBOEXPANDER NO. 2

500 DEVELOPMENT ENGINEERING BLDG.
501 DEVELOP ENGINEERING BLDG. ANNEX

ABBREVIATIONS

SWT - SUPERSONIC WIND TUNNEL
PSL - PROPULSION SYSTEMS LABORATORY
ERB - ENGINE RESEARCH BUILDING
EPRB - ELECTRIC PROPULSION RESEARCH BUILDING

Site 16 Area

Guerin Road Site Are

LEGEND

(9) Reco

(7) Viabl

(27) Not R

(75) Cond

ended

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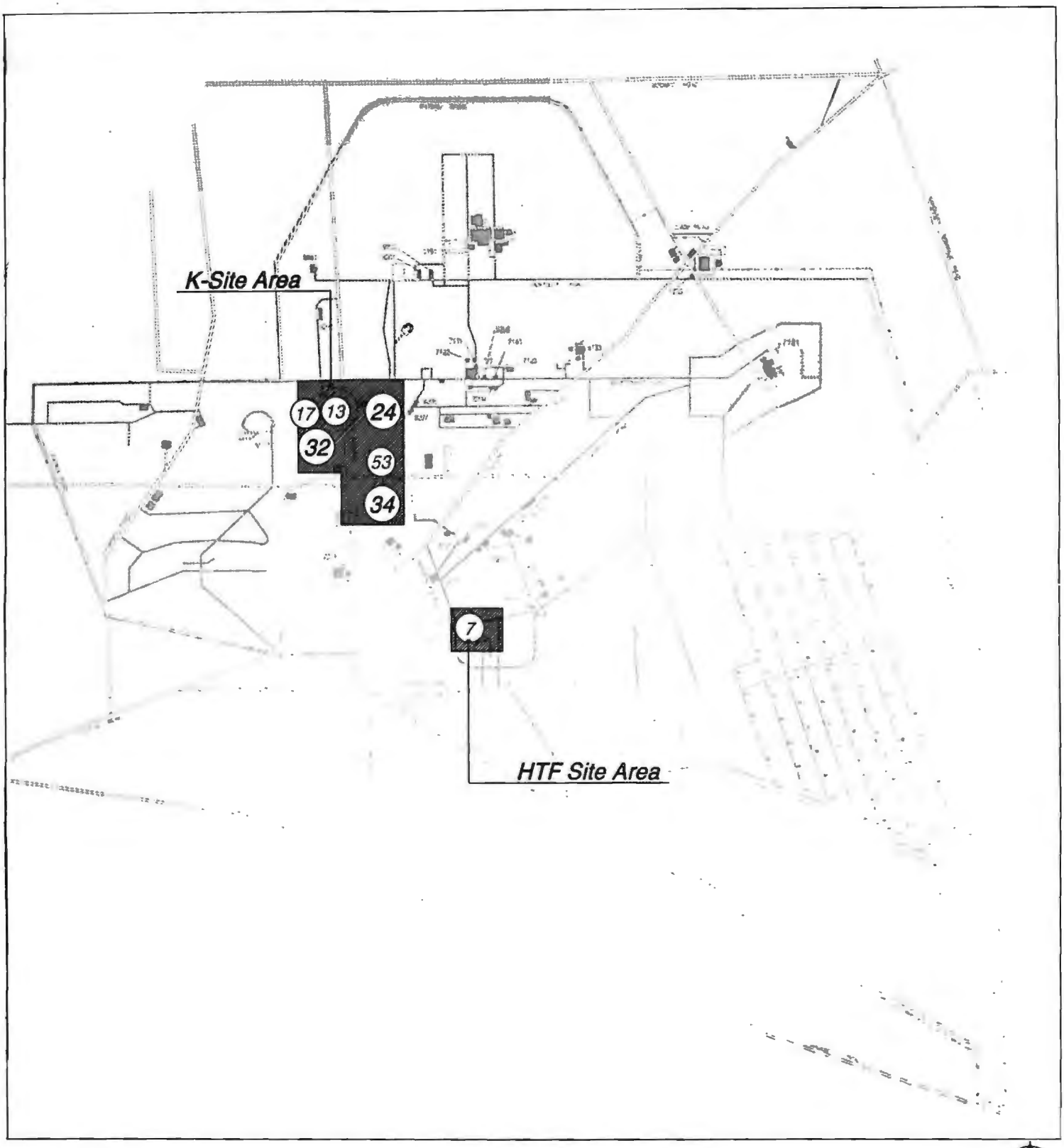
Figure 1-1
John H. Glenn Research Center
Map of Potential S40 Relocation Site Areas
September 17, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates



LEGEND

(9) Recommended

(7) Viable Alternative

(27) Not Recommended

NORTH

CONTOUR INTERVAL 5'

GRAPHIC SCALE

0 1500 3000 4500

Figure 1-2
Plum Brook Station
Map of Potential Relocation Site Areas
September 17, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Parsons Kirkland Bartholomew & Associates, Inc.

1.4 Recommended Alternatives

Project 1

- Four Transient Storage Dewar locations were considered. The recommended location is in the remaining South 40 area with similar use storage. Site 134 is also viable.

- B Stand was studied at three active GRC locations and one Plum Brook location, as well as the option to place the test capsule in a museum and address State Historic Preservation Office (SHPO) requirements for this National Historic Landmark registered facility. The recommended alternative is to consider placing this historic test cell in a Museum or Visitor Center display until such time that a specific programmatic requirement for its use is defined and funded. At that time, B-Stand would be re-built specifically to meet the needs of the funded research program. Also, the Plum Brook HTF Site is represented as viable, and the 35-10 GRC-Lewis Field site has been conditionally rated in this Study.

Project 2

- SMIRF and the A Cells are a very active group of cells that saw more study than any other project segment. Twenty-one A Cell alternatives were studied. The recommended alternative for SMIRF and Test Cell 7 is to co-locate these facilities with Test Cells B and C at "K" Site in Plum Brook.

  The SMIRF Pond Valley Alternative is also viable. At the Pond Valley Site, relocating the Childcare, Recreation / Fitness Center and Picnic area is also recommended.

  Test Cells A were also fully developed at the Creek Rd Site, and determined to be conditionally acceptable. However concurrence on the viability of this site was not available at the time of printing.

- The LH2 Transfer Station is recommended to be collocated in the South 40 Area at GRC with the Transient Dewar Storage and Gated Storage Areas. The Guerin Road Site is also viable.

- The B Cells were studied in 15 alternatives. The B Cells are more dynamic than the A Cells and require larger minimum exclusion zones than the GRC campus can accommodate. The recommended alternative is at "K" Site at Plum Brook.

- The C Cells (Densification) have by far the largest exclusion zones of all the South 40 Cells with their 28,000 gallon LH2 requirement. Although the GRC campus cannot accommodate their requirements, the recommended alternative, "K" Site in Plum Brook, is very compatible.

Project 3

- Building 208 (Materials Storage) was studied at six locations, but the recommendation is to leave it at the existing location. The property line will be 50 feet to the South, and the use is compatible with NASA and Airport safety criteria.

Project 4

- Building 210 was studied at seven locations, but the recommendation is to leave it at the existing location. The property line will be 100' to the South, and the use is compatible with NASA and Airport safety criteria.

- The Outside Gated Storage was studied at eight locations. The recommendation is to collocate this storage area with like uses in the remaining South 40 Area.

- The Contractor Trailer Storage Area was studied at eight locations, and the recommendation is to co-locate this storage area with similar like uses in the remaining South 40 Area.

- A variety of alternate layouts (for the combined storage areas) demonstrate the flexibility (and number of possible scenarios) available within project 4 alone.

Project 5

- The Chemical Storage Building 212, was studied particularly closely, since it was "on the bubble" of the property line. The Airport considered various perimeter road designs to try to keep Building 212 in place, but ultimately was required by FAA Safety Zone Guidance to use a design in which the property line intersects Building 212. Of the nine alternatives studied for Building 212, the Site 16 Area is recommended. The adjacent South 40 Site and Site 65,66,67 are also viable.

1.5 Summary

The Site Study process has been a very dynamic process, in which the project team has gained significant insight to many of

the critical issues associated with NASA's specialized research equipment and operations. The above recommendations are the result of many long hours of study and many years of experience. There are several viable alternatives to these recommendations, and there are alternate assumptions and safety interpretations that could support different conclusions.

The project team has reviewed all of the available information, and has interpreted it based on its technical and professional experience. These recommendations are sound and viable, however there may be additional issues that only NASA can understand and interpret.

The project team looks forward to working with NASA, through the selection process, into the PERs Study and beyond.

5.2.2.1.12 Facility Layout Scheme 21, SMIRF, Cell 7 and Proof Cell at Creek Road, Glenn Research Center:

This facility layout scheme alternative would have located SMIRF (Test Cell A-1), Cell 7 (Test Cell A-2) and the Proof Cell at Creek Road. The B Cells, the liquid hydrogen transfer station, the liquid hydrogen storage area, and Test Cell C requirements would have been located at other locations. Placement of the SMIRF, Proof Cell and Cell 7 research facilities on Creek Road will require the relocation of utility services and the construction of blast protective wall and earthen berms. Construction of these facilities in this area may also require the relocation of the childcare, fitness and recreation facilities, which are currently located just West of this proposed construction area. The potential impacts associated with the relocation of the childcare, fitness center and recreational area are discussed in subsection 5.2.2.2.

The proposed layout is in the Brook Park Issues Area as described in Section 5.1. Consequently, it was originally determined that conducting research at this facility layout scheme would not meet the initially established criterion, and the facility layout scheme was initially eliminated from further consideration. This alternative:

1. Would result in unacceptable other safety criteria concerns (criterion B3),

2. Would result in unacceptable disruption of proximate research and support activities (criterion C2),

3. Was not compatible with adjacent facilities / uses (criterion E1), and

4. Would locate cryogenic facilities within the City of Brook Park (criterion G).

The following is a conditional evaluation of FLS 21 as specifically requested by NASA and directed by the City of Cleveland. This rating is qualified by the City of Cleveland Law Department's opinion regarding the applicability of the Supremacy Clause in preempting local codes and ordinances.

Finally the Study team recommends that consideration be given to relocating the existing Childcare, Recreation and Fitness areas since (although protection will be provided)

the unprotected exclusion zone reaches these areas which cannot be barricaded.

5.2.2.1.12.A Ability To Meet Mission / Facility Requirements:

5.2.2.1.12.A.1 Facility Layout Scheme Meets Research / Storage Capability from the Requirements Documents: Development on the Glenn Research Center as part of this alternative will allow for all identified research requirements to be met.

Consequently, the facility layout scheme has been given a score of two.

5.2.2.1.12.A.2 Facility Layout Scheme Allows for Good Functional Relationships: Selection of these facility layout schemes will result in the construction of new facilities. This allows the opportunity to develop facilities that will best support long term research requirements. However, division of the functions into two areas will result in a minor impact on personnel that will be required to commute between the two areas.

Consequently, this facility layout scheme has been assigned a score one.

5.2.2.1.12.A.3 Facility Layout Scheme Allows for Good Accessibility: Creek Road is located on Cedar Point Road. Access to this location from the main part of the Glenn Research Center is currently hindered by restrictions to Cedar Point Road imposed by NASA security. Once the entire road segment between the West Gate and the former South Gate has been vacated and placed under NASA control this issue will be mitigated.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.2.1.12.A.4 Ability to Meet Long-Term Needs of NASA Research: This project will locate the proposed facilities at GRC-Lewis Field. This location will allow research personnel to commute more easily between their offices and the test areas than if the facilities were located at Plum Brook.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.2.1.12.B Safety Considerations:

5.2.2.1.12.B.1 Minimum Exclusion Zone and Explosive Quantity-Distance Requirements Met: This facility layout scheme provides the minimum required safety distances to other facilities in accordance with NASA guidance, based upon the protected building distances. Unprotected exclusion zones, however reach areas of the facility which cannot be barricaded. Therefore the study team is recommending that consideration be given to relocating the amenity facilities (e.g. Daycare, Fitness Center etc.). Scoring is based on the preceding mitigation. Also consider the proximity of the 35-10 exclusion zone and the possibility that both facilities may be in red light simultaneously. This is highly unlikely and access/egress from Creek road to the west is very good even if both facilities are in red light simultaneously.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.2.1.12.B.2 Facility / Control Room Safe: As currently proposed, a new control room would be constructed on Cedar Point Road well outside the exclusion zone for this facility with good egress capability. This room will provide a safe area for personnel that work in the area during tests.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.2.1.12.B.3 Other Safety Concerns: Construction of SMIRF, Cell 7 and the Proof Pressure Test Cells at Creek Road will place them within the city limits of the City of Brook Park. NASA has made assurances that adequate fire and safety response capabilities will be coordinated. Local zoning ordinances prohibit these uses however, so it is possible that emergency response services will not be available from the local municipality. Alternate arrangements with potentially longer response times may be required.

Consequently, this facility layout scheme has been assigned a conditional score of zero.

5.2.2.1.12.C Impact On NASA Operations:

5.2.2.1.12.C.1 Construction Implementation Not Difficult: The reconstruction of this area can be accomplished while the current facilities are being used.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.2.1.12.C.2 Minimal Disruption of Research / Support Activities: It is anticipated that the use of the Creek Road facilities for research may have minimal to no impacts on other NASA personnel after the mitigation proposed on the safety section.

Consequently, this facility layout scheme has been assigned a conditional score of two.

5.2.2.1.12.D Costs:

5.2.2.1.12.D.1 Initial Construction Cost: Appendix C includes information on the anticipated construction cost for this facility layout scheme. However, since this issue will not be used to determine the preferred location for NASA replacement facilities, it has not been included in this subsection of the analysis.

5.2.2.1.12.D.2 Operation and Maintenance Costs: Development of these facility layout schemes would result in increased operations and maintenance costs. At the present time, the Glenn Research Center does not provide maintenance of Cedar Point Road. Consequently, relocation of this facility would require that access to the area be maintained when testing is being conducted. Additionally, as noted above, development of this facility layout scheme would require new facilities which would add to NASA operations and maintenance burdens.

Consequently, this facility layout scheme has been assigned a score of negative two.

5.2.2.1.12.D.3 Research Costs and Convenience: NASA personnel estimate that conducting research at this facility on Glenn Research Center will cost approximately $1,251,000 per year. This figure represents a cost savings of approximately $200,000 per year when compared to operation of a similar facility at Plum Brook.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.2.1.12.E Compatibility:

5.2.2.1.12.E.1 Facility is Compatible with Adjacent Facilities and Adjacent Land Uses: Development of the Creek Road area for Test Cell A-1, Cell A-2, Proof and a new Control Building will be generally compatible with the surrounding land uses after the mitigation described in the Safety Section.

Consequently, this facility layout scheme has been conditionally assigned a score of one.

5.2.2.1.12.E.2 Visual Character of the Research Center: The construction of these test stands in this very isolated area of the Glenn Research Center will not require any screening for visual compatibility.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.2.1.12.E.3 Electro-Magnetic Interference: The SMRIF (Test Cell A-1), Cell 7 (Test Cell A-2) and the Pressure Proof Test Cell (Test Cell A-3) facility layout scheme at Creek Road is located in an area of low probable EMI impact.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.2.1.12.F Environmental Impacts:

5.2.2.1.12.F.1 Potential Impacts on Species: Development of this facility layout scheme is not anticipated to result in any adverse impacts to threatened and endangered species, or significantly adverse impacts to other species.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.2.1.12.F.2 Potential Impacts to Natural Resources: Development of this facility layout scheme is not anticipated to result in any adverse impacts to other resources.

Consequently, the facility layout scheme has been given a score of two.

5.2.2.1.12.F.3 Potential Impacts from Flooding: The Creek Road existing foot is currently above the adjacent floodway and floodplain. Although fill will be placed, there will no impact to the flood plain or floodway, and there is no appreciable danger of flooding. If the site becomes slightly larger, the bridge to the north can be removed and the upstream and adjacent floodway may be lowered slightly.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.2.1.12.F.4 Potential Impact of Aircraft Noise on Personnel Working at the Facility: Implementation of this alternative is

anticipated to result in average sound levels at the site from aircraft operations of approximately 67 DNL. This noise level should not cause adverse impacts on personnel working the area. Use of hearing protection, if required, would increase the amount of difficulty that personnel will have in build-up for research tests and in collection data.

Consequently, this facility layout scheme has been assigned a score zero.

5.2.2.1.12.F.5 **Potential Impacts of Facility Generated Noise on Other Personnel:** The construction and operation of this facility is not anticipated to result in an increase in the amount of noise that might impact other NASA facilities (after the mitigation in the safety section) or other neighbors.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.2.1.12.G **Brook Park Governmental / Cryogenic Issues.** As noted earlier, this proposed facility layout plan is located within the City of Brook Park. This rating is qualified by the City of Cleveland Law Department's opinion regarding the applicability of the Supremacy Clause with respect to this matter.

Consequently, this facility layout scheme has been assigned a conditional rating of N/A.

5.2.2.1.12.H **Test Cells A at Creek Road Layout Scheme Summary:**

Subsections 5.2.2.1.12.A through 5.2.2.1.12.G contain a discussion of the general issues associated with the development of the Creek Road facility layout scheme for the Test Cells A. The following table contains the evaluation scores that have been assigned to this facility layout scheme.

Criteria Factor Worksheet

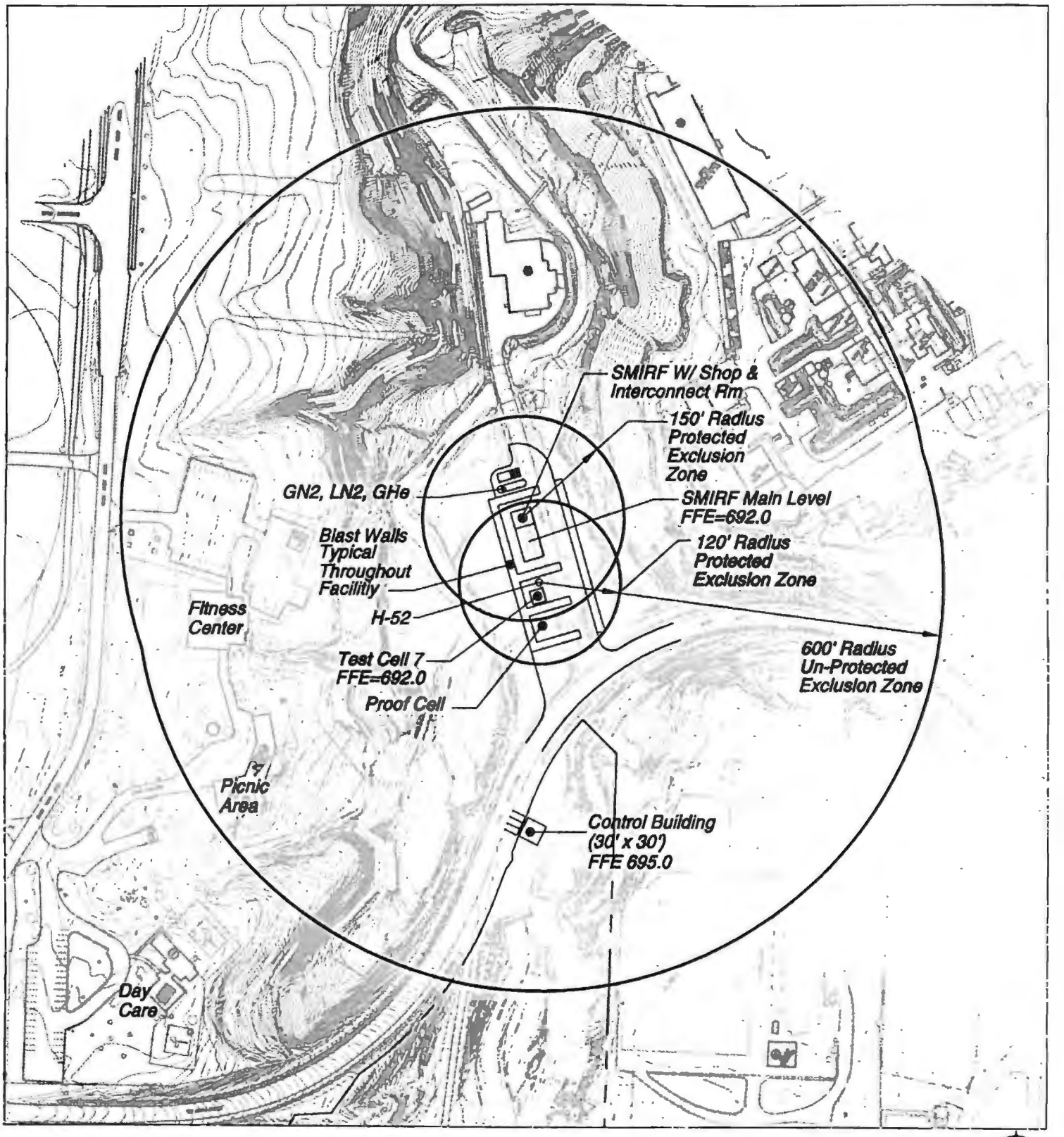
Facility: **SMIRF, Cell 7 and Proof Pressure Test Cell**

Location: Creek Road, Glenn Research Center

Facility Layout Scheme **21**

	Criteria Factor	Score (-2 to 2)	Weight	Total Score
A	**Ability to Meet Mission / Facility Requirements**			**10**
A1	Facility Layout Scheme Meets Research / Storage Capability From the Requirements Document	2	2	4
A2	Facility Layout Scheme Allows for Good Functional Relationships	1	2	2
A3	Facility Layout Scheme Allows for Good Accessibility	1	2	2
A4	Ability to Meet Long-Term Needs of NASA Research	2	1	2
B	**Safety Considerations**			**12**
B1	Minimum Exclusion and Explosive Quantity-Distances Met	2	4	8
B2	Facility / Control Room Safe	1	4	4
B3	Other Safety Criteria (Fire, Police, and Medical Response)	0	4	0
C	**Impact on NASA Operations**			**4**
C1	Construction Implementation Not Difficult	2	1	2
C2	Minimal Disruption of Research / Support Activities	2	1	2
D	**Costs**			**-1**
D1	Initial Construction Costs	0	0	0
D2	Operation and Maintenance costs are relatively low.	-2	1	-2
D3	Research Costs and Convenience	1	1	1
E	**Compatibility**			**10**
E1	Facility Compatible with Adjacent Facilities / Uses	1	2	2
E2	Visual Character of the Research Center	2	2	4
E3	Electro-Magnetic Interference	2	2	4
F	**Environmental Impact**			**12**
F1	Potential Impact to Species	2	1	2
F2	Potential Impacts to Natural Resources	2	2	4
F3	Potential Impact from Flooding	2	2	4
F4	Potential Aircraft Noise Impacts on Personnel Working at Facility	0	2	0
F5	Potential Impact of Facility Noise on Others	1	2	2
G	**Brook Park Issues: Conditionally rated:**	N/A	N/A	N/A
	Facility Layout Scheme Total Score			**47**

1



NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

0 100 200 300

Layout 21
SMIRF, Proof, Cell 7: Creek Rd. Site Area

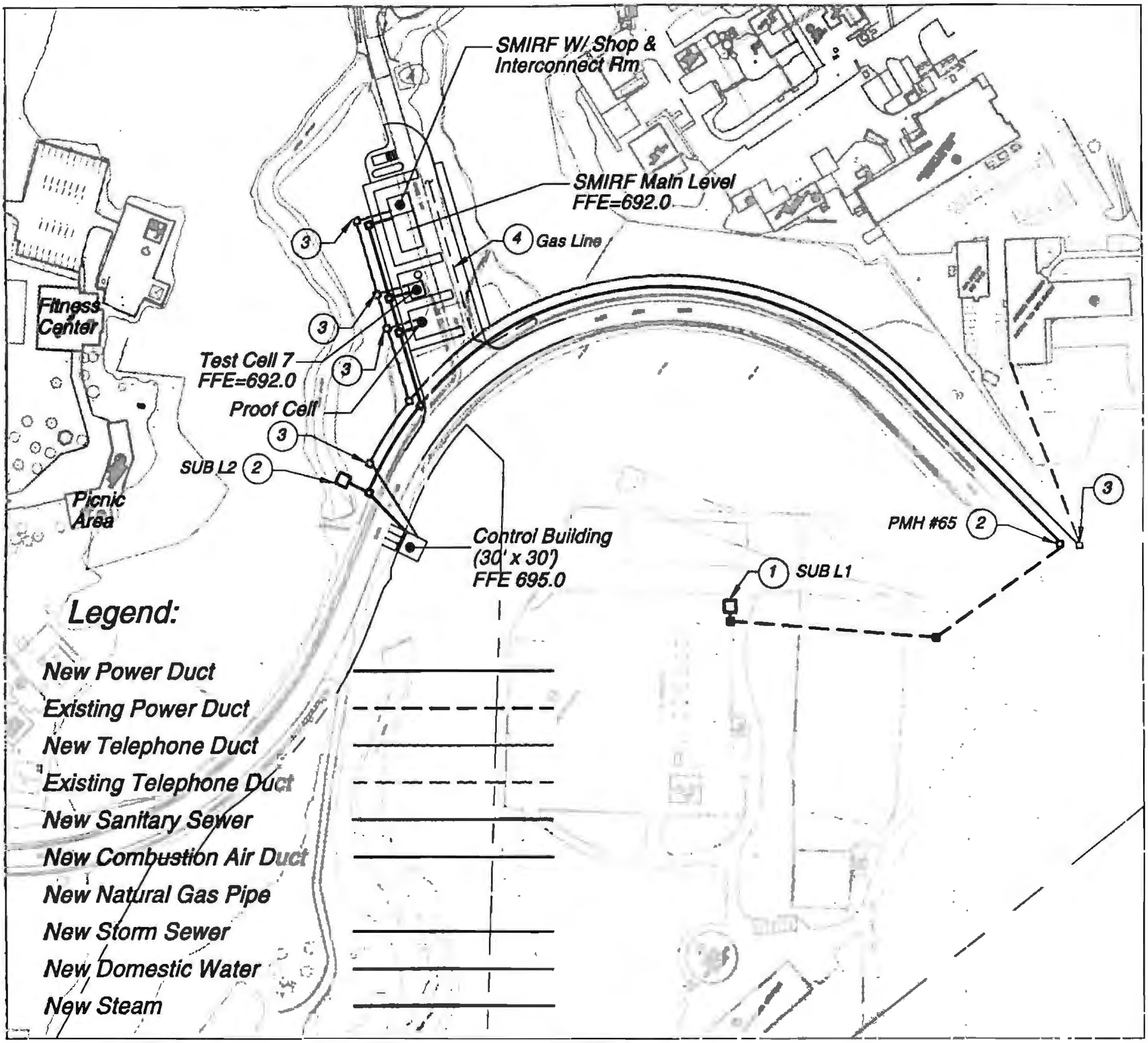
October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Ralph Tyler Companies

Parsons Harland Bartholomew & Associates, Inc.

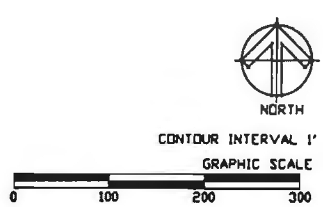


1. Relocate the 34.5kV primary, 2.4kV secondary section of sub "L" to an area adjacent to sub "A". Reconnect sub "L" to the existing 35kV switch in sub "A". This portion of sub "L" shall be referred to as sub "L1".

2. Relocate the 2.4kV to 480V section of sub "L" to Pond Valley. This portion of sub "L" shall be referred to as sub "L2". Route (3) 2.4kV circuits from sub "L1" through existing ducts to manhole PMH # 65. From manhole PMH # 65 install a new duct bank down Cedar Point Road to site A and B and route (1) 2.4kV circuit through the new duct to sub "L2".

3. Route fiber optic communications cable, fire alarm cable, CCTV cable and control cabling from building 35-10 through existing duct to manholes TMH # 40 and INST MH # 3. From manholes TMH # 40 and INST MH # 3 route the cable though the new duct down Cedar Point Road to test cells.

4. Route 4" steel gas line from the existing 4" 50 psig main. The 4" steel line shall be buried.



Layout 21-U
SMIRF, Proof, Cell 7:
Creek Rd. Site Area

October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates — Ralph Tyler Companies — Parsons Harland Bartholomew & Associates, Inc.

5.2.4.2.8 Facility Layout Scheme 74, Outside Gated Storage in the South 40, Glenn Research Center:

This facility layout scheme is a scenario of facility layout scheme 58. When Building 212 is added to the remaining South 40, a portion of the outside gated storage is deemed the first element to be relocated elsewhere. This scenario (FLS 74) leaves Gate 3 in the South 40, and relocates the remainder of the gates. Alternately, Gate 3 could be relocated and the remainder could stay.

5.2.4.2.8.A Ability To Meet Mission / Facility Requirements:

5.2.4.2.8.A.1 Facility Layout Scheme Meets Research / Storage Capability From the Requirements Documents: The site would provide ample space required for the storage areas and for access.

Consequently, the site has been given a score of two.

5.2.4.2.8.A.2 Facility Layout Scheme Allows for Good Functional Relationships: This site would provide a good functional relationship with the surrounding area. (even when Gate 3 is split from the remainder of the gates.)

Consequently, the site has been given a score of one.

5.2.4.2.8.A.3 Facility Layout Scheme Allows for Good Accessibility: Site access in the South 40 area of the Glenn Research Center is good.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.8.A.4 Ability to Meet Long-Term Needs of NASA Research: Location of these storage areas on Glenn Research Center, in an area proximate to many of the research facilities will provide excellent support to research efforts over the long-term.

Consequently, this site would be assigned a score of two.

5.2.4.2.8.B Safety Considerations:

5.2.4.2.8.B.1 Minimum Exclusion Zone and Explosive Quantity-Distance Requirements Met: This site is located within an area in which there is no exclusion zones. Additionally, gated storage will not likely generate any incremental hazards for adjacent operations.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.8.B.2 **Facility / Control Room Safe:** The nearest potential hazards are the RCRA Building 212 and Sub A. Neither of these presents any exposures.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.7.8.3 **Other Safety Concerns:** Construction of these storage facilities in the South 40 area will not result in any additional safety concerns. The City of Cleveland fire and emergency response capabilities will be adequate to support this facility.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.8.C **Impact On NASA Operations:**

5.2.4.2.8.C.1 **Construction Implementation Not Difficult:** The construction of the Outside Storage Areas can be accomplished while the current facilities are being used.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.8.C.2 **Minimal Disruption of Research / Support Activities:** It is anticipated that the Outside Storage Areas and other construction that would be required in the area could be accomplished with little or no impact on proximate NASA or surrounding community activities.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.8.D **Costs:**

5.2.4.2.8.D.1 **Initial Construction Cost:** Appendix C includes information on the anticipated construction cost for this facility layout scheme. However, since this issue will not be used to determine the preferred location for NASA replacement facilities, it has not been included in this subsection of the analysis.

5.2.4.2.8.D.2 **Operation and Maintenance Costs:** The estimated annual operations and maintenance cost required at this site is approximately $8,700 per year. Construction of these facilities in this area is not anticipated to result in any

significant differences in the cost of operations and maintenance when compared to the current facilities.

Consequently, this facility layout scheme has been assigned a neutral score of zero.

5.2.4.2.8.D.3 **Research Costs and Convenience:** Location of these facilities at the Glenn Research Center complex would result in relatively low costs associated with personnel commuting between this research area and other facilities.

Consequently, this facility layout scheme has been assigned a one.

5.2.4.2.8.E **Compatibility:**

5.2.4.2.8.E.1 **Facility Compatible with Adjacent Facilities / Uses:** This facility would be compatible with the surrounding facilities in the area.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.8.E.2 **Visual Character of the Research Center:** This site is located in a low circulation area of the installation and is shielded for the primary circulation.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.8.E.3 **Electro-Magnetic Interference:** These storage facilities should not be affected by EMI.

Consequently, this facility will be assigned a neutral score of zero for this criterion.

5.2.4.2.8.F **Environmental Impacts:**

5.2.4.2.8.F.1 **Potential Impacts on Species:** Development of this site is not anticipated to result in any adverse impacts to threatened and endangered species, or significantly adverse impacts to other species.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.8.F.2 **Potential Impacts to Natural Resources:** This site has the potential of being impacted by historic landfill (Coal Storage Area) or other disposal site contamination. Although

previously completed testing has not detected contamination, additional site investigation should be completed prior to construction at this site.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.8.F.3 **Potential Impacts from Flooding:** The proposed site is not located in the floodplain or within a known floodway. Additionally, there are not signs of localized flooding in the area.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.8.F.4 **Potential Impact of Aircraft Noise on Personnel Working at the Facility:** It is anticipated that the 75 DNL sound levels at this alternative will result in adverse impact on personnel using the areas.

Consequently, this facility layout scheme has been assigned a score of negative two.

5.2.4.2.8.F.5 **Potential Impacts of Facility Generated Noise on Other Personnel:** The construction and operation of this facility is not anticipated to result in any unacceptable noise impacts on proximate uses.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.8.G **Brook Park Governmental / Cryogenic Issues.** As noted earlier, this proposed facility layout plan is located within the City of Cleveland, consequently this criterion does not apply to this location.

5.2.4.2.8.H **Outside Storage Areas at Site 20, Site Summary:** Subsections 5.2.4.2.8.A through 5.2.4.2.8.G contain a discussion of the general issues associated with the construction of Outside Storage Areas in the South 40 area of Glenn Research Center. The following table contains the evaluation scores that have been assigned to this site.

Criteria Factor Worksheet

Facility: **Outside Storage Areas (Gates)**

Location: South 40

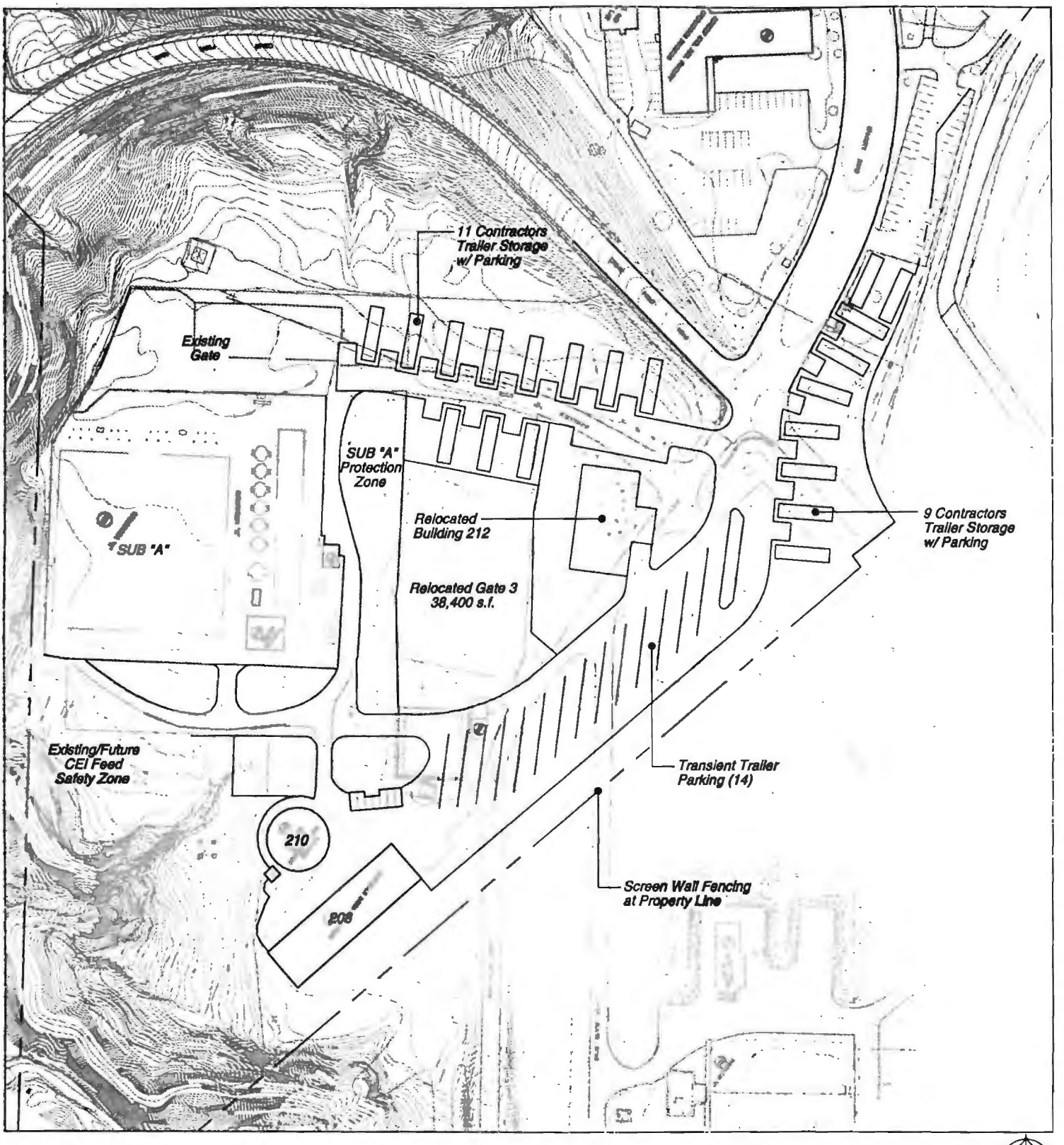
Facility Layout Scheme **74**

	Criteria Factor	Score (-2 to 2)	Weight	Total Score
A	**Ability to Meet Mission / Facility Requirements**			**10**
A1	Facility Layout Scheme Meets Research / Storage Capability From the Requirements Document	2	2	4
A2	Facility Layout Scheme Allows for Good Functional Relationships	1	2	2
A3	Facility Layout Scheme Allows for Good Accessibility	1	2	2
A4	Ability to Meet Long-Term Needs of NASA Research	2	1	2
B	**Safety Considerations**			**24**
B1	Minimum Exclusion and Explosive Quantity-Distances Met	2	4	8
B2	Facility / Control Room Safe	2	4	8
B3	Other Safety Criteria (Fire, Police, and Medical Response)	2	4	8
C	**Impact on NASA Operations**			**4**
C1	Construction Implementation Not Difficult	2	1	2
C2	Minimal Disruption of Research / Support Activities	2	1	2
D	**Costs**			**1**
D1	Initial Construction Costs	0	0	0
D2	Operation and Maintenance costs are relatively low.	0	1	0
D3	Research Costs and Convenience	1	1	1
E	**Compatibility**			**8**
E1	Facility Compatible with Adjacent Facilities / Uses	2	2	4
E2	Visual Character of the Research Center	2	2	4
E3	Electro-Magnetic Interference	0	2	0
F	**Environmental Impact**			**6**
F1	Potential Impact to Species	2	1	2
F2	Potential Impacts to Natural Resources	1	2	2
F3	Potential Impact from Flooding	2	2	4
F4	Potential Aircraft Noise Impacts on Personnel Working at Facility	-2	2	-4
F5	Potential Impact of Facility Noise on Others	1	2	2
G	**Brook Park Issues:**	N/A	N/A	N/A
	Facility Layout Scheme Total Score			**53**

1

2

3



NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

0 75 150 225

Layout 74

Building 212, Contractor Trailer Storage (Full), Outside Storage Area (Partial), Transient Trailer Storage

South 40 Site Area

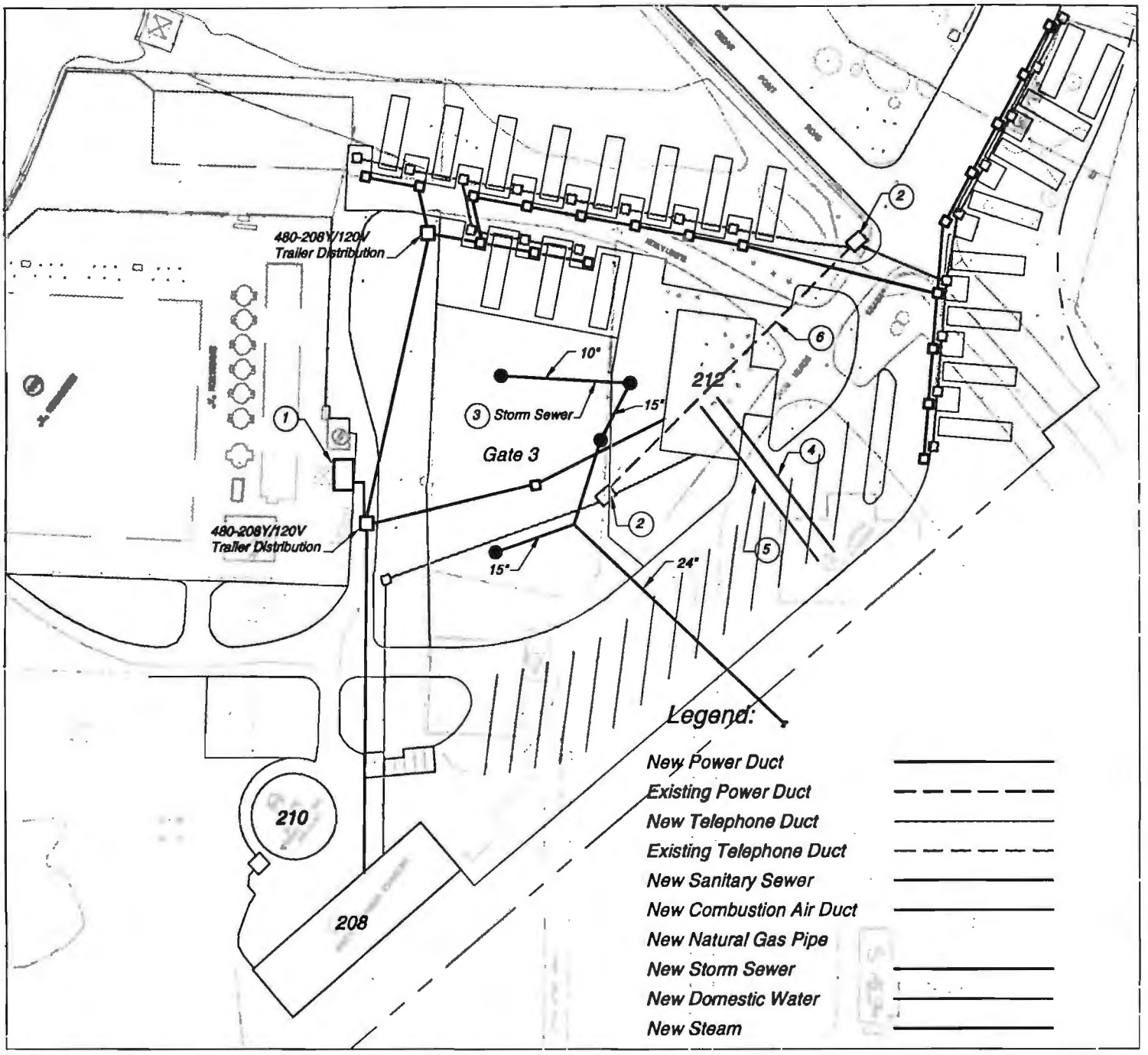
October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Robb Tyler Company

Parsons Harland Bartholomew & Associates, Inc.



1. A new 34.5kv to 480V substation will provide the following services:
   Trailer Storage – 400A, Gated Storage – 100A,
   Building 208 – 200A, General Lighting – 200A (Provide parking lot lighting),
   Building 212 – 200A

2. Telephone and security shall be run to gated storage and to each of the trailer sites. Route telephone cable through existing duct to building 125.

3. Route new storm sewer as shown, with sizes as shown. The new storm sewers shall be buried.

4. Route new 4" sanitary sewer. The new sewer shall be buried.

5. Route new 2" domestic water line. The new water line shall be buried.

6. Reroute main telephone duct bank 6–4" & 2–5" fiber around building 212 foundation. Also reroute 8–4" fiber instrumental ducts.

NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

0 60 120 180

Layout 74-U

Building 212, Contractor Trailer Storage (Full), Outside Storage Area (Partial), Transient Trailer Storage

South 40 Site Area

October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Robb Tyler Companies

Parsons Harland Bartholomew & Associates, Inc.

5.2.4.2.9 Facility Layout Scheme 76 Outside Gated Storage on Creek Road, Glenn Research Center:

This facility layout scheme should be worked with FLS 73 and 74 with Building 212 and a portion of the gated outdoor storage in the S 40. This scenario (FLS 76) leaves Gate 3 in the South 40, and relocates the remainder of the gates to Creek Rd. Alternately, Gate 3 could be relocated and the remainder could stay.

Previous versions of this FLS were failed because the Project Requirements Documents do not allow this use in the West Area. This FLS is conditionally rated as specifically requested by NASA and the City of Cleveland, in anticipation that the PRDs will be modified to accommodate this arrangement.

5.2.4.2.9.A Ability To Meet Mission / Facility Requirements:

5.2.4.2.9.A.1 Facility Layout Scheme Meets Research / Storage Capability From the Requirements Documents: Although the Project Requirement documents do not permit gated storage in the West Area, the site would provide ample space required for the storage areas and for access.

Consequently, the site has been given a score of one.

5.2.4.2.9.A.2 Facility Layout Scheme Allows for Good Functional Relationships: This site would provide a good functional relationship with the surrounding area, but allows little room for expansion.

Consequently, the site has been given a score of one.

5.2.4.2.9.A.3 Facility Layout Scheme Allows for Good Accessibility: Site access to Creek Road is hindered by security issues, until Cedar Pont Road is fully vacated. Semi-trailer and other equipment should have no constraints.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.9.A.4 Ability to Meet Long-term Needs of NASA Research: Location of these storage areas on Glenn Research Center, in an area proximate to many of the research facilities will provide excellent support to research efforts.

Consequently, this site would be assigned a score of two.

5.2.4.2.9.B Safety Considerations:

5.2.4.2.9.B.1 Minimum Exclusion Zone and Explosive Quantity-Distance Requirements Met: This site is located within an area in which there is no exclusion zones. Additionally, gated storage will not likely generate any incremental hazards.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.9.B.2 Facility / Control Room Safe: There are no proximate hazards to Creek Road. Protected zones from 35-10 do not impact the site, however Cedar Point Rd. may be closed during red light.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.9.B.3 Other Safety Concerns: Construction of these storage facilities in the South 40 area will not result in any additional safety concerns. The City of Brook Park fire and emergency response capabilities will be adequate to support these facilities.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.9.C Impact On NASA Operations:

5.2.4.2.9.C.1 Construction Implementation Not Difficult: The construction of the Outside Storage Areas can be accomplished while the current facilities are being used.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.9.C.2 Minimal Disruption of Research / Support Activities: It is anticipated that the Outside Storage Areas and other construction that would be required in the area could be accomplished with little or no impact on proximate NASA or surrounding community activities.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.9.D Costs:

5.2.4.2.9.D.1 Initial Construction Cost: Appendix C includes information on the anticipated construction cost for this facility layout scheme. However, since this issue will not be used to determine the preferred location for NASA replacement facilities, it has not been included in this subsection of the analysis.

5.2.4.2.9.D.2 Operation and Maintenance Costs: T: Development of these facility layout schemes would result in increased operations and maintenance costs. At the present time, the Glenn Research Center does not provide maintenance of Cedar Point Road. Consequently, relocation of this facility would require that access to the area be maintained when testing is being conducted. Additionally, as noted above, development of this facility layout scheme would require new facilities which would add to NASA operations and maintenance burdens.

Consequently, this facility layout scheme has been assigned a score of negative two.

5.2.4.2.9.D.3 Research Costs and Convenience: Location of these facilities at the Glenn Research Center complex would result in relatively low costs associated with personnel commuting between this research area and other facilities.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.9.E Compatibility:

5.2.4.2.9.E.1 Facility Compatible with Adjacent Facilities / Uses: This facility would be constructed in a remote area with no current use and little capability for development.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.9.E.2 Visual Character of the Research Center: This site is located in a low circulation area of the installation and is shielded from the primary circulation.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.9.E.3 Electro-Magnetic Interference: These storage facilities should not be affected by EMI.

Consequently, this facility will be assigned a neutral score of zero.

5.2.4.2.9.F Environmental Impacts:

5.2.4.2.9.F.1 Potential Impacts on Species: Development of this site is not anticipated to result in any adverse impacts to threatened and endangered species, or significantly adverse impacts to other species.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.9.F.2 Potential Impacts to Natural Resources: Preliminary screening of this site does not show evidence of wetlands or species impacts.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.9.F.3 Potential Impacts from Flooding: The proposed facility can be located outside of the identified floodplain and floodway.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.9.F.4 Potential Impact of Aircraft Noise on Personnel Working at the Facility: It is anticipated that the 67 DNL sound levels at this alternative will not result in adverse impact on personnel using the areas.

Consequently, this facility layout scheme has been assigned a score of zero.

5.2.4.2.9.F.5 Potential Impacts of Facility Generated Noise on Other Personnel: The construction and operation of this facility is not anticipated to result in any unacceptable noise impacts on proximate uses.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.9.G Brook Park Governmental / Cryogenic Issues. As noted earlier, this proposed facility layout plan is located within the City Limits of Brook Park, however this use does not appear to conflict.

Consequently this criterion is rated as not applicable N/A.

5.2.4.2.9.H Outside Storage Areas at Creek Road, Site Summary: Subsections 5.2.4.2.9.A through 5.2.4.2.9.G contain a discussion of the general issues associated with the construction of Outside Storage Areas at the Creek Road area of Glenn Research Center. The following table contains the evaluation scores that have been assigned to this site.

Criteria Factor Worksheet

Facility: **Outside Storage Areas (Gates)**

Location: Creek Road (Partial)

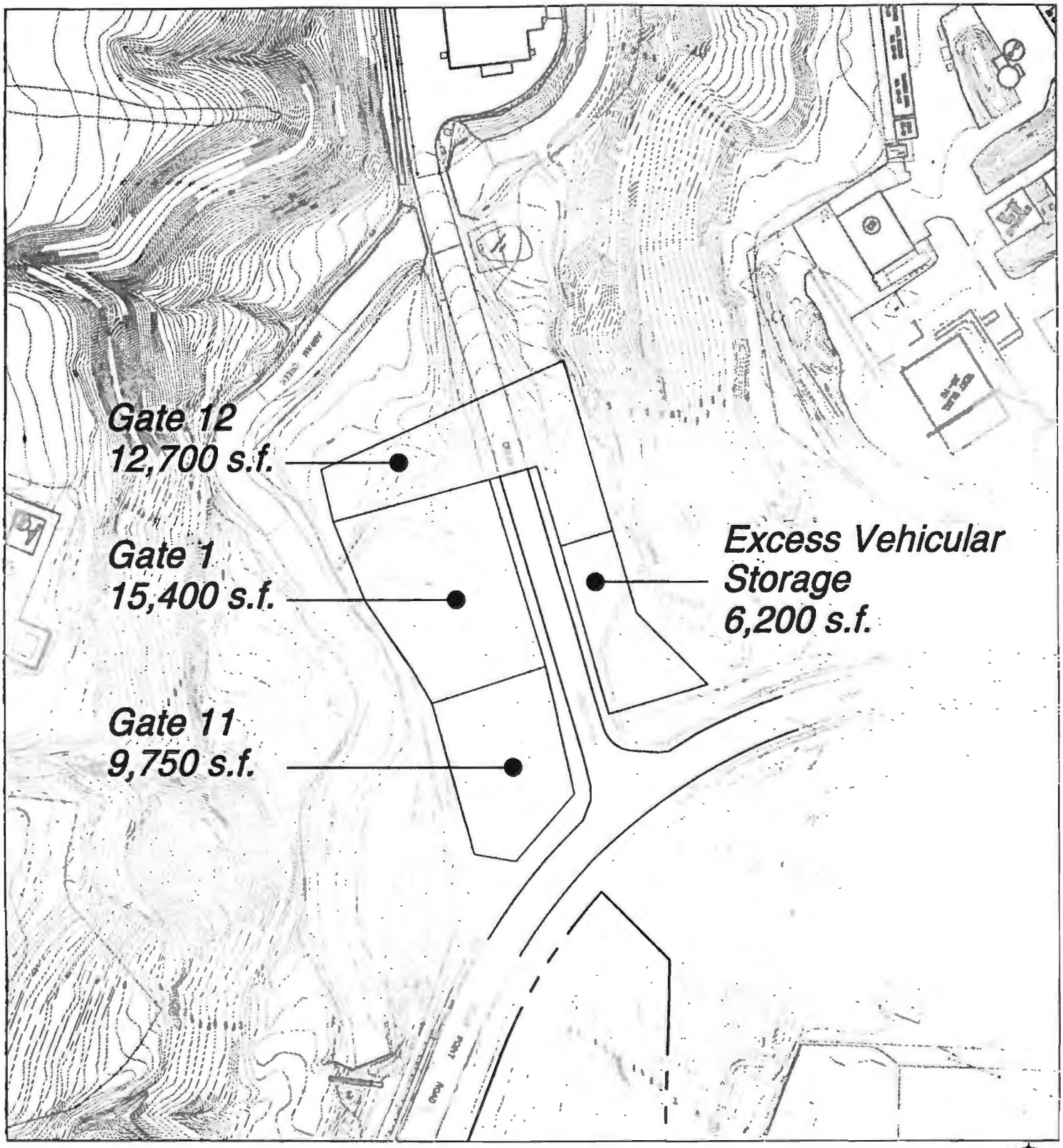
Facility Layout Scheme **76**

	Criteria Factor	Score (-2 to 2)	Weight	Total Score
A	**Ability to Meet Mission / Facility Requirements**			**8**
A1	Facility Layout Scheme Meets Research / Storage Capability From the Requirements Document **Conditionally rated:**	1	2	2
A2	Facility Layout Scheme Allows for Good Functional Relationships	1	2	2
A3	Facility Layout Scheme Allows for Good Accessibility	1	2	2
A4	Ability to Meet Long-Term Needs of NASA Research	2	1	2
B	**Safety Considerations**			**20**
B1	Minimum Exclusion and Explosive Quantity-Distances Met	2	4	8
B2	Facility / Control Room Safe	1	4	4
B3	Other Safety Criteria (Fire, Police, and Medical Response)	2	4	8
C	**Impact on NASA Operations**			**4**
C1	Construction Implementation Not Difficult	2	1	2
C2	Minimal Disruption of Research / Support Activities	2	1	2
D	**Costs**			**-1**
D1	Initial Construction Costs	0	0	0
D2	Operation and Maintenance costs are relatively low.	-2	1	-2
D3	Research Costs and Convenience	1	1	1
E	**Compatibility**			**8**
E1	Facility Compatible with Adjacent Facilities / Uses	2	2	4
E2	Visual Character of the Research Center	2	2	4
E3	Electro-Magnetic Interference	0	2	0
F	**Environmental Impact**			**10**
F1	Potential Impact to Species	2	1	2
F2	Potential Impacts to Natural Resources	1	2	2
F3	Potential Impact from Flooding	2	2	4
F4	Potential Aircraft Noise Impacts on Personnel Working at Facility	0	2	0
F5	Potential Impact of Facility Noise on Others	1	2	2
G	**Brook Park Issues:**	N/A	N/A	N/A
	Facility Layout Scheme Total Score			**49**

1

2

3

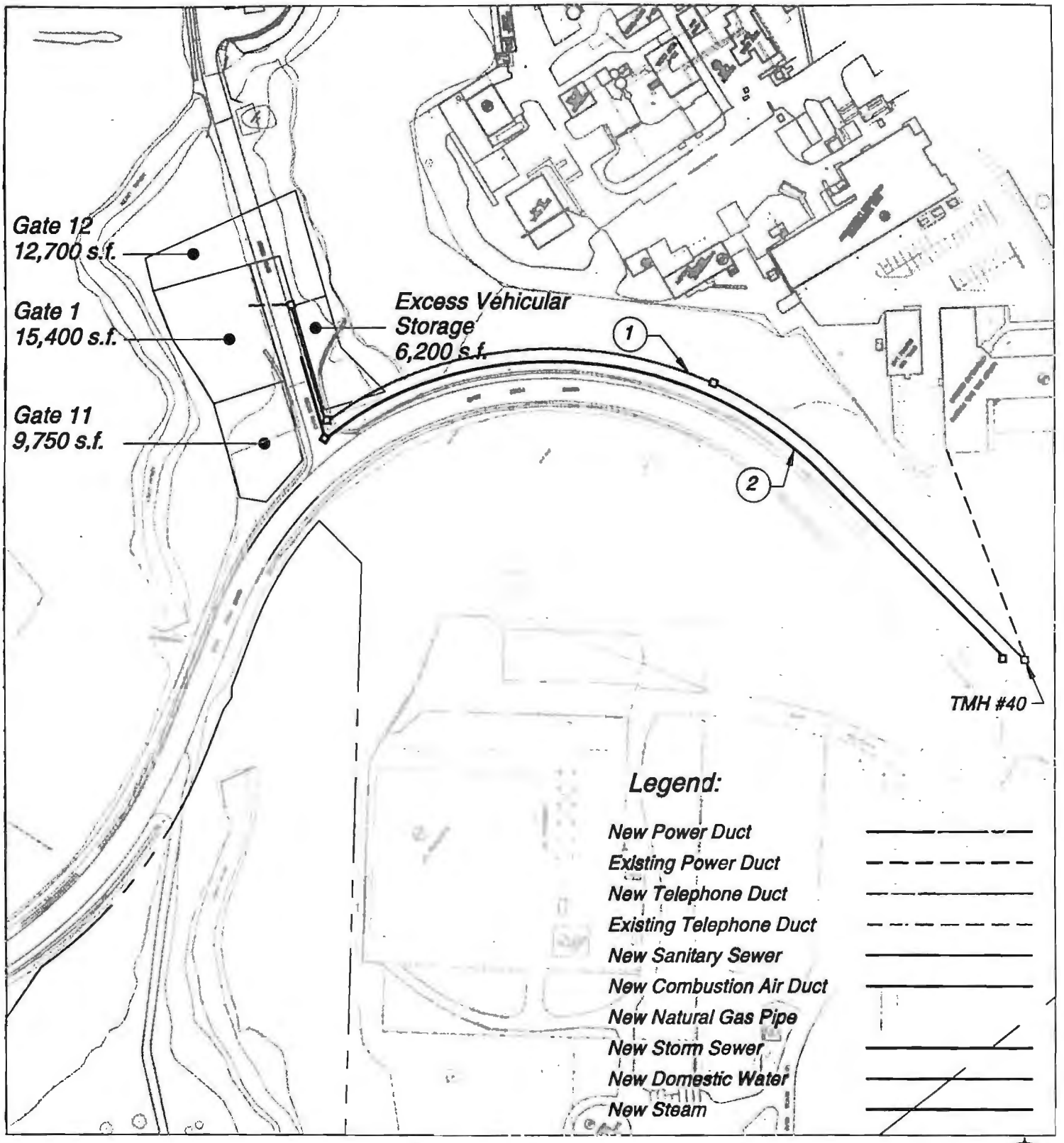


Layout 76
Gated Storage:
Creek Rd. Site Area
October, 1999

NASA GLENN RESEARCH CENTER
CLEVELAND, OHIO 44135

KS Associates

Parsons Harland Bartholomew & Associates, Inc.



1. Provide communications duct from manhole TMH#40 down to Cedar Point Road to gated storage for CCTV.

2. Route new 100A 460V power for lighting from new SUB L-1 to gated storage.

NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

0 80 160 240

Layout 76-U
Gated Storage:
Creek Rd. Site Area

October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Ralph Wilcox Companies

Parsons Harland Bartholomew & Associates, Inc.

5.2.4.2.10 Facility Layout Scheme 77, Outside Gated Storage at the Pond Valley Site, Glenn Research Center:

This facility layout scheme should be worked with FLS 73 and 74 with Building 212 and a portion of the gated outdoor storage in the S 40. This scenario (FLS 77) leaves Gate 3 in the South 40, and relocates the remainder of the gates to Pond Valley. Alternately, Gate 3 could be relocated and the remainder could stay.

Development of the Pond Valley facility layout scheme will require the lease of this property from the City of Cleveland to NASA. Additionally, as part of the construction effort for the new airport runway, the City of Cleveland will be required to perform an extensive amount of site development including placement of Abrams Creek culvert fill, in the area.

Originally, this FLS would have been failed because the Project Requirements Documents do not allow this use in the West Area. This FLS is conditionally rated as specifically requested by NASA and the City of Cleveland in anticipation that the PRDs will be updated to accommodate this arrangement.

5.2.4.2.10.A Ability To Meet Mission / Facility Requirements:

5.2.4.2.10.A.1 Facility Layout Scheme Meets Research / Storage Capability From the Requirements Documents: Although the Project Requirement documents do not permit gated storage in the West Area, the site would provide ample space required for the storage areas and for access.

Consequently, the site has been given a score of one.

5.2.4.2.10.A.2 Facility Layout Scheme Allows for Good Functional Relationships: This site would provide a fair functional relationship with the surrounding area. (Even when Gate 3 is split from the remainder of the gates.) Access is not as good as in the main campus or South 40 Areas.

Consequently, the site has been given a score of zero.

5.2.4.2.10.A.3 Facility Layout Scheme Allows for Good Accessibility: Site access to the Pond Valley site for semi's and equipment may be slightly restricted especially in the winter if the road is not maintained as well as the main roads. Access via

Cedar Point Road will be hindered by security issues until it is fully vacated.

Consequently, this facility layout scheme has been assigned a score of zero.

5.2.4.2.10.A.4 Ability to Meet Long-term Needs of NASA Research: Location of these storage areas on Glenn Research Center, is an area relatively proximate to many of the research facilities will provide good support to research efforts. There is limited room for future expansion, however.

Consequently, this site would be assigned a score of one.

5.2.4.2.8.B Safety Considerations:

5.2.4.2.10.B.1 Minimum Exclusion Zone and Explosive Quantity-Distance Requirements Met: This site is located within an area in which there are no exclusion zones. Additionally, gated storage will not likely generate any incremental hazards for adjacent operations.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.10.B.2 Facility / Control Room Safe: There are no proximate hazards that present any exposures.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.10.B.3 Other Safety Concerns: Construction of these storage facilities in Pond Valley will not result in any additional safety concerns. The City of Cleveland fire and emergency response capabilities will be adequate to support this facility.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.10.C Impact On NASA Operations:

5.2.4.2.10.C.1 Construction Implementation Not Difficult: The construction of the Outside Storage Areas can be accomplished while the current facilities are being used.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.10.C.2 Minimal Disruption of Research / Support Activities: It is anticipated that the Outside Storage Areas and other construction that would be required in the area could be accomplished with little or no impact on proximate NASA or surrounding community activities.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.10.D Costs:

5.2.4.2.10.D.1 Initial Construction Cost: Appendix C includes information on the anticipated construction cost for this facility layout scheme. However, since this issue will not be used to determine the preferred location for NASA replacement facilities, it has not been included in this subsection of the analysis.

5.2.4.2.10.D.2 Operation and Maintenance Costs: Development of these facility layout schemes would result in increased operations and maintenance costs. At the present time, the Glenn Research Center does not provide maintenance of Cedar Point Road. Consequently, relocation of this facility would require that access to the area be maintained when testing is being conducted. Additionally, as noted above, development of this facility layout scheme would require new facilities which would add to NASA operations and maintenance burdens.

Consequently, this facility layout scheme has been assigned a score of negative two.

5.2.4.2.10.D.3 Research Costs and Convenience: Location of these facilities at the Glenn Research Center complex would result in relatively low costs associated with personnel commuting between this research area and other facilities.

Consequently, this facility layout scheme has been assigned a one.

5.2.4.2.10.E Compatibility:

5.2.4.2.10.E.1 Facility Compatible with Adjacent Facilities / Uses: This facility would be generally compatible with the surrounding facilities in the area. The area is relatively remote from the main campus, and is screened from an adjacent a medium size office building.

Consequently, this facility layout scheme has been assigned

a score of two.

5.2.4.2.10.E.2 Visual Character of the Research Center: This site is located in a low circulation area of the installation and is shielded for the primary circulation. No visual screening will be required.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.2.10.E.3 Electro-Magnetic Interference: These storage facilities should not be affected by EMI.

Consequently, this facility will be assigned a neutral score of zero for this criterion.

5.2.4.2.10.F Environmental Impacts:

5.2.4.2.10.F.1 Potential Impacts on Species: Development by the City of Cleveland Airport will result in significant modifications to the southern end of the Pond Valley area, prior to the planned development by NASA.

Consequently, this facility layout scheme has been conditionally assigned a score of two.

5.2.4.2.10.F.2 Potential Impacts to Natural Resources: This site will impact the flood plain and has the potential of impacting open water and wetlands. The EIS appears to require the Finding of No Practical Alternative, FONPA, as justification for taking these resources. If this FLS is selected, this will need to be justified, and the loses will be mitigated.

Consequently, this facility layout scheme has been conditionally assigned a score of negative two.

5.2.4.2.10.F.3 Potential Impacts from Flooding: The proposed site requires the placement of fill and the elimination of portions of the floodplain (but not floodway). This requires a USA COE Section 404 approval and justification of the purpose and need requirements in the EIS. If this purpose and need can be justified, there will be no potential impact from flooding.

Consequently, this facility layout scheme has been assigned a score of zero.

5.2.4.2.10.F.4 Potential Impact of Aircraft Noise on Personnel Working at the Facility: Implementation of this alternative is

anticipated to result in average sound levels at the site of 70 DNL.

Consequently, this facility layout scheme has been assigned a score of negative 1.

5.2.4.2.10.F.5 Potential Impacts of Facility Generated Noise on Other Personnel: The construction and operation of this facility is not anticipated to result in any unacceptable noise impacts on proximate uses.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.2.10.G Brook Park Governmental / Cryogenic Issues. As noted earlier, this proposed facility layout plan is located within the City of Cleveland, consequently this criterion does not apply to this location.

5.2.4.2.10.H Outside Storage Areas at Site 20, Site Summary: Subsections 5.2.4.2.10.A through 5.2.4.2.10.G contain a discussion of the general issues associated with the construction of Outside Storage Areas in the Pond Valley area adjacent to Glenn Research Center. The following table contains the evaluation scores that have been assigned to this site.

Criteria Factor Worksheet

Facility: **Outside Storage Areas (Gates)**

Location: Pond Valley

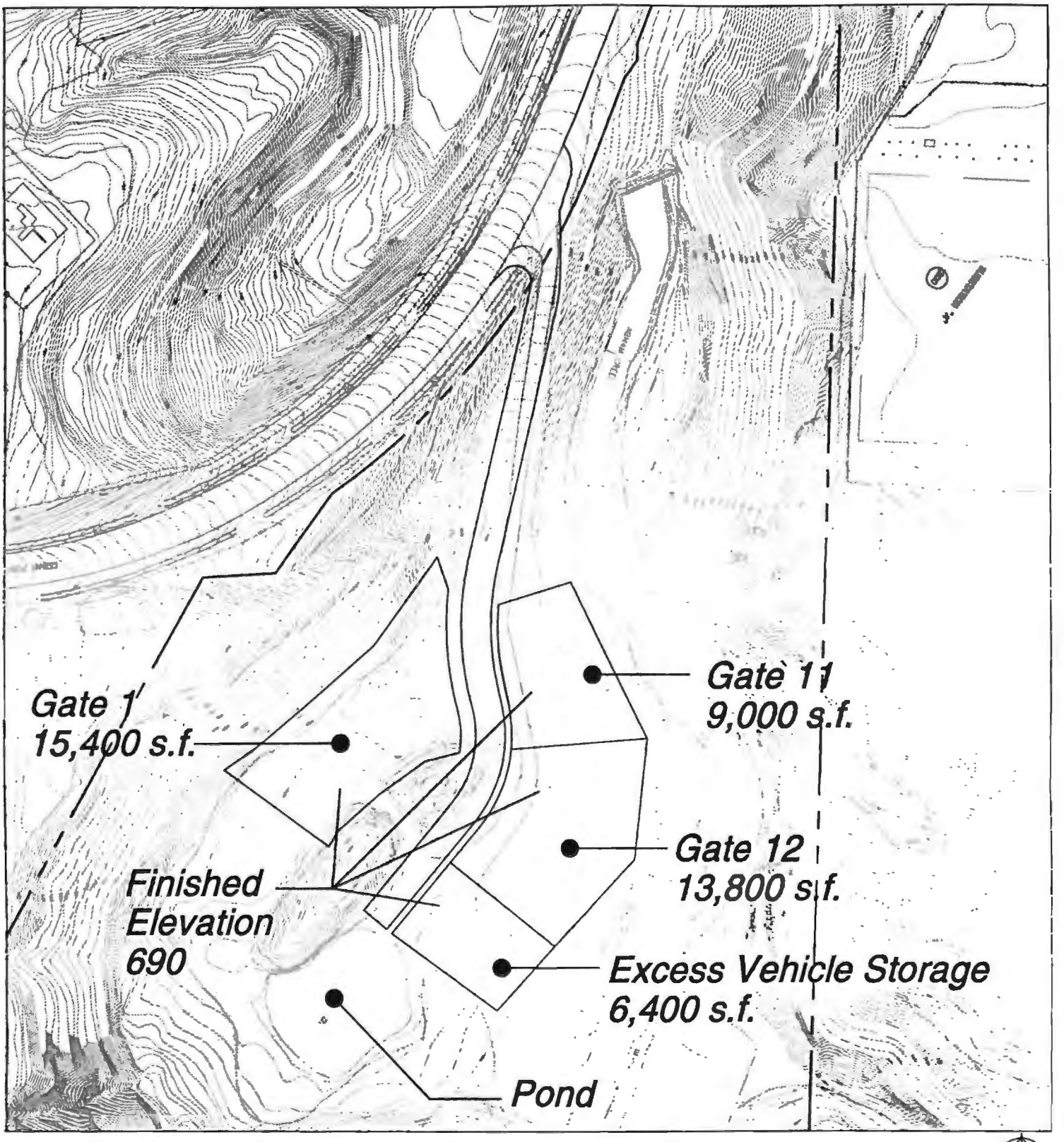
Facility Layout Scheme **77**

	Criteria Factor	Score (-2 to 2)	Weight	Total Score
A	**Ability to Meet Mission / Facility Requirements**			**3**
A1	Facility Layout Scheme Meets Research / Storage Capability From the Requirements Document **Conditionally rated:**	1	2	2
A2	Facility Layout Scheme Allows for Good Functional Relationships	0	2	0
A3	Facility Layout Scheme Allows for Good Accessibility	0	2	0
A4	Ability to Meet Long-Term Needs of NASA Research	1	1	1
B	**Safety Considerations**			**24**
B1	Minimum Exclusion and Explosive Quantity-Distances Met	2	4	8
B2	Facility / Control Room Safe	2	4	8
B3	Other Safety Criteria (Fire, Police, and Medical Response)	2	4	8
C	**Impact on NASA Operations**			**4**
C1	Construction Implementation Not Difficult	2	1	2
C2	Minimal Disruption of Research / Support Activities	2	1	2
D	**Costs**			**-1**
D1	Initial Construction Costs	0	0	0
D2	Operation and Maintenance costs are relatively low.	-2	1	-2
D3	Research Costs and Convenience	1	1	1
E	**Compatibility**			**8**
E1	Facility Compatible with Adjacent Facilities / Uses	2	2	4
E2	Visual Character of the Research Center	2	2	4
E3	Electro-Magnetic Interference	0	2	0
F	**Environmental Impact**			**-2**
F1	Potential Impact to Species	2	1	2
F2	Potential Impacts to Natural Resources	-2	2	-4
F3	Potential Impact from Flooding	0	2	0
F4	Potential Aircraft Noise Impacts on Personnel Working at Facility	-1	2	-2
F5	Potential Impact of Facility Noise on Others	1	2	2
G	**Brook Park Issues:**	N/A	N/A	N/A
	Facility Layout Scheme Total Score			**36**

1

2

3



NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

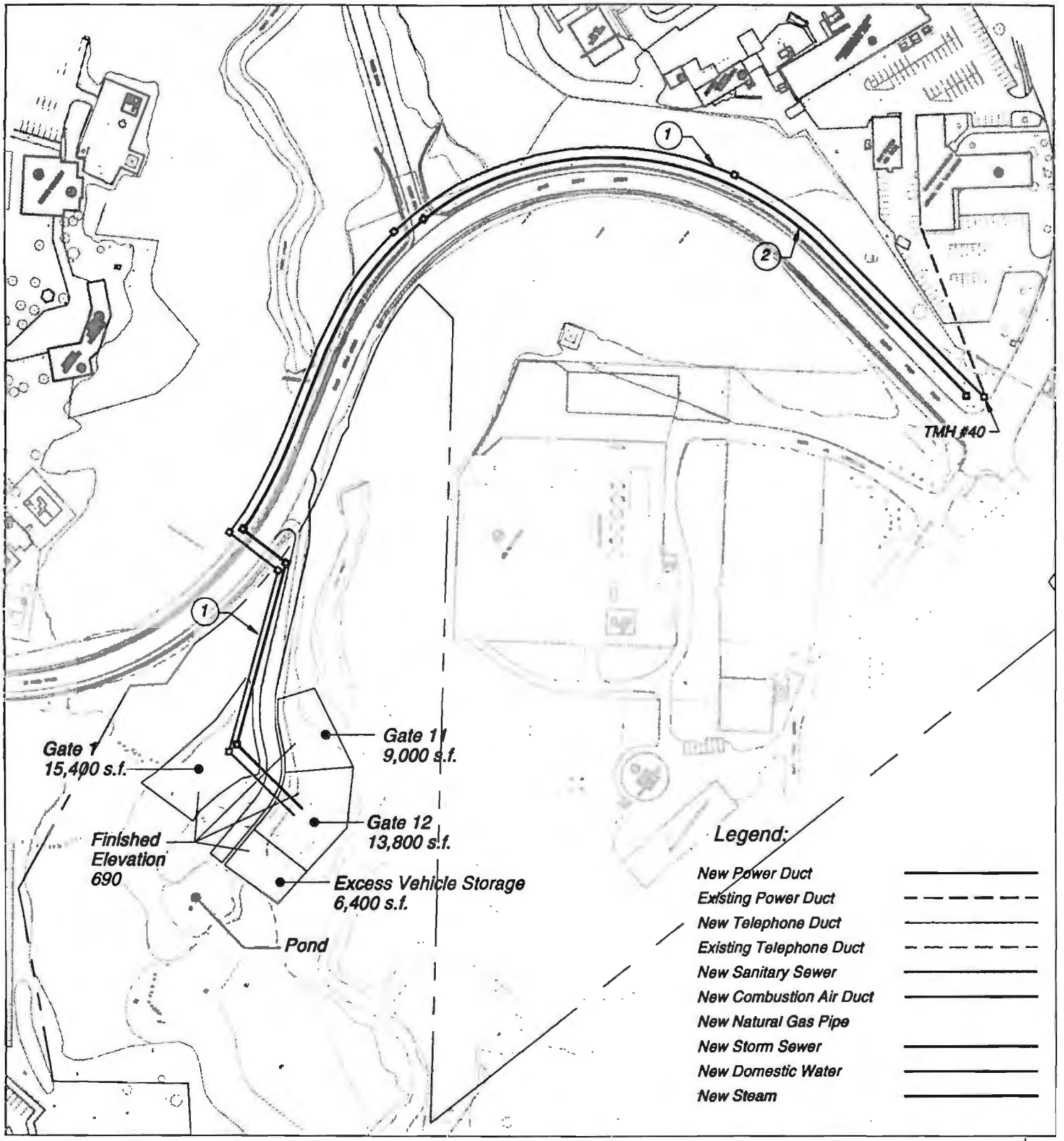
0 50 100 150

Layout 77
Gated Storage:
Pond Valley Site Area
October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Parsons Harland Bartholomew & Associates, Inc.



1. Provide communications duct from manhole TMH#40 down to Cedar Point Road to gated storage for CCTV.

2. Route new 100A 460V power for lighting from new SUB L-1 to gated storage.

NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

0 100 200 300

Layout 77-U
Gated Storage:
Pond Valley Site Area

October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Robb Tyler Companies

Parsons Harland Bartholomew & Associates, Inc.

5.2.4.3.6 Facility Layout Scheme 75, Contractor Trailer Storage at Guerin Rd, Glenn Research Center:

This FLS is located in the West Area of GRC-Lewis Field. (It also shows an alternate LH2 transfer station alignment and an additional alternate outdoor storage area.)

This scenario should be worked with FLS 73 where Building 212 and the LH2 transfer station are both in the South 40. In that scenario, as many as 15 contractor storage trailers can fit in the South 40. If the northern trailers are not acceptable or if the LH2 transfer station requires a larger exclusion zone (Ex. 75'), then additional contractor trailers could move to Guerin Road. This FLS shows as many as eight with additional future outdoor storage expansion.

Previous versions of this FLS were failed because the Project Requirements Documents do not allow this use in the West Area. This FLS is conditionally rated as specifically requested by NASA and the City of Cleveland in anticipation that the PRDs will be modified to accommodate this arrangement.

5.2.4.3.6.A Ability To Meet Mission / Facility Requirements:

5.2.4.3.6.A.1 Facility Layout Scheme Meets Research / Storage Capability from the Requirements Documents: The site would provide space required for up to the full 20 Contractor's trailers and an associated parking and service drives.

Consequently, the site has been given a score of two.

5.2.4.3.6.A.2 Facility Layout Scheme Allows for Good Functional Relationships: This site would provide fairly functional relationships. This West Area site layout is not as proximate to main campus users as the South 40 layout. There is adequate room for future expansion.

Consequently, the site has been given a score of zero.

5.2.4.3.6.A.3 Facility Layout Scheme Allows for Good Accessibility: This site layout provides good access for vehicles and equipment to all of the storage areas.

Consequently, this facility layout scheme has been assigned

a score of two.

5.2.4.3.6.A.4 **Ability to Meet Long-Term Needs of NASA Research:** No research will be performed at this facility.

Consequently, this facility layout scheme has been assigned a neutral score of zero.

5.2.4.3.6.B **Safety Considerations:**

5.2.4.3.6.B.1 **Minimum Exclusion Zone and Explosive Quantity-Distance Requirements Met:** The site is not located in an area that is constrained by exclusion zones created by other facilities.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.3.6.B.2 **Facility / Control Room Safe:** This criterion is not applicable to this specific project.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.3.6.B.3 **Other Safety Concerns:** The proposed contractors trailer storage will be located with the City of Brook Park, and the response personnel will have the requisite skills necessary to respond to these facilities.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.3.6.C **Impact On NASA Operations:**

5.2.4.3.6.C.1 **Construction Implementation Not Difficult:** The construction of the Contractor Trailer Storage can be accomplished while the current facilities are being used.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.3.6.C.2 **Minimal Disruption of Research / Support Activities:** No existing facilities are envisioned to be affected by construction of these new facilities on Guerin Road.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.3.6.D Costs:

5.2.4.3.6.D.1 Initial Construction Cost: Appendix C includes information on the anticipated construction cost for this facility layout scheme. However, since this issue will not be used to determine the preferred location for NASA replacement facilities, it has not been included in this subsection of the analysis.

5.2.4.3.6.D.2 Operation and Maintenance Costs: Construction of these facilities in this area is not anticipated to result in any significant differences in the cost of operations and maintenance when compared to the current facilities.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.3.6.D.3 Research Costs and Convenience: Implementation of this alternative will result in the trailers being located on two different sides of the facility, so some loss of synergy is expected. Since there are different uses and customers for these trailers, that loss should not be significant. Some customers may even prefer the West Area location.

Consequently, this facility layout scheme has been assigned a score of negative one.

5.2.4.3.6.E Compatibility:

5.2.4.3.6.E.1 Facility is Compatible with Adjacent Facilities and Adjacent Land Uses: This facility would be fairly compatible with other facilities in the area. The surrounding uses vary from the existing LH2 storage area (to the south) to the Guerin Rd House (on the north).

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.3.6.E.2 Visual Character of the Research Center: This site is located in a low circulation area of the installation at the northern end of the Guerin Road. This northern site should not require screening to mitigate negative visual impacts

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.3.6.E.3 Electro-Magnetic Interference: The contractor trailers storage area is not generally subject to EMI interference.

Consequently, this facility will be assigned a score of positive two for this criterion.

5.2.4.3.6.F Environmental Impacts:

5.2.4.3.6.F.1 Potential Impacts on Species: Development of this site is not anticipated to result in any adverse impacts to threatened and endangered species, or significantly adverse impacts to other species.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.3.6.F.2 Potential Impacts to Natural Resources: This site should not impact any water, soil, air, or Natural Resources. The adjacent Park should not be affected.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.3.6.F.3 Potential Impacts from Flooding: The proposed site is not located in the floodplain or within a known floodway. Additionally, there are not signs of localized flooding in the area.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.4.3.6.F.4 Potential Impact of Aircraft Noise on Personnel Working at the Facility: This noise level at this site will be relatively low. Storage activities should not be adversely impacted.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.4.3.6.F.5 Potential Impacts of Facility Generated Noise on Other Personnel: The construction and operation of this facility is not anticipated to result in any unacceptable noise impacts on proximate uses.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.2.5.6.G Brook Park Governmental / Cryogenic Issues. As noted earlier, this proposed facility layout plan is located within the City of Brook Park. This appears to be permitted, and adequate fire and safety services should be available.

Consequently this criterion is not applicable.

5.2.4.3.6.H Contractor's Trailer Storage at Guerin Road Summary: Subsections 5.2.4.3.6.A through 5.2.4.3.6.G contain a discussion of the general issues associated with the construction of the Contractor's Trailer Storage at Guerin Road. The following table contains the evaluation scores that have been assigned to this site.

Criteria Factor Worksheet

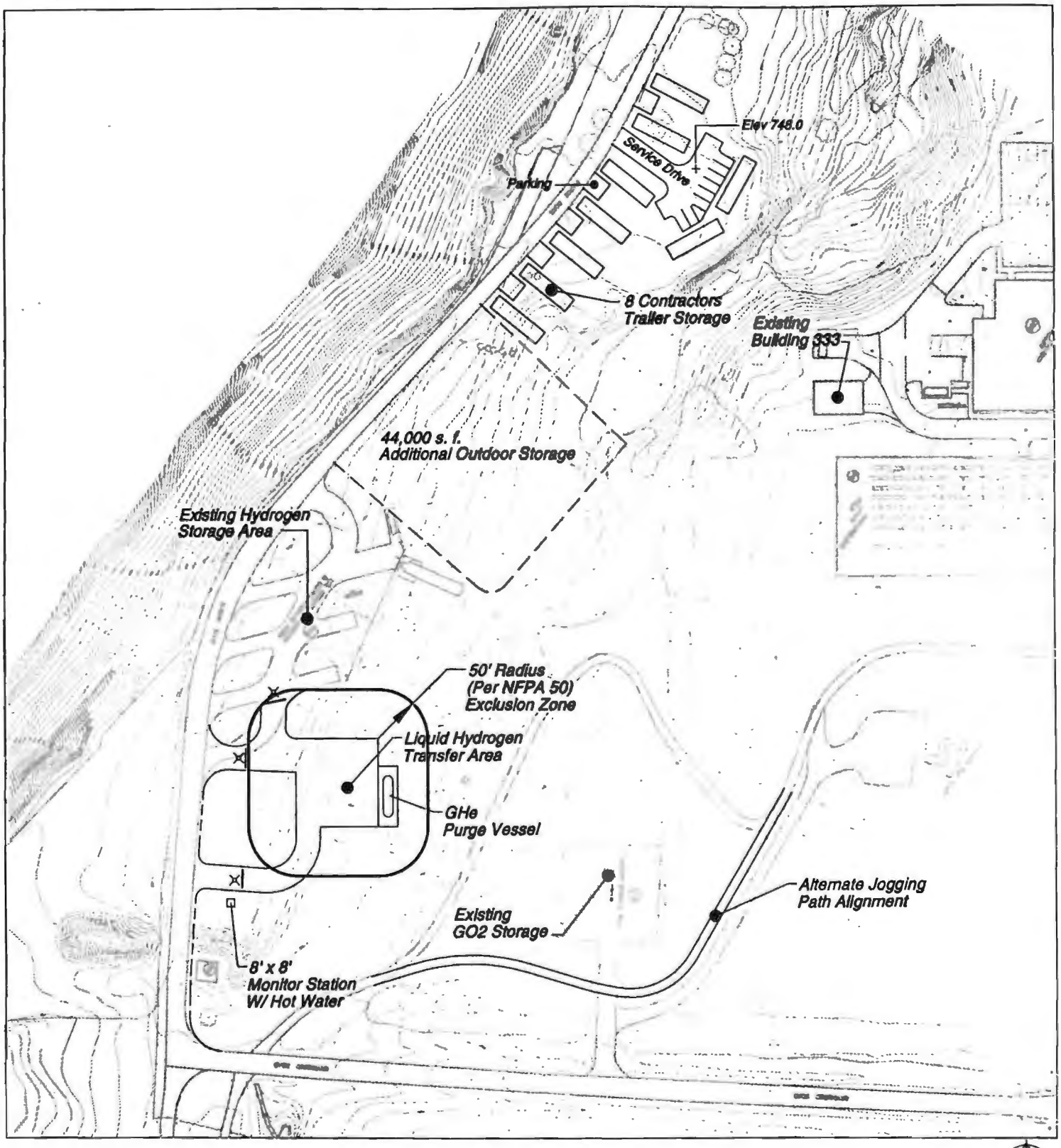
Facility: **Contractor Trailer Storage**

Location: Guerin Rd Site Area

Facility Layout Scheme 75

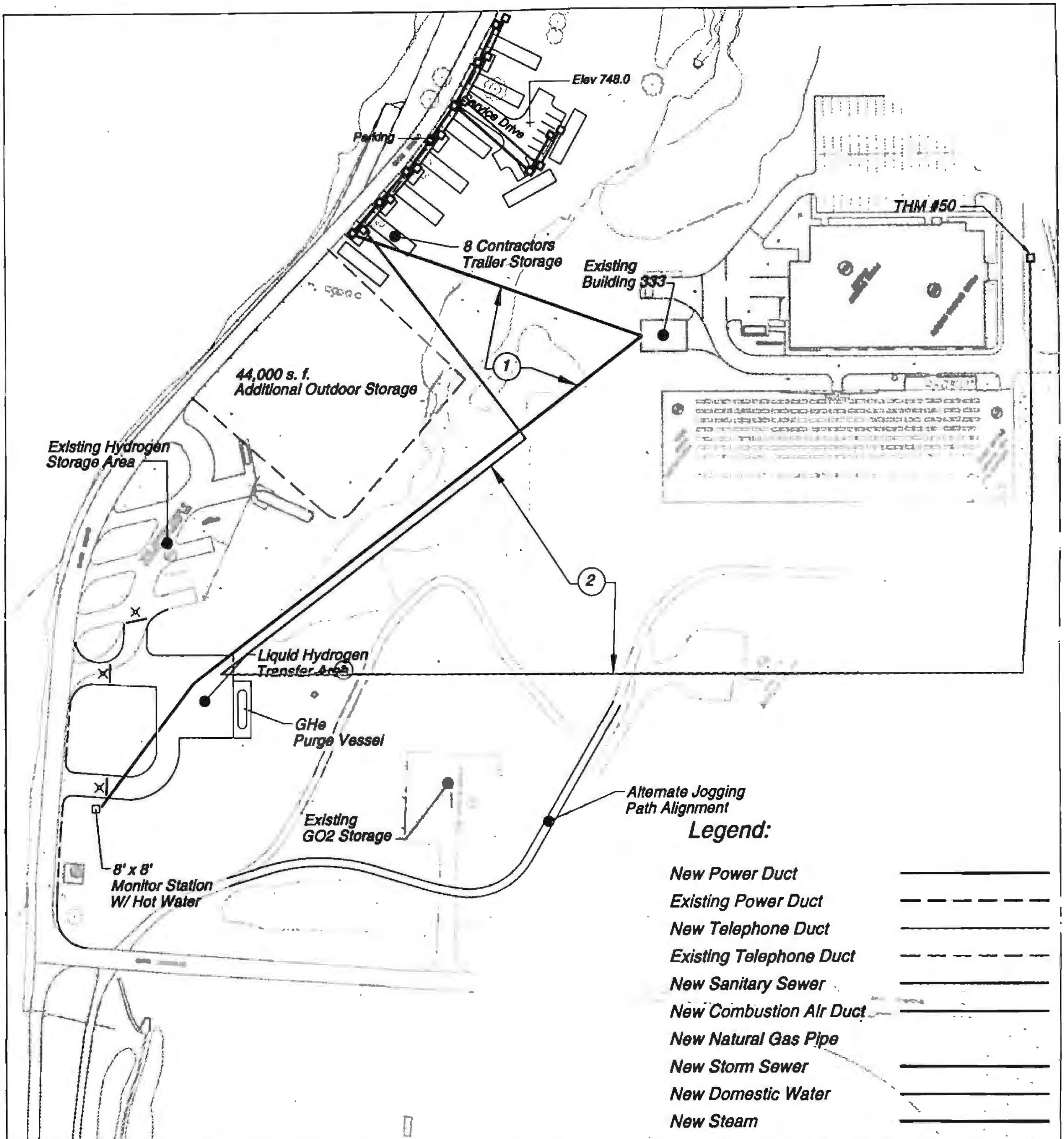
	Criteria Factor	Score (-2 to 2)	Weight	Total Score
A	**Ability to Meet Mission / Facility Requirements**			**6**
A1	Facility Layout Scheme Meets Research / Storage Capability From the Requirements Document **Conditionally rated:**	2	2	4
A2	Facility Layout Scheme Allows for Good Functional Relationships	0	2	0
A3	Facility Layout Scheme Allows for Good Accessibility	2	2	2
A4	Ability to Meet Long-Term Needs of NASA Research	0	1	0
B	**Safety Considerations**			**24**
B1	Minimum Exclusion and Explosive Quantity-Distances Met	2	4	8
B2	Facility / Control Room Safe	2	4	8
B3	Other Safety Criteria (Fire, Police, and Medical Response)	2	4	8
C	**Impact on NASA Operations**			**3**
C1	Construction Implementation Not Difficult	1	1	1
C2	Minimal Disruption of Research / Support Activities	2	1	2
D	**Costs**			**0**
D1	Initial Construction Costs	0	0	0
D2	Operation and Maintenance costs are relatively low.	1	1	1
D3	Research Costs and Convenience	-1	1	-1
E	**Compatibility**			**8**
E1	Facility Compatible with Adjacent Facilities / Uses	1	2	2
E2	Visual Character of the Research Center	1	2	2
E3	Electro-Magnetic Interference	2	2	4
F	**Environmental Impact**			**14**
F1	Potential Impact to Species	2	1	2
F2	Potential Impacts to Natural Resources	2	2	4
F3	Potential Impact from Flooding	2	2	4
F4	Potential Aircraft Noise Impacts on Personnel Working at Facility	1	2	2
F5	Potential Impact of Facility Noise on Others	1	2	2
G	**Brook Park Issues:**	N/A	N/A	N/A
	Facility Layout Scheme Total Score			**55**

1



Layout 75
Contractor Storage and Liquid Hydrogen Transfer Station
Guerin Rd. Site Area
October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135
KS Associates
Parsons Harland Bartholomew & Associates, Inc.



1. Route a direct buried telephone cable from TMH#50 to Hydrogen transfer area (for gas detector signalling) and to contractor trailers for phones.

2. Provide 480V, 60A service from existing building 333 to monitor station and 208/120V to contractor trailers.

NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

0 75 150 225

Layout 75-U
Contractor Storage and Liquid Hydrogen Transfer Station
Guerin Rd. Site Area

October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Ralph Tyler Companies

PARSONS HARLAND BARTHOLOMEW & ASSOCIATES, INC.

5.2.5.9 Facility Layout Scheme 73, Central Chemical Storage at South 40 Central Area, Glenn Research Center: This FLS would propose the construction of a new Central Chemical Storage Building with loading dock area, and a small parking area for use by personnel working in the area. Because of the potential sound levels at this site (proximate to the airport), the outside storage area would have to be enclosed at this location. Previous FLSs in this area were failed due to lack of Noise Data. However, as a result of FAA release of certain data and a cursory study completed by Airport personnel, it is now understood that the predicted sound levels should be easily mitigated to meet published standards.

5.2.5.9.A Ability To Meet Mission / Facility Requirements:

5.2.5.9.A.1 Facility Layout Scheme Meets Research / Storage Capability From the Requirements Documents: The proposed new facility would be fully capable of meeting currently identified NASA requirements, however the outdoor portions of the facility would have to be enclosed to meet NASA hearing conservation standards.

Consequently, the site has been given a score of one.

5.2.5.9.A.2 Facility Layout Scheme Allows for Good Functional Relationships: The proposed site mirrors the existing facility's relationships with the other GRC-Lewis Field facilities, but is not as central as other site areas that were considered.

Consequently, the site has been given a score of one.

5.2.5.9.A.3 Facility Layout Scheme Allows for Good Accessibility: The proposed site has excellent accessibility to drives and loading docks for trucks and equipment, however the indoor storage portion may not be as efficient as the equivalent outdoor storage.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.5.9.A.4 Ability to Meet Long-Term Needs of NASA Research: No research will be performed at this facility, and all of the alternatives being reviewed for this project are located at Glenn Research Center.

Consequently, this facility layout scheme has been assigned

a neutral score of zero.

5.2.5.9.B Safety Considerations:

5.2.5.9.B.1 Minimum Exclusion Zone and Explosive Quantity-Distance Requirements Met: Other than the gas cylinders that would be stored in the outdoor storage area (indoor for this FLS), there are no exclusion zones associated with this FLS. The only possible conflict is the adjacent LH2 transfer station's exclusion zone (which is only present in certain scenarios). This zone fully complies with NASA's Safety Manual section 6.11.3, and there is minimal chance for any impact.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.5.9.B.2 Facility / Control Room Safe: This criterion is not applicable to this specific project.

Consequently, this facility layout scheme has been assigned a neutral score of zero.

5.2.5.9.B.3 Other Safety Concerns: This facility will be located in the City of Cleveland. Consequently, no additional personnel, facilities, or equipment are required, and the response personnel will have the requisite skills necessary to respond during emergency situations.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.5.9.C Impact On NASA Operations:

5.2.5.9.C.1 Construction Implementation Not Difficult: The construction of this FLS can occur while the existing facility operates, however it will involve temporary inconveniences to access on South Road to the existing CCSF, Building 208 and 210, as well as relocation/disruption of several main utilities. In addition there is an adjacent environmental area of concern that should be avoided.

Consequently, this facility layout scheme has been assigned a score of negative one.

5.2.5.9.C.2 Minimal Disruption of Research / Support Activities: As noted above, the construction of this area can be accomplished while the current facility is being used. Once the facility is available, there would be a short period of

disruption while the functions are relocated to the new facility, but this period of disruption is anticipated to be relatively short in duration. Also because of the need to obtain a RCRA closure for the existing Building 212, there may be a construction/demolition phasing impact which requires temporary CCSF operation elsewhere (depending on the extent of the RCRA closure activities).

Consequently, this facility layout scheme has been assigned a score of negative one.

5.2.5.9.D Costs:

5.2.5.9.D.1 Initial Construction Cost: Appendix C includes information on the anticipated construction cost for this facility layout scheme. However, since this issue will not be used to determine the preferred location for NASA replacement facilities, it has not been included in this subsection of the analysis.

5.2.5.9.D.2 Operation and Maintenance Costs: Construction of a new Central Chemical Storage Building will allow the facility to be designed and constructed out of low-maintenance materials using energy efficient heating, cooling, and ventilation systems. This should reduce long term maintenance costs when compared to the continued use of the existing facility. However the increased indoor storage areas (and increased capital basis) will cause the future maintenance costs to be higher than other than other alternatives.

Consequently, this facility layout scheme has been assigned a score of negative one.

5.2.5.9.D.3 Research Costs and Convenience: Implementation of this alternative will place the central storage area in a location that mirrors the existing facility. This should result in no increase in costs of convenience when compared to the existing facility.

Consequently, this facility layout scheme has been assigned a neutral score of zero.

5.2.5.9.E Compatibility:

5.2.5.9.E.1 Facility is Compatible with Adjacent Facilities and Adjacent Land Uses: Construction of a Central Chemical Storage Building in the remaining South 40 would be somewhat compatible with the other proposed outdoor storage uses.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.5.9.E.2 **Visual Character of the Research Center:** Construction of a Central Chemical Storage Building in the South 40 would be visually compatible with the surrounding environment. Screening or special architectural treatments would not be necessary to mitigate any adverse visual impacts.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.5.9.E.3 **Electro-Magnetic Interference:** This location should not be adversely affected by EMI.

Consequently, this facility will be assigned a score of positive two for this criterion.

5.2.5.9.F **Environmental Impacts:**

5.2.5.9.F.1 **Potential Impacts on Species:** Redevelopment of this site is not anticipated to result in any adverse impacts to threatened and endangered species, or significantly adverse impacts to other species.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.5.9.F.2 **Potential Impacts to Natural Resources:** Redevelopment of CCSF in this FLS involves siting this RCRA facility in very close proximity to several known areas of concern. The specific footprint selected is immediately adjacent to the Coal Storage Area (UPR-05-16) which has been identified to contain acids and metals from past hazardous materials practices at the site. Further investigation is required if site is selected, and mitigation may be required, however schedule driven constraints may make alternate layouts more desirable. (All other South 40 sites are similarly encumbered by areas of concern.)

Consequently, this facility layout scheme has been assigned a score of minus 1.

5.2.5.9.F.3 **Potential Impacts from Flooding**: Construction at the proposed site is not located within any existing floodway or floodplain.

Consequently, this facility layout scheme has been assigned a score of two.

5.2.5.9.F.4 **Potential Impact of Aircraft Noise on Personnel Working at the Facility:** Previously this alternative was failed due to lack of Sound level data, however a cursory survey available data shows that the approximately 75DNL sound levels at this site are mitigatable for indoor work areas. The outdoor storage areas will be mitigated by enclosing them. Other outdoor activities (e.g. loading, loading etc.) may still require the use of personal protective equipment, PPE.

Consequently, this facility layout scheme has been assigned a score of negative 2.

5.2.5.9.F.5 **Potential Impacts of Facility Generated Noise on Other Personnel:** The continued operation of this facility is not anticipated to result in any unacceptable noise impacts on proximate uses.

Consequently, this facility layout scheme has been assigned a score of one.

5.2.5.9.G **Brook Park Governmental / Cryogenic Issues.** As noted earlier, this proposed facility layout plan is located within the City of Cleveland. Consequently this criterion does not apply to this location.

5.2.5.9.H **Central Chemical Storage at South 40, Glenn Research Center Site Summary:**

Subsections 5.2.5.9.A through 5.2.5.9.G contain a discussion of the general issues associated with the construction of a new Central Chemical Storage Building in the South 40 at Glenn Research Center. The following table contains the evaluation scores that have been assigned to this site.

Criteria Factor Worksheet

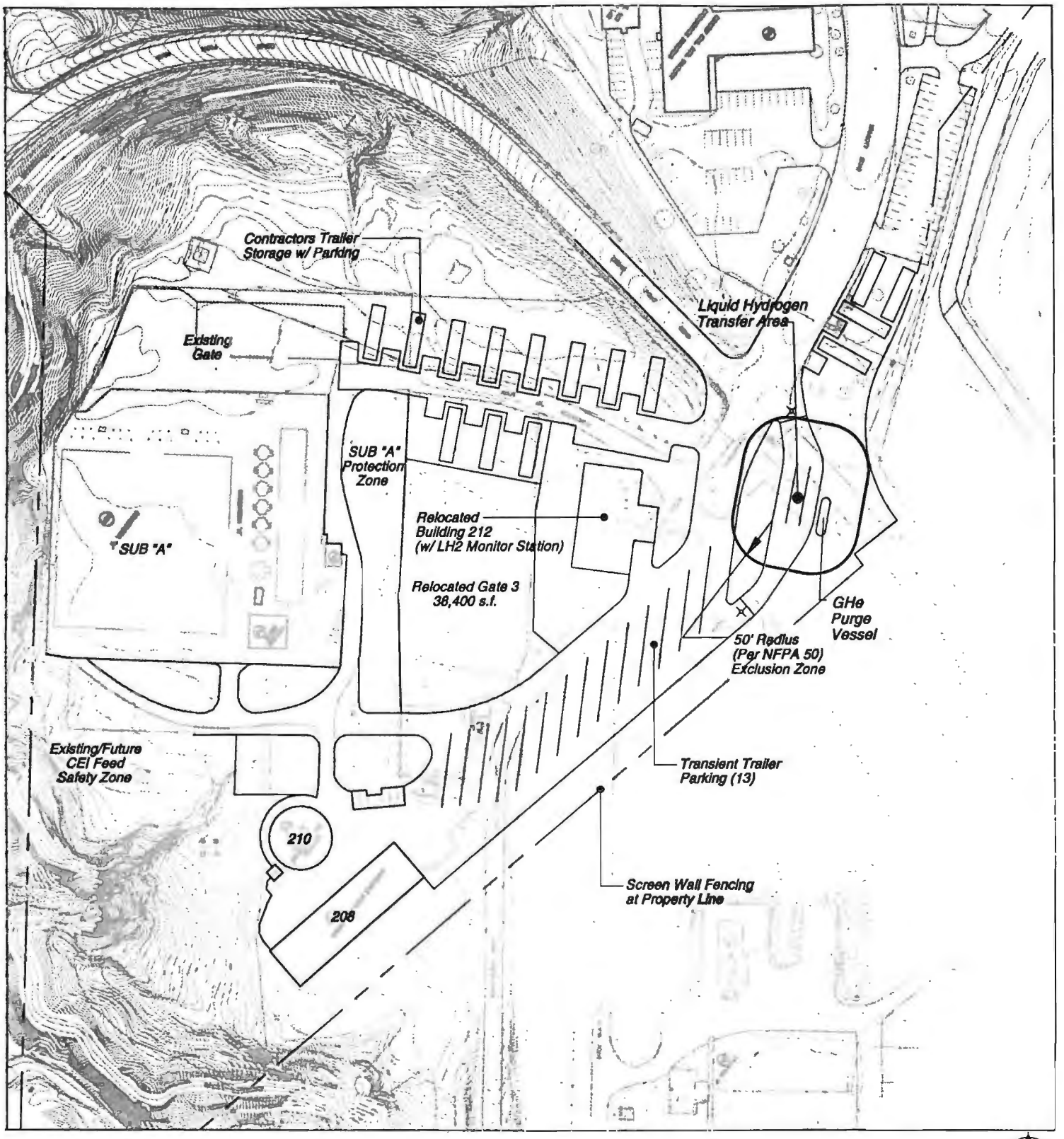
Facility: **Central Chemical Storage Building**

Location: Glenn Research Center, South 40 Central Area

Facility Layout Scheme **73**

	Criteria Factor	Score (-2 to 2)	Weight	Total Score
A	**Ability to Meet Mission / Facility Requirements**			**6**
A1	Facility Layout Scheme Meets Research / Storage Capability From the Requirements Document	1	2	2
A2	Facility Layout Scheme Allows for Good Functional Relationships	1	2	2
A3	Facility Layout Scheme Allows for Good Accessibility	1	2	2
A4	Ability to Meet Long-Term Needs of NASA Research	0	1	0
B	**Safety Considerations**			**16**
B1	Minimum Exclusion and Explosive Quantity-Distances Met	2	4	8
B2	Facility / Control Room Safe	0	4	0
B3	Other Safety Criteria (Fire, Police, and Medical Response)	2	4	8
C	**Impact on NASA Operations**			**-2**
C1	Construction Implementation Not Difficult	-1	1	-1
C2	Minimal Disruption of Research / Support Activities	-1	1	-1
D	**Costs**			**-2**
D1	Initial Construction Costs	0	0	0
D2	Operation and Maintenance costs are relatively low.	-1	1	-2
D3	Research Costs and Convenience	0	1	0
E	**Compatibility**			**10**
E1	Facility Compatible with Adjacent Facilities / Uses	1	2	2
E2	Visual Character of the Research Center	2	2	4
E3	Electro-Magnetic Interference	2	2	4
F	**Environmental Impact**			**2**
F1	Potential Impact to Species	2	1	2
F2	Potential Impacts to Natural Resources	-1	2	-2
F3	Potential Impact from Flooding	2	2	4
F4	Potential Aircraft Noise Impacts on Personnel Working at Facility	-2	2	-4
F5	Potential Impact of Facility Noise on Others	1	2	2
G	**Brook Park Issues:**	N/A	N/A	N/A
	Facility Layout Scheme Total Score			**30**

1



NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

0 75 150 225

Layout 73

Building 212, LH2 Transfer, Contractor Trailer Storage (Partial), Outside Storage Area (Partial), Transient Trailer Storage

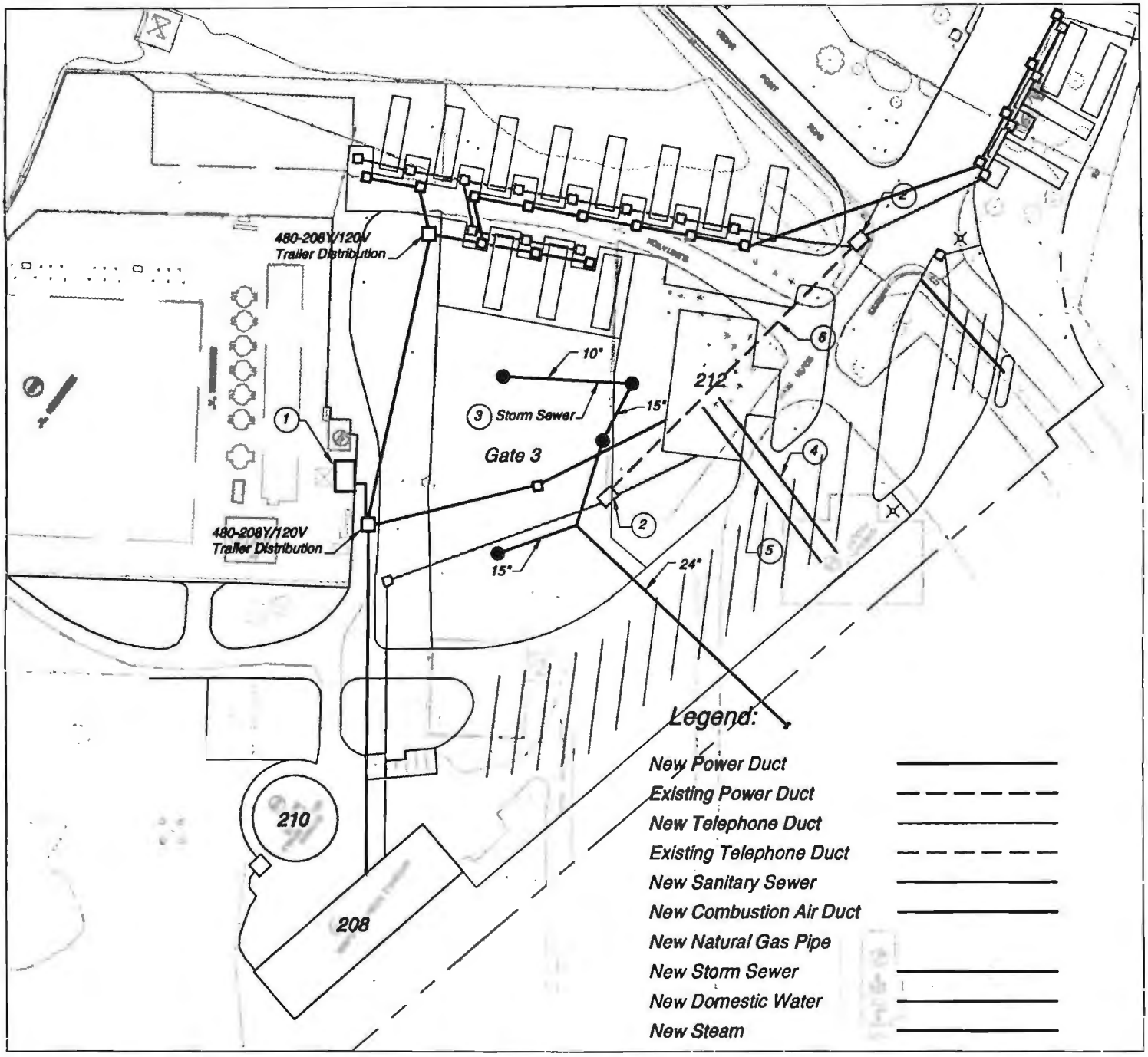
South 40 Site Area

October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates

Parsons Harland Bartholomew & Associates, Inc.



1. A new 34.5kv to 480V substation will provide the following services:
   Trailer Storage – 400A, Gated Storage – 100A,
   Building 208 – 200A, General Lighting – 200A (Provide parking lot lighting),
   Building 212 – 200A

2. Telephone and security shall be run to gated storage and to each of the trailer sites. Route telephone cable through existing duct to building 125.

3. Route new storm sewer as shown, with sizes as shown. The new storm sewers shall be buried.

4. Route new 4" sanitary sewer. The new sewer shall be buried.

5. Route new 2" domestic water line. The new water line shall be buried.

6. Reroute main telephone duct bank 6–4" & 2–5" fiber around building 212 foundation. Also reroute 8–4" fiber instrumental ducts.

NORTH

CONTOUR INTERVAL 1'

GRAPHIC SCALE

0 60 120 180

Layout 73-U

Building 212, LH2 Transfer, Contractor Trailer Storage (Partial), Outside Storage Area (Partial), Transient Trailer Storage

South 40 Site Area

October, 1999

NASA GLENN RESEARCH CENTER CLEVELAND, OHIO 44135

KS Associates · Ralph Tyler Companies · Parsons Harland Bartholomew & Associates, Inc.

5.3 Phase 2, Facility Layout Scheme Analysis

As noted in the introduction to this section, this phase of the analysis process will compare the potential facility layout schemes that have been selected for each facility, to establish an initially preferred facility layout scheme for each facility

In the following tables the relative scores obtained during the Phase I analysis have been carried forward, including the total score. The higher the score in this part of the table the more preferred the facility layout scheme. Conversely, the lower the score the less preferred the facility layout scheme.

The facility layout scheme that received the highest initial total score for each facility summary has been shown in **bold** text.

5.3.1 Project 1, Relocation of Cryogenic and Gas Containers, Selected Equipment and B-Stand Layout Scheme Summary

5.3.1.1 Transient Dewar Storage Area Facility Layout Scheme Summary: Based upon the analysis located in sections 5.2.1.1 the following table has been developed to rate the relative ranking of the alternative facility layout schemes that have been considered for Transient Dewar Storage areas.

Transient Dewar Storage Area Facility Layout Scheme Summary

	Facility Requirement	Safety	Impact	Life Cycle Costs	Compatibility of Use	Environmental Impacts	Brook Park	Total
FLS 1, Building 125 area	Failed		Failed		Failed			Failed
FLS 2, Guerin Road		Failed			Failed		Failed	Failed
FLS 3, Building 134 area	12	12	4	2	8	18	N/A	56
FLS 4, South 40	**14**	**16**	**4**	**2**	**8**	**14**	**N/A**	**58**

Based upon this analysis two alternatives remain viable for the location of this function, although construction of the new Transient Dewar Storage area in the South 40 area of the Glenn Research Center would appear to be the preferred alternative.

5.3.1.2 B-Stand Facility Layout Scheme Summary: Based upon the analysis located in section 5.2.1.2, the following table has been developed to rate the relative ranking of the alternative facility layout schemes that have been considered for the B-Stand.

B-Stand Layout Scheme Summary

	Facility Requirement	Safety	Impact	Life Cycle Costs	Compatibility of Use	Environmental Impacts	Brook Park	Total
FLS 5,[1] B 35-10	*0*	*24*	*-1*	*3*	*6*	*8*	*N/A*	*40*
FLS 6, Northern Squaw Valley	Failed	Failed			Failed	Failed	Failed	Failed
FLS 7, HTF Plum Brook	12	24	4	-2	12	14	N/A	64
FLS 8, Southern Squaw Valley	Failed	Failed			Failed		Failed	Failed
FLS 9, Museum, Construct Later	**14**	**24**	**4**	**4**	**12**	**18**	**N/A**	**76**

Note 1: FLS 5 is conditionally rated because it conflicts with the PRDs.

Based upon this analysis two alternatives remain viable for the location of this function. Construction at Plum Brook would be the recommended alternative, except that there are currently no research projects scheduled that would use the capabilities of B-Stand if it were reconstructed. Consequently, the alternative to obtain funding for the potential future construction of a B-Stand (should one be required) is the preferred alternative. The annual maintenance and repair cost of maintaining a facility for a future unknown use will be avoided. Additionally, replacement of the B-Stand at a future date would allow for the use of the

latest technology available in the future, and allow the facility to be tailored to more specifically support the currently unidentified future requirement.

5.3.2 Project 2, Relocation of the Cryogenic Component Laboratory, including four Test Cells, SMIRF, and Propellant Densification Test Site Facility Layout Scheme Summary

Based upon the analysis located in section 5.2.2, the following subsections have been developed to summarize the facility layout schemes considered for siting the nine discrete Test Cells associated with this project.

5.3.2.1 Test Cell A Facility Layout Scheme Summary: Based upon the analysis located in sections 5.2.2.1, the following table has been developed to rate the relative ranking of the alternative facility layout schemes that have been considered for location of Test Cell A. Note that FLS 21 has been conditionally rated.

5.3.2.2

Test Cells A Facility Layout Scheme Summary

	Facility Requirement	Safety	Impact	Life Cycle Costs	Compatibility of Use	Environmental Impacts	Brook Park	Total
FLS 10, South 40 Areas A-1 and 20			Failed		Failed			Failed
FLS 11, Guerin Road		Failed	Failed		Failed		Failed	Failed
FLS 12, West Area Road		Failed	Failed		Failed		Failed	Failed
FLS 13, K Site Plum Brook (A and B in B 2811)	Failed	Failed						Failed
FLS 14, Cryogenic Road		Failed	Failed		Failed		Failed	Failed
FLS 15, West Area Road		Failed	Failed		Failed		Failed	Failed

Test Cells A Facility Layout Scheme Summary								
	Facility Require-ment	Safety	Impact	Life Cycle Costs	Compa-tibility of Use	Environ-mental Impacts	Brook Park	Total
FLS 16, South 40 Central		Failed	Failed		Failed			Failed
FLS 17, K Site Plum Brook (A in B 2811)	Failed	Failed						Failed
FLS 18, Pond Valley		Failed	Failed		Failed			Failed
FLS 19, South 40 (SMIRF, C7 and B Cells)		Failed	Failed		Failed			Failed
FLS 20, South 40 (SMIRF, and C7)			Failed		Failed			Failed
FLS 21[1],SMIRF ,7, Proof Creek Road.	*10*	*12*	*4*	*-1*	*10*	*12*	*N/A*	*47*
FLS 22, West Area Road, North		Failed	Failed		Failed		Failed	Failed
FLS 23, West Area Road, South		Failed	Failed		Failed		Failed	Failed
FLS 24, K Site Plum Brook	**12**	**16**	**4**	**0**	**12**	**18**	**N/A**	**62**
FLS 25, Pond Valley (SMIRF, C7 and Proof)	10	16	4	-1	6	4	N/A	39

Note 1: FLS 21 is conditionally rated based on the City of Cleveland Law Department's opinion on the applicability of the Supremacy Clause.

1

As illustrated in the preceding table, facility layout scheme 24 is the preferred location for Test Cell A. This facility layout scheme is preferred for the following reasons:

1. It provides more flexibility for future use and expansion,

2. It collocates Test Cell A near the preferred location for Test Cell B and Test Cell C (as discussed below), and

3. It meets all safety and operational requirements.

Facility Layout Scheme 25 is one scheme that locates Test Cell A (SMIRF, Cell 7, and the Pressure Proof Test Cell) at the Glenn Research Center. However, should this facility layout scheme alternative be implemented, the existing child care, recreation / fitness center, and picnic facilities located along West Area Road are recommended to be relocated. Also as proposed, additional protection of the neighboring office building (i.e. Dynex) will be provided through the construction of an extensive blast-wall system. Purchase and demolition of the building and relocation of the offices currently occupied in the building may be an option, depending upon the cost of doing so. Subsection 5.3.2.2, below, contains a summary of the review process that was conducted concerning potential relocation alternatives for the Childcare, Recreation. / Fitness Center and Picnic Pavilion facilities.

The conditionally acceptable FLS 21 also sites the A Cells at GRC-Lewis Field. Please refer to the City of Cleveland Law Department's opinion regarding use of the Supremacy Clause to preempt local codes and ordinances. This FLS also recommends consideration of relocating the amenity facilities.

5.3.2.2 Child Care, Recreation / Fitness Center and Picnic Facilities Layout Scheme Summary:

Based upon the analysis located in subsection 5.2.2.2, the following table has been developed to rate the relative ranking of the alternative facility layout schemes that have been considered for location of the Child Care, Recreation / Fitness Center, and Picnic Pavilion facilities. Relocation of the child care, recreation / fitness center and picnic facilities is not a direct result of airport expansion.

The relocation of these facilities would only be required if either Facility Layout Scheme 21 or 25 is selected for relocating Test Cell A (the SMIRF, Cell 7, and the Proof Pressure Test Cell) at Pond Valley or Creek Road. As noted in subsection 5.2.2.17 under all other alternative facility layout schemes, NASA could continue to use the existing child care, recreation / fitness center and picnic facilities.

Child Care, Recreation / Fitness Center and Picnic Facility Layout Scheme Summary (Only if Test Cell A is located in Pond Valley – Facility Layout Scheme 25)								
	Facility Require-ment	Safety	Impact	Life Cycle Costs	Compa-tibility of Use	Environ-mental Impacts	Brook Park	Total
FLS 26, Existing Location		Failed [1]			Failed [1]			Failed [1]
FLS 27, 500/501 Building	Failed		Failed		Failed			Failed
FLS 28, Guerin Road Cul-de-Sac	**14**	**8**	**3**	**2**	**12**	**16**	**N/A**	55
Note: 1 The existing site only fails established safety and compatibility criterion if the Pond Valley or Creek Rd. site (Facility Layout Scheme 21 or 26) is selected for construction of Test Cell A (SMIRF, Test Cell 7, and the Proof Pressure Test Cell). Otherwise continued use of the Existing Location is the preferred alternative.								

As illustrated on the preceding table, the facility layout scheme 28 is the preferred location for the child care, recreation / fitness center and picnic facilities only if Facility Layout Scheme 21 or 25 is selected for the SMIRF, Cell 7 and Proof Pressure Test Cell. In all other layout schemes the preferred location for the existing child care, recreation / fitness center and picnic facilities is for them to remain at their current locations.

5.3.2.3 **Test Cell B Facility Layout Scheme Summary:** Based upon the analysis located in subsection 5.2.2.3, the following table has been developed to rate the relative ranking of the alternative facility layout schemes that have been considered for location of the Test Cell B requirements. As noted in subsection 5.2.1.2, a total of 11 alternative facility layout schemes for Test Cell B were considered that collocated these functions with Test Cell A facilities. The facility layout scheme summary table contains those facility layout scheme summaries also to facilitate selection of the preferred facility layout scheme.

Test Cells B Facility Layout Scheme Summary								
	Facility Requirement	Safety	Impact	Life Cycle Costs	Compatibility of Use	Environmental Impacts	Brook Park	Total
FLS 10, South 40 Areas A-1 and 20			Failed		Failed			Failed
FLS 11, Guerin Road		Failed	Failed		Failed		Failed	Failed
FLS 12, West Area Road		Failed	Failed		Failed		Failed	Failed
FLS 13, K Site Plum Brook (A and B in B 2811)	Failed	Failed						Failed
FLS 14, Cryogenic Road		Failed	Failed		Failed		Failed	Failed
FLS 15, West Area Road		Failed	Failed		Failed		Failed	Failed
FLS 16, South 40 Central		Failed	Failed		Failed			Failed
FLS 17, K Site Plum Brook (A in B 2811)	Failed	Failed						Failed
FLS 19, South 40 (SMIRF, C7 and B Cells)		Failed	Failed		Failed			Failed
FLS 29, B Cells in Northern Squaw Valley		Failed			Failed	Failed	Failed	Failed

Test Cells B Facility Layout Scheme Summary								
	Facility Require-ment	Safety	Impact	Life Cycle Costs	Compa-tibility of Use	Environ-mental Impacts	Brook Park	Total
FLS 30, B Cells in Southern Squaw Valley		Failed			Failed		Failed	Failed
FLS 31, B Cells in Pond Valley		Failed	Failed		Failed			Failed
FLS 32, K Site Plum Brook	**12**	**24**	**4**	**1**	**12**	**18**	**N/A**	**71**

As illustrated on the preceding table, following a review of 11 alternative facility layout schemes for Test Cell B, only one of the facility layout schemes was determined to be a safe and viable alternative. Consequently, implementation of facility layout scheme 32 is the preferred alternative for this part of the project.

5.3.2.4 **Test Cell C Summary**: Based upon the analysis located in subsection 5.2.2.4, the following table has been developed to rate the relative ranking of the alternative facility layout schemes that have been considered for location of the Test Cell C requirements.

Test Cell C (Fuel Densification) Facility Layout Scheme Summary								
	Facility Require-ment	Safety	Impact	Life Cycle Costs	Compa-tibility of Use	Environ-mental Impacts	Brook Park	Total
FLS 33, Cryogenic Road	Failed	Failed			Failed		Failed	Failed
FLS 34, K Site Plum Brook	**12**	**24**	**4**	**4**	**12**	**18**	**N/A**	**74**

As illustrated on the preceding table, facility layout scheme 34, which would locate the fuel densification research facility at the Plum Brook Station K-Site, is the only viable alternative.

5.3.2.5 Hydrogen Transfer, Hydrogen Storage, and Proof Pressure Test Cell Summary: Based upon the preceding analysis, the following table has been developed to rate the relative ranking of the five alternative facility layout schemes.

Hydrogen Transfer, Hydrogen Storage, and Proof Pressure Test Cell C Facility Layout Scheme Summary

	Facility Requirement	Safety	Impact	Life Cycle Costs	Compatibility of Use	Environmental Impacts	Brook Park	Total
FLS 35, Guerin Road near installation boundary		Failed	Failed		Failed			Failed
FLS 36, South 40		Failed	Failed		Failed			Failed
FLS 37, Proof Pressure Test Cell only S-40	Failed							Failed
FLS 38, Liquid Hydrogen Transfer Station, Guerin Road, Eastern Location	10	20	4	1	10	12	N/A	57
FLS 72, Liquid Hydrogen South 40 Area [1]	**14**	**20**	**4**	**4**	**12**	**16**	**N/A**	**70**

Note: 1 The South 40 Area analysis is based upon NASA's determination that the Hydrogen Transfer Station condition is a cold-flow (no ignition), Dewar to Dewar, hydrogen fuel storage condition where National Fire Protection Association standards, not normal NASA safety standards apply (facility layout scheme 72).

As illustrated on the preceding table facility layout scheme 72, South 40 area is the preferred location for Hydrogen Transfer, Hydrogen Storage and Proof Pressure Test Cell.

5.3.3 Project 3, Construction of the Material Storage Building Facility Layout Scheme Summary

Based upon the analysis located in section 5.2.3, continued use of the existing materials storage building, located in Building 208, is the preferred alternative. Following a determination that the location, elevation and safety zones associated with the new runway would not require relocation of this function from the South 40 area, consideration of all other alternative facility scheme was eliminated.

5.3.4 Project 4, Construction of Grounds Bulk Materials Storage Building, Outside Storage Areas, and Contractors Storage Area Facility Layout Scheme Summary

5.3.4.1 Grounds Bulk Materials Storage Building Summary: Based upon the analysis located in section 5.2.4.1, continued use of the existing Grounds Bulk Materials Storage building, located in Building 210, is the preferred alternative. Following a determination that the location, elevation and safety zones associated with the new runway would not require relocation of this function from the South 40 area, consideration of all other alternative facility scheme was eliminated.

5.3.4.2 Outside Storage Areas (Gates) Facility Layout Scheme Summary: Based upon the analysis located in section 5.2.4.2, the following table has been developed to rate the relative ranking of the alternative facility layout schemes for the Outside Storage Areas (Gates). Note that FLS 74, 76 and 77 have been conditionally rated as specifically requested by NASA and the City of Cleveland. Similar FLSs have previously been failed because they are contrary to the project Requirement Documents.

Outside Storage Areas (Gates) Layout Scheme Summary								
	Facility Require-ment	Safety	Impact	Life Cycle Costs	Compa-tibility of Use	Environ-mental Impacts	Brook Park	Total
FLS 52, Squaw Valley						Failed		Failed
FLS 53, Plum Brook	Failed							Failed
FLS 54, Guerin Road	Failed							Failed
FLS 55, South 40, Site A-1								Eliminated [1]
FLS 56, Cryogenic Road	Failed							Failed
FLS 57, South 40, near Building 208 and 210								Eliminated [1]
FLS 58, South 40, East of Substation A	**10**	**24**	**4**	**1**	**8**	**6**	**N/A**	**53**
FLS 74, South 40 (partial)	10	24	4	1	8	6	N/A	53
FLS 76, [2] Creek Road (partial)	*8*	*20*	*4*	*-1*	*8*	*10*	*N/A*	*49*
FLS77, [2,3] Pond Valley (partial)	*3*	*24*	*4*	*-1*	*8*	*-2*	*N/A*	*36*

Note: 1 FLS 55 and FLS 57 were eliminated from consideration due to conflicts with other development alternatives.

2 FLS 76 and 77 have been conditionally rated because they conflict with the PRDs.

3 FLS 77 potentially conflicts with the Purpose and Need stated in the EIS process. (I.e. alternatives that do not impact floodplains and/or wetlands may be available.)

1

As illustrated on the preceding table facility layout scheme 58, South 40, East of Substation A is the preferred location for Outside Storage Areas (Gates). This facility layout scheme will place the Gates such that each gate will have direct access to the installation roadway system. The partial South 40 FLS 57 is also viable when linked with partial gates on the conditionally rated FLS 76 Creek Road Site. Although not rated, a Guerin Road partial FLS would also meet objectives (but conflict with the PRDs).

5.3.4.3 5.3.9 Contractor's Trailer Storage Area Facility layout scheme Summary: Based upon the preceding analysis, the following table has been developed to rate the relative ranking of the alternative facility layout schemes. FLS 75 (Guerin Rd) has been conditionally rated as specifically requested by NASA and the City of Cleveland. Similar FLSs have previously been failed because they are contrary to the Project Requirement Documents.

Contractors Trailers Storage Areas Layout Scheme Summary

	Facility Requirement	Safety	Impact	Life Cycle Costs	Compatibility of Use	Environmental Impacts	Brook Park	Total
FLS 59, Squaw Valley						Failed		Failed
FLS 60, Cryogenic Road	Failed				Failed			Failed
FLS 61, South 40, Site A-1								Eliminated [1]
FLS 62, Guerin Road	Failed				Failed			Failed
FLS 63, South 40, Site A-1 (Modified)	**10**	**24**	**0**	**1**	**8**	**6**	**N/A**	**49**
FLS 75, [2] Contractor Storage (Partial) Guerin Rd	*6*	*24*	*3*	*0*	*8*	*14*	*N/A*	*55*

Note: 1 Facility layout scheme 61 was eliminated from consideration due to conflicts with other development alternatives.

2 FLS 75 has been conditionally rated because it conflicts with the PRDs.

As illustrated on the preceding table facility layout scheme 63, South 40, Site A-1 (modified) is the preferred location for Contractors Trailers Storage Area. This facility layout scheme will place the Contractors Trailers along a new access roadway into the subsection. The conditionally rated FLS 75 depicting a portion of the contractor trailers on the north end of Guerin Road also scored highly.

5.3.10 Central Chemical Storage Area Facility layout scheme

Summary: Based upon the preceding analysis, the following table has been developed to rate the relative ranking of the alternative facility layout schemes.

Central Chemical Storage Building Layout Scheme Summary

	Facility Require-ment	Safety	Impact	Life Cycle Costs	Compa-tibility of Use	Environ-mental Impacts	Brook Park	Total
FLS 64, South 40 area						Failed		Failed
FLS 65, Site 14 area	Failed			Failed	Failed			Failed
FLS 66, Reconstruction at Current Site	Failed			Failed	Failed			Failed
FLS 67, Various Site 20 areas	Failed				Failed			Failed
FLS 68, Wiggins Fuel Farm area	Failed				Failed			Failed
FLS 69, Building 65 area	4	16	4	2	4	16	N/A	46
FLS 70, Site 94 area	Failed				Failed			Failed
FLS 71, Building 16 area	**12**	**16**	**4**	**2**	**12**	**16**	**N/A**	**62**
FLS 73, South 40 Central	6	16	-2	-2	10	2	N/A	30

As illustrated on the preceding table, facility layout scheme 71, Building 16 area is the preferred location for Central Chemical Storage Area. This facility layout scheme will place the Central Chemical Storage Area in an area proximate to many of the research facilities. The facility will also be located along a major traffic route and will enable the exterior storage area to be shielded from view by most other facilities. FLS 69 and 75 are also viable.